Perceptions of Driver Distraction by Cellular Phone Users and Nonusers

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The present study examined the perceptions of cellular phone users and nonusers on issues relating to vehicle control and driver distraction. Participants were asked if they own a cellular phone; if so, how much they use it; and their beliefs regarding cellular phone use while driving, including actions involving the use of cellular phones which could potentially cause vehicular accidents and the need for laws. A total of 330 individuals participated; 72% owned a cellular phone. The results indicate that nonusers of cellular phones believed more strongly than users that cellular phone use while driving negatively affects driving performance and that talking on the cellular phone could potentially cause an accident, and they also had a greater preference for new laws limiting such acts. Cellular phone users, more than nonusers, preferred no laws limiting cellular phone use and believed more strongly that other people driving while using a cellular phone were more dangerous than themselves doing the same. Implications of these results are discussed. Actual or potential applications of this research include interventions that limit driver distractibility.

INTRODUCTION

Cellular phone use in the United States and around the world has dramatically increased over the last two decades. According to the Cellular Telecommunications and Internet Association (CTIA, 2004), there are more than 180 million wireless subscribers in the United States. Moreover, since 1985 the number of subscribers has increased on average 13.7% each year (CTIA, 2004). Cain and Burris (1999) reported the same general trends between 1985 and 1998. Ownership of cellular phones in the United States is now nearing saturation levels. What was a novelty a few years ago is now ubiquitous.

Clearly, cellular phones have advantages. Cellular phones allow mobility in communicating with others. As technology progresses, the seemingly innocuous cellular phone has continued to advance in adding more functional features (e.g., personal digital assistants, video, Internet). However, despite their benefits, there are disadvantages, and one is in their use by drivers and consequent distraction from the task of driving.

Research in recent years has employed several kinds of methodologies to investigate the potential effects of cellular phones on driving performance. These include epidemiological investigations (Redelmeier & Tibshirani, 1997; Violanti, 1998; Violanti & Marshall, 1996), observational studies (Reinfurt, Huang, Feaganes, & Hunter, 2001), simulator studies (Alm & Nilsson, 1994; Briem & Hedman, 1995; Haigney, Taylor, & Westerman, 2000; McKnight & McKnight, 1993; Reed & Green, 1999; Strayer, Drews, Albert, & Johnston, 2001; Strayer, Drews, & Johnston, 2002; Strayer & Johnston, 2001), and open road studies (Brookhuis, de Vries, & de Waard, 1991; Reed & Green, 1999). Overall, research on the topic of concomitant use of cellular phones and driving indicates that their use can lead to decreased driving performance and an increased risk of being involved in an accident.

There are various factors when pairing cellular phone use and driving that may contribute to increased frequency of vehicular accidents. These factors include dialing, answering, and

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talking on the phone, all of which increase the user's cognitive load (Lamble, Kauranen, Laakso, & Summala, 1999). It diverts some attention away from the driving task (Goodman, Tijerina, Bents, & Wierwille, 1999), reducing the amount of limited attention capacity available for processing the driving task which could be used for dealing with hazards that may occur and thereby increasing the likelihood of an accident. One proposed solution to this problem is the use of hands-free equipment (headsets, etc.). In fact, there have been several attempts to prohibit the use of cellular phones while driving unless hands-free equipment is used. According to a National Conference of State Legislatures (2002) report, the legislatures of the District of Columbia, Puerto Rico, and 43 states have proposed one or more bills pertaining to cellular phones and driving. However, only one state to date, the State of New York, has outlawed the use of cellular phones while driving except when hands-free equipment is used (Use of Mobile Telephones, 2001). Although hands-free equipment may decrease accident risks related to the handling of cellular phones, there still is the problem of cognitive load and attention distraction. Some of the driver's limited attention capacity is absorbed in listening and talking on the phone, using processing resources that would otherwise be used for the driving task (e.g., Lamble et al., 1999).

Although there have been several attempts (Horberry, Bubnich, Hartley, & Lamble, 2001; Reinfurt et al., 2001; Violanti & Marshall, 1996) to determine the frequency of cellular phone use while driving, no study has addressed the issue of whether perceptions differ between cellular phone users and nonusers on issues pertaining to vehicular safety and laws. Cellular phone users may perceive talking on a cellular phone while driving to be less of a safety problem than do nonusers of cellular phones. Moreover, it may be that cellular phone users believe themselves to be better able than others to use a cellular phone when driving, a phenomenon known as *optimism bias* (Dalziel & Job, 1997; Dejoy, 1987). Optimism bias is a systematic error in perception of an individual's own standing relative to group averages, in which positive events are seen as more likely to occur to the individual as compared with the average of a group, and conversely, negative events are seen as less likely to occur to the individual as compared with the average of a group (Dalziel & Job, 1997). In the present research, participants were classified as cellular phone users according to a number of categorizations, such as ownership and weekly usage estimates.

