Cell Phone Use While Driving in North Carolina: 2002 Update Report

Final Project Report to the
North Carolina Governor's Highway Safety Program

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TECHNICAL SUMMARY

As a follow-on to an earlier study funded by the North Carolina Governor's Highway Safety Program, the current study was carried out to further understanding regarding the safety implications of cellular telephone use while driving. The study involved three separate tasks: (1) a statewide telephone survey to gather information on cell phone use and user characteristics, along with drivers' opinions regarding the safety and potential regulation of cell phone use while driving; (2) an analysis of the characteristics of cell phone-related crashes, based on 452 cell phone crashes identified from an earlier computerized narrative search of N.C. crash data; and (3) a supplementary data collection activity by the North Carolina State Highway Patrol to identify and report cell phone-related crashes occurring statewide over a two-month period.

The statewide telephone survey was conducted during the early summer of 2002 and targeted 500 users and 150 non-users of cell phones. All participants were licensed North Carolina drivers ages 18 and older. Key findings from the survey include the following:

- An estimated 58.8 percent of the state's licensed drivers have used a cell phone while driving.

- Cell phone use levels were highest among drivers in the 25-39 and 40-54 year age categories. Other demographic characteristics, including driver gender, race, and vehicle type, did not differ significantly for users versus non-users, although a higher proportion of users than non-users drove sport utility vehicles.

- The average reported time per day spent talking on a cell phone while driving was 14.5 minutes; while the median reported time was much lower at 5.0 minutes. Talk time decreased with increasing age, and was higher for males than for females.

- One in four users reported having a hands-free device, although they did not always use the device when talking on their cell phones.

- Users generally perceived talking on cell phones while driving to be less distracting and less of a safety concern than did non-users. Users were also less likely than non-users to support legislation that would prohibit anything other than hand-held phone use, and were less likely to support stricter penalties for cell phone users involved in crashes.

To examine the characteristics of cell phone-related crashes, a computerized narrative search of all reported crashes occurring in the state from January 1, 1996 through August 31, 2000 resulted in the identification of 452 cell phone-related crashes. The characteristics of these crashes were compared with the nearly 1.1 million non-cell phone crashes occurring in the state during the same time period. Results showed that:

- Cell phone crashes were less likely than non-cell phone crashes to result in serious or fatal injury. They were nearly twice as likely to involve rear-end collisions (45.1% versus

25.6%), but involved approximately equal proportions of ran-off-road and angle collisions.

- Cell phone crashes were somewhat more likely to occur during the mid-day or afternoon hours. They were also more likely to occur in urban areas, on local streets, and at roadway locations with "no special feature." They were not found to be overrepresented at intersection locations.

- Compared to non-users, drivers who were using their cell phone at the time of their crash were more likely to be male, under the age of 55, and driving a sport utility vehicle. The vast majority were at least partially responsible for their crash, based on information noted under the "driver violation" variable of the crash report form.

- The most commonly identified driver violations for cell phone users involved in crashes were failure to reduce speed (23.5%), traffic signal violation (9.6%), speeding (4.9%), following too closely (3.5%), and failure to yield (3.5%).

Finally, results of the special two-month data collection activity by the North Carolina State Highway Patrol revealed the following:

- Of the 29 identified cases, all but one involved a hand-held cell phone.

- The largest number of reported crashes involved simply talking or listening on the cell phone. Smaller numbers involving reaching for the phone, dialing or preparing to dial the phone, and answering the phone. However, a range of other activities was also identified, including retrieving a phone, picking up a dropped phone, looking down at the phone, hanging up the phone, and checking messages.

- Based on the reported cases, it was estimated that cellular telephones are involved in *at least* 0.16 percent of crashes occurring in non-metropolitan areas of the state, or about one in 623 reported crashes. This is almost identical to the estimate generated from the pilot data collection activity carried out the previous year, and reported in Reinfurt et al., 2001.

For the special two-month data collection activity, the total of 29 reported cell phone crashes projects to 174 crashes annually. From the analysis of cell phone-related crashes reported in Chapter 3, it was shown that 90.6 percent of the crashes occurred within municipal boundaries. The vast majority of these crashes would have been reported by municipal police, rather than State Highway Patrol troopers. In fact, only an estimated 11.8 percent of the crashes identified from the 1996-2000 narrative search were reported by the Highway Patrol. Thus, the total number of cell phone-related crashes projected for the state would be 174 ÷ .118, or 1,475 crashes annually.

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Chapter 1. Introduction

This study represents a follow-on to an earlier study of cell phone use while driving in North Carolina.[1] That study involved five tasks: (1) a review of the literature; (2) a review of recent legislative activity related to cell phone use while driving; (3) an observational study of cell phone use while driving in North Carolina; (4) pilot-testing of a supplemental data collection form by the N.C. State Highway Patrol; and (5) a computerized search of police crash report narrative data to identify cell-phone related crashes. Among other findings, the observational portion of the study (Task 3) revealed that at any point in time, an estimated 3.1 percent of drivers in the state were using cell phones. Observed usage was highest in the more urban central region of the state, for younger drivers, drivers of sport utility vehicles, and drivers of white ethnicity. Usage was also higher during afternoon as opposed to morning hours, and for those driving without a front seat passenger in their vehicle.