In addition, users and nonusers of cellular phones may have different perceptions on other issues related to cellular phones. For example, they may differ with regard to beliefs regarding the likelihood that a set of basic operator actions (e.g., dialing or answering a call) constitutes a potential cause of accidents. In addition, cellular phone users may be more resistant to new laws than are nonusers.

In the present study, cellular phone users and nonusers evaluated a set of statements regarding (a) the safety of using cellular phones while driving, (b) the potential of phone-related operator actions in causing an accident, and (c) the establishment of new cellular phone laws. Also examined was whether (a) use of cellular phone safety accessories, (b) accident and near-miss experiences, and (c) demographic variables relate to safety beliefs about cellular phone use while driving.

METHOD

Participants

The participants were 330 volunteers (217 men, 113 women) from the Research Triangle region of North Carolina, including the cities of Raleigh, Durham, and Chapel Hill. The sample consisted of 221 undergraduate students (M = 21.3 years, SD = 2.4) and 109 nonstudents (M = 34.2 years, SD = 13.1). Their average education was 15.1 years (SD = 1.9) or a junior in college. The respondents were predominantly Caucasian (84%), followed by African-American (5%), Asian (3%), Latino (2%), mixed race (2%), and other (4%). English was the first language for 313 (95%) of the participants.

Materials and Procedure

Each participant completed a multiple-topic survey that included items on demographics, driving safety, product literature, and electric vehicles. The present study focuses on the items concerning (a) cellular phone use generally and

while driving, with and without accessories such as voice activation and hands-free equipment; (b) beliefs about the safety of driving while using a cellular phone; (c) operator actions involving cellular phones that might cause vehicle accidents; and (d) the need for new laws. Also examined were basic demographic information and participant reports of accidents or near misses involving cellular phone use.

Cellular phone use. The cellular phone usage items asked participants about ownership of a cellular phone, amount of use, whether they use one while driving, and whether they have and use accessories that may reduce manual handling. The items were as follows: (a) "Do you own a cellular phone?" (b) "Estimate how many minutes per week that you use a cellular phone." (c) "Do you use a cellular phone while driving a vehicle?" (d) "Do you use a cellular phone that has voice-activated dialing?" (e) "Do you use the voice-activated feature when driving your vehicle?" (f) "Do you have a hands-free adapter for cellular phone use in a vehicle?" (g) "Do you use a hands-free adapter for a cellular phone while driving?" For all of these items participants responded yes or no, except for Item b, for which they made a numerical estimate of the minutes per week that they use a cellular phone.

Safety beliefs. The safety belief items consisted of the following: (a) "It is important to have a cellular phone available in vehicles in case of an emergency." (b) "I want other drivers not to use cellular phones." (c) "I can use a cellular phone safely when driving." (d) "When driving, cellular phones should be used only in emergencies." (e) "People, in general, can use a cellular phone safely when driving." (f) "The use of cellular phones by other drivers is more dangerous than if I use a cellular phone while driving." The safety belief items were evaluated using participants' ratings of agreement versus disagreement. These judgments were based on 9-point scales with the following anchors: 0 = *extremely disagree,* 1 = *very much disagree,* 2 = *disagree,* 3 = *somewhat disagree,* 4 = *neutral,* 5 = *somewhat agree,* 6 = *agree,* 7 = *very much agree,* and 8 = *extremely agree.*

Operator actions. The items concerning operational actions with a cellular phone that could cause an accident while driving were (a) pressing buttons on the cellular phone, (b) answering the cellular phone, (c) talking on the cellular phone, and (d) using a hands-free cellular phone. For these items, participants responded yes or no.

New laws. The items concerning the passage of new laws restricting cellular phone use while driving were as follows: (a) "There should be a law prohibiting people from using cellular phones while driving, except for emergency phone calls." (b) "There should be a law prohibiting people from using cellular phones while driving." (c) "There should be no laws at all regarding cellular phone use while driving." The new laws items were evaluated using the same rating scales as those for the safety belief items.

Accidents and near misses. In addition, two items asked about being in an accident or a near miss involving a cellular phone, both of which required a yes or no response: (a) "Have you ever been in an accident because the driver was talking on a cellular phone?" (b) "Have you almost been in an accident (a 'close call' or a 'near miss') because the driver was talking on a cellular phone?"

RESULTS

The results for reported habits of cellular phone owners are provided in Table 1. Of the total group of 330 participants, 72% (n = 237) reported owning a cellular phone. These 237 owners reported, on average, using a cellular phone approximately 74 min/week (median = 60, SD = 152), and 81% (n = 191) of them reported that they use a cellular phone while driving a vehicle. Although the majority of owners used cellular phones while driving, less than a quarter of them reported using safety devices such as a voice-activated phone (18%) or a hands-free adapter (19%) when driving. Interestingly, having these accessories does not translate into professed use. Although 78 participants reported owning a cellular phone with the voice-activated feature, only 42 (53%) reported using the device. Likewise, 60 people reported owning a hands-free adapter, yet only 44 (73%) reported using it.

There was no significant difference between owners and nonowners of cellular phones for reports of past accident involvement associated with cellular phone use (6% and 7%, respectively) or reports of near misses associated with

TABLE 1: Frequency (*f*) and Percentage of Cellular Phone Owners Responding "Yes" to Questions Concerning Cellular Phone Use

Cellular Phone Use	*f*	Yes
Do you own a cellular phone?	237	72%
Do you use a cellular phone while driving a vehicle?	191	81%
Do you have a cellular phone that has voice-activated dialing?	76	32%
Do you use the voice-activated feature when driving your vehicle?	42	18%
Do you have a hands-free adapter for a cellular phone to use in a vehicle?	59	25%
Do you use a hands-free adapter for a cellular phone while driving?	44	19%

Note. For the first item, *N* (total sample) = 330. For all other items, percentages are calculated using 237 as the denominator (i.e., users of cellular phones only).

cellular phone use (33% and 41%, respectively), *p*s > .05.

The analyses that follow used measures of people's beliefs regarding (a) the use of cellular phones while driving, (b) the accident potential of a set of operator actions involving the use of a cellular phone, and (c) the acceptability of new laws. These measures were examined with respect to self-reports of (a) cellular phone ownership status (owner vs. nonowner) and amount of use, (b) cellular phone use while driving, (c) use of cellular phone safety accessories, and (d) previous accident and near-miss experiences involving cellular phones.

Safety Beliefs

The following subsections describe analyses involving a set of six safety belief statements in conjunction with one of several classification variables, such as cellular phone ownership and estimated usage rate. In these analyses, the dependent variable is agreement ratings.

Cellular phone ownership. Table 2 shows the mean agreement ratings for the safety belief statements as a function of whether or not the participant reported owning a cellular phone. The data were analyzed using a 2 (cellular phone ownership) × 6 (safety belief statements) mixed-model analysis of variance (ANOVA). Both main effects were significant: For cellular phone ownership, $F(1, 328) = 13.43$, $p < .001$, and safety belief statements, $F(5, 1640) = 103.95$, $p < .001$. There was also a significant interaction, $F(5, 1640) = 18.95$, $p < .001$. In general, nonowners

TABLE 2: Mean Ratings of Agreement (vs. Disagreement) for Nonowners Versus Owners of Cellular Phones for Safety Belief Statements (*SD*s in Parentheses)

	Cellular Phone Ownership		
Safety Beliefs	Nonowner	Owner	Mean
It is important to have a cellular phone available in vehicles in case of an emergency	6.11 (1.58)	7.08 (1.13)**	6.60
I want other drivers not to use cellular phones	5.24 (1.88) **	4.45 (1.94)	4.85
I can use a cellular phone safely when driving	3.73 (1.77)	5.22 (1.96)**	4.48
When driving, cellular phones should be used only in emergencies	4.83 (2.07) *	3.89 (2.08)	4.36
People, in general, can use a cellular phone safely when driving	3.37 (1.81)	4.07 (1.81)*	3.72
The use of cellular phones by other drivers is more dangerous than if I use a cellular phone while driving	2.89 (1.95)	3.60 (2.15)*	3.25
Mean	4.72	4.36	

Note. Ratings are based on 9-point scales with the following anchors: 0 = *extremely disagree*, 1 = *very much disagree*, 2 = *disagree*, 3 = *somewhat disagree*, 4 = *neutral*, 5 = *somewhat agree*, 6 = *agree*, 7 = *very much agree*, and 8 = *extremely agree*. Thus higher scores indicate greater agreement.

*$p < .01$, **$p < .001$.

of cellular phones reported lower ratings of agreement to the statements (i.e., more negative beliefs) than did owners of cellular phones. Comparisons of the statement means shown in the right column of Table 2 using Tukey's honestly significant difference (HSD) test at $p < .05$ showed that participants believed that it is more important to have a cellular phone in a vehicle in case of emergencies ($M = 6.60$), as compared with all other statements. The item of not wanting other drivers to use a cellular phone ($M = 4.85$) was rated significantly higher than the remaining items, except for the participants' belief that they themselves could safely use a cellular phone when driving ($M = 4.48$). The latter item and the belief that cellular phones should be used only in emergencies ($M = 4.36$) were rated significantly higher than either the belief that people, in general, can use a cellular phone safely when driving ($M = 3.72$) or the belief that cellular phone use by others is more dangerous than is personal use ($M = 3.25$). The last two items did not significantly differ.

The interaction means are shown in Table 2. Simple effects analysis showed that cellular phone owners gave higher agreement ratings than did nonowners to four of the six safety belief statements: (a) the importance of having a cellular phone for emergencies; (b) being personally able to use a cellular phone safely when driving; (c) that people, in general, can use a cellular phone safely when driving; and (d) that other drivers are more dangerous using a cellular phone than themselves. However, nonowners of cellular phones gave higher agreement ratings to the remaining two statements: (a) preferring that other drivers not use cellular phones and (b) that cellular phones be used only in an emergency.

Overall cellular phone usage. An analysis similar to the one just described substituted reported overall cellular phone usage for cellular phone ownership as an independent variable. The analysis included only those participants who reported owning a cellular phone ($n = 237$), and they were divided into two groups based on estimated cellular phone use per week. An approximate median-split procedure (median = 60 min) produced two groups of lower ($n = 107$) and higher ($n = 130$) amount of use. The 2 (usage) × 6 (safety belief statements) mixed-model ANOVA produced significant effects and a pattern of means similar to the cellular phone ownership analysis described previously and in Table 2. In other words, the responses of participants with high versus low usage rates were comparable to those of owners versus nonowners of cellular phones, respectively.

Using a cellular phone while driving. Another similar analysis compared cellular phone owners according to whether or not they reported using their phone while driving. The results were similar to those already described for cellular phone ownership and estimated usage levels.

Use of safety accessories. Two analyses were conducted in a similar manner using only data from cellular phone owners, who were divided into users versus nonusers of a voice-activated device or other hands-free accessories when driving. The analyses produced the same basic pattern of means as described previously and in Table 2, except that the differences between users and nonusers of accessories on the safety belief statements were weaker in strength in terms of mean differences and higher variability.

Accidents and near misses. Finally, two other variables were examined with respect to safety beliefs. One was reports of personal experience of a motor-vehicle accident involving a cellular phone; the other was near-miss reports. Both were analyzed using a 2 (J) × 6 (safety belief statements) mixed-model ANOVA, in which J was whether or not the participant had been involved in either (a) an accident involving a cellular phone or (b) a near-miss event involving a cellular phone. In both analyses, the safety belief statements produced a significant main effect (described previously), but there was no significant main effect for accident or near-miss involvement. However, in one analysis there was a significant near-miss report by safety belief interaction. Simple effects analyses indicated that the pattern of near-miss versus no near-miss reports was fairly consistent with the pattern of means described for the nonowners versus owners of cellular phones, except there was no difference between the groups for the statements (a) that it is important to have a cellular phone available in vehicles in case of an emergency and (b) that the use of cellular phones by other drivers is more dangerous than if the participant uses a cellular phone while driving.

Operator Actions

The following subsections describe analyses involving a set of four operator actions in conjunction with the same classification variables employed previously. In these analyses, participants were asked whether or not the actions could cause an accident.

Cellular phone ownership. The data were analyzed using a 2 (cellular phone ownership) × 4 (actions) mixed-model ANOVA. Both main effects were significant: For cellular phone ownership, $F(1, 328) = 12.73$, $p < .001$, and for actions, $F(3, 984) = 186.47$, $p < .0001$. There was no significant interaction, $F(3, 984) = 1.53$, $p > .05$. In general, nonowners of cellular phones ($M = .69$) more frequently indicated the actions would cause accidents than did owners of cellular phones ($M = .57$). Tukey's HSD test on the actions showed that participants believed that pressing buttons on a cellular phone ($M = .94$) had the greatest potential to cause accidents, as compared with all other items. The next highest was answering the cellular phone ($M = .77$), which was significantly higher than talking on the cellular phone ($M = .57$), which in turn was significantly higher than using a hands-free cellular phone ($M = .24$).

Overall cellular phone usage. Lower versus higher usage of cellular phones (divided by a median split on estimated time per week) was also examined as a factor affecting perceptions of the set of operator actions on whether or not they could cause an accident. Table 3 shows the mean proportion accident potential judgments as a function of usage and operator actions. A 2 (amount of use) × 4 (actions) mixed-model ANOVA produced significant main effects of amount of use, $F(1, 235) = 4.03$, $p < .05$, and actions, $F(3, 705) = 161.04$, $p < .001$, as well as a significant interaction, $F(3, 705) = 3.78$, $p < .01$. As shown in the bottom row of Table 3, persons who reported lower levels of cellular phone use also reported that the actions were more likely to cause accidents, as compared with persons who reported higher cellular phone use. The means for the actions main effect are given in the right column of Table 3. It has the same pattern as that described previously in the owners versus nonowners analysis. Simple effects analysis of the interaction cell means in Table 3 showed that lower usage participants indicated greater potential of accidents when answering the phone ($M = .74$) and talking on the phone ($M = .57$) did than higher usage users ($M = .58$ and .42, respectively).

Using a cellular phone while driving. A similar analysis was conducted on the operator actions according to whether or not cellular phone owners reported using their phones while driving. The results were similar to those of the low- and high-usage analysis described previously and in Table 3, except that Tukey's HSD test failed to find a difference between answering and talking on the cellular phone and that the simple effects analysis showed only one significant difference: Participants who reported not using their phone while driving indicated that talking on the phone could cause accidents at a higher level than did those who reported using their phone while driving.

Use of accessories. Similar analyses were

TABLE 3: Mean Proportion Accident Potential as a Function of Operator Action and Usage (*SD*s in Parentheses)

	Amount of Cellular Phone Usage		
Operator Action Statements	Lower	Higher	Mean
Pressing buttons on the cellular phone	.90 (.32)	.92 (.30)	.91
Answering the cellular phone	.74 (.46) *	.58 (.50)	.66
Talking on the cellular phone	.57 (.50) *	.42 (.49)	.50
Using a hands-free cellular phone	.19 (.38)	.19 (.39)	.19
Mean	.60	.53	

Note. Ratings are based on yes/no responses coded as 1 and 0, respectively. Higher scores indicate participants' increasing beliefs that an operator action might cause an accident. Amount of cellular phone use was split at the median of 60 min (lower: $n = 107$; higher: $n = 130$).

*$p < .001$.

conducted using data on use of cellular phone safety devices while driving. The reported use versus nonuse of voice-activated dialing and hands-free accessories was examined. Both analyses employed a 2 (safety device usage while driving) × 4 (actions) mixed-model ANOVA. For voice-activated dialing, both main effects were significant – safety device use, $F(1, 235) = 4.31$, $p < .05$, and actions, $F(3, 705) = 100.47$, $p < .001$ – but the interaction was not, $F(3, 705) < 1.0$. For hands-free adapter use, the results were similar. Both main effects were significant – safety device use, $F(1, 235) = 7.48$, $p < .007$, and actions, $F(3, 705) = 107.61$, $p < .001$ – but the interaction was not significant, $F(3, 705) = 2.20$, $p > .09$. Users who used voice-activated dialing while driving ($M = .49$) were less likely to indicate that the actions would cause accidents than were cellular phone users who did not use voice-activated dialing ($M = .59$). Likewise, users who used hands-free adapters while driving ($M = .47$) were less likely to indicate that the actions would cause accidents than were users who did not use hands-free adapters ($M = .59$). Tukey's HSD test indicated that all of the main effect means for operator actions differed significantly from one another and were ordered in a manner identical to those in the description given previously for the actions in the ownership analysis.

Accidents and near misses. Two sets of analyses addressed the influence of previous accident and near-miss involvement on the perceptions of operator actions that might cause accidents. For each analysis, a 2 (incident involvement) × 4 (operator action) mixed-model ANOVA was conducted. Both showed a significant main effect for actions ($p < .05$), yielding a pattern of means already described. However, no other significant effects were shown ($ps > .05$).

Beliefs Concerning New Laws

The following subsections describe analyses of agreement ratings involving a set of three items concerning laws regarding cellular phone restrictions in conjunction with the same classification factors employed in the preceding analyses.

Cellular phone ownership. The mean agreement ratings as a function of statement regarding new laws restricting cellular phone use while driving and cellular phone ownership are displayed in Table 4. The data were analyzed using a 2 (cellular phone ownership) × 3 (law statements) mixed-model ANOVA. Both main effects were significant: For cellular phone ownership, $F(1, 328) = 5.65$, $p < .05$, and law statements, $F(2, 656) = 4.08$, $p < .05$. The interaction was also significant, $F(2, 656) = 9.03$, $p < .001$. The main effect means are shown in the bottom row and right columns of Table 4. Overall, nonowners of cellular phones gave higher ratings than did owners. Tukey's HSD test showed significantly higher agreement ratings for the statement regarding the need for a law restricting cellular phone use while driving except for emergencies, as compared with the statement that

TABLE 4: Mean Ratings of Agreement Versus Disagreement for the Passage of New Laws Restricting Cellular Phone Use While Driving by Cellular Phone Nonowners Versus Owners (*SD*s in Parentheses)

	Cellular Phone Ownership		
New Laws	Nonowner	Owner	Mean
There should be a law prohibiting people from using cellular phones while driving, except for emergency phone calls	4.34 (2.46) **	3.57 (2.51)	3.95
There should be a law prohibiting people from using cellular phones while driving	4.35 (2.39) **	3.35 (2.41)	3.85
There should be no laws at all regarding cellular phone use while driving	3.01 (2.06)	3.73 (2.40)*	3.37
Mean	3.90	3.55	

Note. Ratings are based on 9-point scales with the following anchors: 0 = *extremely disagree*, 1 = *very much disagree*, 2 = *disagree*, 3 = *somewhat disagree*, 4 = *neutral*, 5 = *somewhat agree*, 6 = *agree*, 7 = *very much agree*, and 8 = *extremely agree*. Thus higher scores indicate greater agreement.

*$p < .05$, **$p < .01$.

there should be no prohibitions on using a cellular phone while driving. The interaction means, displayed in Table 4, shows that nonowners of cellular phones, as compared with owners, gave significantly higher agreement ratings for the two statements favoring new laws prohibiting the use of cellular phones while driving (both overall and excepting an emergency) and significantly lower agreement ratings for the statement that there ought to be no laws at all regarding cellular phone use while driving.

Overall cellular phone usage. A 2 (amount of use) × 3 (law statements) mixed-model ANOVA was used to determine if beliefs regarding new laws varied by the reported amount of cellular phone usage. Neither main effect was significant (*p*s > .05); however, the interaction was significant, $F(2, 470) = 7.91$, $p < .001$. The pattern of means was nearly identical to the interaction described previously with respect to ownership, as provided in Table 4.

Using a cellular phone while driving. A similar analysis was conducted using reports of using or not using a cellular phone while driving. A 2 (cellular phone use while driving) × 3 (law statements) mixed-model ANOVA produced significant effects and a pattern of means similar to that for cellular phone owners described previously and in Table 4.

Use of accessories. Use of voice-activation and hands-free accessories were analyzed using separate 2 (safety device usage while driving) × 3 (law statements) mixed-model ANOVAs. Table 5 shows the means for the voice-activated dialing data. There was a significant main effect of law statement, $F(2, 470) = 4.07$, $p < .05$, and a significant interaction, $F(2, 470) = 4.07$, $p < .05$, but the main effect of safety device usage was not significant, $F(1, 235) = 1.71$, $p > .05$. Tukey's HSD test showed that significantly higher ratings were given to the statement that there should be no laws at all restricting cellular phone use while driving than to the statement that there should be a law prohibiting people from using cellular phones while driving. Simple effects analysis on the interaction means showed there was only one significant difference between users and nonusers of voice-activation devices while driving. Participants who reported using a voice-activation device while driving produced ratings that were significantly less favorable to a law prohibiting cellular phone use while driving except for emergencies, as compared with participants who reported not using a voice-activation device.

The hands-free adapter use data revealed a main effect of device usage, $F(1, 235) = 5.15$, $p < .05$, but there was no significant main effect of law statement or interaction, $F(2, 470) = 1.64$, $p > .05$, and $F(2, 470) < 1.0$, respectively. People who used hands-free accessories (rating $M = 3.17$) generally agreed less with the law statements than did those who did not use hands-free adapters (rating $M = 3.63$).

TABLE 5: Mean Agreement Ratings as a Function of Nonuse and Use of Voice-Activated Dialing and Law Statements (*SD*s in Parentheses)

	Use Voice-Activated Dialing While Driving		
Law Statements	No	Yes	Mean
There should be a law prohibiting people from using cellular phones while driving, except for emergency phone calls	3.72 (2.52)*	2.83 (2.36)	3.28
There should be a law prohibiting people from using cellular phones while driving	3.47 (2.41)	2.81 (2.35)	3.14
There should be no laws at all regarding cellular phone use while driving	3.59 (2.31)	4.33 (2.70)	3.96
Mean	3.60	3.33	

Note. Ratings are based on 9-point scales with the following anchors: 0 = *extremely disagree*, 1 = *very much disagree*, 2 = *disagree*, 3 = *somewhat disagree*, 4 = *neutral*, 5 = *somewhat agree*, 6 = *agree*, 7 = *very much agree*, and 8 = *extremely agree*. Thus higher scores indicate greater agreement.

*$p < .05$.

Accidents and near misses. An ANOVA that included reported accident experience involving a cellular phone failed to produce any significant effects (*p*s > .05). For near-miss involvement, only the interaction was significant, $F(2, 654) = 16.61$, $p < .001$. Table 6 shows the means for the near-miss data. Simple effects analysis on the interaction means showed that participants who reported near misses were in favor of the two statements on new laws prohibiting cellular use and less in favor of no laws restricting cellular usage, as compared with participants who did not report a near miss.

Demographic Variables

Several demographic variables (occupation, gender, ethnicity, and education level) were included in the aforementioned analyses as a third (between-subjects) factor. With the exception of gender, none of these demographic variables produced significant main effects or interactions with the variables described previously. A significantly larger percentage of women (84%) than of men (65%) reported owning a cellular phone, $F(1, 328) = 13.20$, $p < .001$. Also, more women (73%) than men (50%) reported using their cellular phones while driving, $F(1, 328) = 15.80$, $p < .001$; however, no gender difference was observed when amount of use per week use was analyzed. Self-reported use of safety devices such as voice-activated dialing and hands-free adapters did not vary by gender, nor did reports of previous involvement in accidents or near misses. However, there was a main effect of gender in the analysis of safety beliefs ($p < .05$), in which women gave lower ratings to the safety belief statements than did men. Also, there was a significant interaction between gender and safety beliefs ($p < .001$). Women gave significantly lower agreement ratings than did men to the statement that cellular phone use by others while driving is more dangerous than is using it themselves.

DISCUSSION

The majority (72%) of participants reported owning a cellular phone, and most of the owners (81%) reported using it when they drive. This latter percentage is somewhat higher than the 73% reported by the National Highway Traffic Safety Administration (NHTSA, 2001), but it probably reflects the growth in cellular phone use since the NHTSA data were collected. The failure to find much difference among the demographic variables, except for a few belief differences between genders, suggests that cellular phone use has penetrated the population at large without regard to class, such as socioeconomic status, occupation, and education. The usage rates indicate that much of the public has adopted the cellular phone despite it being a relatively new technology.

The main focus of the present research was to determine whether beliefs concerning the safety

TABLE 6: Mean Agreement Ratings as a Function of Reported Near Misses Involving Cellular Phone Use and Law Statements (*SD*s in Parentheses)

	Reported Near Misses Involving Cellular Phone		
Law Statements	No	Yes	Mean
There should be a law prohibiting people from using cellular phones while driving, except for emergency phone calls	3.51 (2.08)*	4.18 (2.28)*	3.84
There should be a law prohibiting people from using cellular phones while driving	3.19 (2.28)	4.30 (2.28)**	3.75
There should be no laws at all regarding cellular phone use while driving	3.95 (2.38)**	2.88 (2.12)	3.41
Mean	3.55	3.79	

Note. Ratings are based on 9-point scales with the following anchors: 0 = *extremely disagree*, 1 = *very much disagree*, 2 = *disagree*, 3 = *somewhat disagree*, 4 = *neutral*, 5 = *somewhat agree*, 6 = *agree*, 7 = *very much agree*, and 8 = *extremely agree*. Thus higher scores indicate greater agreement.

*$p < .05$, **$p < .001$.

of cellular phone use while driving differed depending on whether the individual is a user or a nonuser of cellular phones. The classification of user versus nonuser was based on several measures, including ownership or nonownership of a cellular phone, estimated use per week, and reported use while driving. Although there were a few differences among the different user versus nonuser classifications, the basic pattern across them was generally consistent. The results suggest that nonusers of cellular phones have stronger beliefs that there are safety problems associated with driving while using cellular phones than do users of cellular phones. Nonusers, to a greater extent than users, wanted other drivers not to use cellular phones and, if used while driving, to limit their use only to emergencies. Although both users and nonusers gave some of their highest ratings to the importance of having a cellular phone for emergencies, the users gave higher ratings to this item than did nonusers. Cellular phone users also gave higher agreement ratings than did nonusers to other items that suggested that they believe they, and other people, can use a cellular phone safely when driving. Also, cellular phone users gave higher agreement ratings than did nonusers to the statement that other people are more dangerous than themselves when driving while using a cellular phone. This latter notion will be discussed in more detail later.

Differences between users and nonusers were also found in the evaluation of several basic operator actions involved in using a cellular phone and in their beliefs regarding the need for laws governing cellular phone use while driving. Three of the four operator actions involved physical and cognitive use of the device (involving pressing buttons and talking on the phone), and these were judged to be more likely to cause accidents as compared with the use of a hands-free adapter. Dialing a number was judged as having the highest potential among the four actions for causing an accident. Users of cellular phones judged that talking on the phone was less hazardous than did nonusers. The nonusers' perceptions relative to the users' concur with research indicating that hands-free equipment does not eliminate all of the distractive aspects of cellular phones because the cognitive aspects of the driving tasks still remain. In fact, users of safety accessories such as voice-activated and hands-free accessories were less likely than nonusers of such devices to indicate that operator actions could cause accidents. This finding suggests that users of safety devices may be inclined to believe that they are safe while concurrently using a cellular phone and driving.

Cellular phone users held a less favorable opinion about new laws prohibiting cellular phone use and were more likely to support no laws at all regulating cellular phone usage, as compared with nonusers. As mentioned earlier, cellular phone users believe that they are better than other people in using their cellular phones while driving and that people, in general, can use cellular phones safely while driving. Together the findings suggest that cellular phone users would resist laws regarding cellular phone use while driving. Likewise, users of safety accessories were significantly less favorable to laws limiting cellular phone use while driving.

Although a number of the cellular phone users owned safety devices such as voice-activation and hands-free accessories, only a fraction reported using them. Although these devices will not eliminate all distraction, these accessories could be useful in decreasing some distracting aspects of response processing. More people might use hands-free features if they were made more compatible with the driving task. For example, future cellular phones might incorporate better tactile cues to decrease the need to glance at the phone to assess finger placement. Usability testing could be used to determine better in-vehicle systems (e.g., the incorporation of universal phone mounts that connect to enlarged touch screens in navigation displays), which could reduce some of the task load involved in using a cellular phone and consequently reduce distraction from the driving task.

Although there were rather clear user versus nonuser differences, the mean ratings were generally in the neutral range of the scales, usually between *somewhat disagree* and *somewhat agree.* Nevertheless, the ratings showed an apparent distinction (a relative difference) between the beliefs of users of cellular phones and those of nonusers. There are several potential explanations for the differences in safety beliefs between users and nonusers. One is optimism bias

(Dalziel & Job, 1997; Dejoy, 1987), in which people believe that they are more capable than others. A second explanation is the third person effect (Perloff, 1993), in which people tend to believe they are less susceptible to hazards than are other people (Adams, Bochner, & Bilik, 1998). Although there was some support for these explanations, it was not always strong. Consider the item, "The use of cellular phones by other drivers is more dangerous than if I use a cellular phone when driving." Overall, the ratings tended to be in the *slightly disagree* side of the scale. However, if the data are viewed as relative differences between users and nonusers, the effect is more apparent: Users of cellular phones agreed to this item to a greater extent than did nonusers. According to these two biases, cellular phone users, as compared with nonusers, may erroneously believe that negative outcomes are less likely occur to themselves than to others.

Although we suggest that cellular phone users, particularly those who use hands-free and voice-activated safety accessories, may have some false beliefs regarding their ability, there also might be some kernel of truth to their perceptions. Persons who frequently use cellular phones while driving have had practice, reducing some of the load, and might be better able to distribute their attention as compared with nonusers or less frequent users. It is also possible that nonusers have difficulty in attention distribution and, as a consequence, choose not to use cellular phones while driving. Whether some people are better able than others to distribute their attention appropriately, and whether those with higher ability tend to use cellular phones while driving and those with lower ability do not, are issues that need further investigation.

Related to this topic of attention distribution is a third explanation for the present results. While using a cellular phone, drivers may experience inattentional blindness (Strayer et al., 2001) by dividing their attentional resources between the driving task and phone-related activity and thus decreasing detection of visible stimuli. In driving simulator research, participants using a cellular phone failed to recognize cues from the environment, such as roadside billboards, even when an eye-tracking paradigm verified that they had fixated on them. In the present study, some indication of inattentional blindness was noted in the near-miss results. Those persons who indicated not having experienced a near-miss event produced a pattern of results similar to that of users of cellular phones. Cellular phones users' attention may be so tied up that they do not notice the near misses when they occur, even though one might expect that cellular phone users would have more near misses than would nonusers.

Past accident involvement as a factor failed to show significant effects, probably because accidents are relatively low-frequency events and cell phone involvement is a subset of that. Thus another explanation of the present results is that because bad consequences are relatively infrequent, when combined with prior positive experiences of using a cellular phone, a bias toward reduced perceptions of risk and higher safety beliefs might be produced among cellular phone users.

Because of the potential dangers involved, it may be useful to make drivers more aware of the attentional cost of using the cellular phone in detracting from the primary task of driving through an educational campaign to reduce false beliefs. The hazard communication and warnings literature (Laughery, Wogalter, & Young, 1994; Wogalter, Young, & Laughery, 2001) offers methods that might be effective in debiasing beliefs. For example, videos that illustrate the behavior of a model faced with the same safety dilemmas as the user have been shown to be effective (Racicot & Wogalter, 1995). In addition, vignette-based warnings could be designed as a proxy for personal experience and used to promote comprehension and compliance (Mayhorn, Nichols, Rogers, & Fisk, 2004). Because participants who reported near-miss experiences provided more favorable ratings for laws limiting cellular phone usage while driving than did those who did not report such incidents, it is strongly suggestive that previous experience plays an important role in forming attitudes.

Alternatively, simulators might be modified to mimic the delayed driving responses (e.g., sluggish braking behavior) associated with inattention blindness. Data from Strayer, Drews, and Johnston (2003) suggest that although people are aware of their impairment and attempt to

compensate for it by increasing following distance, users of cellular phones in simulated driving tasks were still subject to increased risk of traffic accidents. The present research suggests that at least some cellular phone users were aware that cellular phone use can impair driving, but they may not know the extent and ways it could be impaired. Using a high-fidelity simulator (or a video of one) to demonstrate impairment might be useful in risk calibration.

Although it might be foolhardy to expect that any educational efforts, even large-scale ones, will be effective for all drivers, some impact on some drivers could be considered valuable. Previous educational efforts in seat belt use showed some success, but it took primary and secondary enforcement laws to move some persons into compliance. Even with primary laws, some "hardcore" nonusers still do not buckle up. The kinds of educational efforts that can overcome cellular phone users' deflated risk perception and the potential for overconfidence in the use of safety accessories needs further investigation. Because well-established belief systems are difficult to change (DeJoy, 1999), new drivers who have not yet established firm beliefs and habitual behaviors would be more likely to be influenced by such programs than would experienced cellular phone users. If so, incorporation of material into driver education instruction, books, and classes could be useful.

One limitation of the present research is the use of self-reports. More direct measures of driving performance while using a cellular phone would be preferred. However, self-reports can provide at least some indication of what people may do. Although responses to a questionnaire might not be synonymous with actual driving behavior, it should be noted that the major focus of this research was on people's beliefs. Self-report methodology is an appropriate and fairly direct measure of beliefs. Thus, although one might be cautious in interpreting the self-report data that address behaviors (e.g., operator actions), no such caution is necessary for those self-reports intended to capture beliefs. Nevertheless, further research employing other kinds of methods could verify and determine variance attributable to content and technique.

ACKNOWLEDGMENTS

The authors wish to thank Eric F. Shaver for his assistance in this research.

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Date received: February 3, 2003
Date accepted: September 10, 2004