The piloting of a supplementary data collection form by the State Highway Patrol (Task 4) resulted in 11 identified cell phone crashes over a two-month period in three of the state's eight highway patrol districts. This translated into one in 608 reported crashes. Finally, the computerized search of crash report narratives (Task 5) showed rapid growth in the number of reported crashes, from just 22 crashes in 1996, to 231 for the first eight months of 2000. Talking on the cell phone was the most frequently identified driver activity, followed by answering the phone and then reaching for the phone.

The current effort extends on this initial study in three areas. First, a statewide telephone survey was carried out to gather information on cell phone use and user characteristics, along with drivers' opinions regarding the safety and potential regulation of cell phone use while driving. The survey targeted 500 users and 150 non-users of cell phones. Secondly, using the 452 cell phone crashes identified from the earlier computerized narrative search of N.C. crash data, an analysis of the characteristics of cell phone-related, versus non-cell phone-related, crashes was carried out. Lastly, the supplementary data collection activity by the State Highway Patrol was expanded to include all troops statewide, and data collected over a similar two-month period during the spring and early summer of 2002.

The three chapters that follow present more detailed information on each of these activities. Each includes a review of relevant background literature, a description of the study methods, a presentation and discussion of the results, and a listing of cited references. A final chapter summarizes and discusses key findings from all three activities.

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[1] Reinfurt, D. W., Huang, H. F., Feaganes, J. R. and Hunter, W. W. *Cell Phone Use While Driving in North Carolina*. Highway Safety Research Center, University of North Carolina - Chapel Hill, November 2001. Available on the web at: http://www.hsrc.unc.edu/pdf/2001/cellphone.pdf .

Chapter 2. Cell Phone Use While Driving: Results of a Statewide Survey

(Adapted from a paper prepared for presentation at the Annual Meeting of the Transportation Research Board, Washington, D.C., January 2003)

Background

The number of cell or mobile phone users in the United States has grown from fewer than 100,000 in January, 1985 to an estimated 137 million in July, 2002 *(1)*. With the explosion in ownership has come increased use of cell phones while driving. Data collected by the National Highway Traffic Safety Administration (NHTSA) as part of its Fall 2000 National Occupant Protection Use Survey revealed that an estimated 3.9% of passenger car drivers are using cell phones at any time while driving *(2)*.

Use of cell phones while driving raises safety concerns. A varied and growing body of literature provides convincing evidence that cell phone use while driving leads to poorer driving performance and increased risk of crash involvement *(3-7)*. Studies have been conducted using driving simulators *(8-11)*, instrumented vehicles on the road *(12)*, case-control and other epidemiological study designs *(13-15)*, and analyses of national and state motor vehicle crash data *(7)*. Even though there is general consensus that talking on cell phones while driving poses safety risks, there is no consensus on the magnitude of these risks and on the best approaches for lowering them. Some favor strict regulation at the state or local level, even including a total ban on cell phone use while driving; others argue that more consumer education, focused not only on cell phone use but on all activities shown to distract drivers, is sufficient to allay safety concerns.

All parties agree on the need for more and better data to clarify the risks associated with use of cell phones while driving and the specific parameters influencing this risk. One topic that has drawn considerable attention is the extent to which "hands-free" cellular phone systems afford safety benefits over "hand-held" models. While the newer systems may well be easier and less distracting to use, whether this translates into fewer crashes is still a topic for debate. Despite a Japanese study showing that the greatest proportion of cell phone crashes occur while receiving or placing calls *(7)*, U.S. studies have generally shown most crashes to occur while talking on phones, and suggest that hands-free versus hand-held systems have little impact on the cognitive distraction associated with carrying on a conversation while driving *(8, 13)*.

Although legislation being considered in five states this year would prohibit use of cell phones while driving except in emergencies, and legislation in 24 states would ban the use of hand-held systems, only New York State currently has a law in place prohibiting use of a hand-held cell phone while driving *(16)*. In addition, nine local jurisdictions have enacted bans on hand-held phone use while driving *(16)*. A project was recently undertaken by the National Congress of State Legislatures in response to ever increasing requests for information regarding cell phones and other in-vehicle technologies from state and local lawmakers and the general public. The project brought state legislators and staff together with representatives from industry and the highway safety community to "identify important issues, review current information, and create a forum where stakeholders could work toward finding common ground" *(3)*. Consensus

was reached in 14 important areas, including the need for better data and increased public education. However, the group failed to reach consensus on whether legislation was needed to lower the potential risk of crashes due to cell phones and other wireless technologies, or on whether cell phones should be singled out from other common driver distractions in state data collection efforts.

The current telephone survey of cell phone users and non-users in North Carolina was carried out as part of two larger projects funded by the state's Governor's Highway Safety Program exploring cell phone use and driving safety. Three tasks were carried out as part of the initial project. These included (1) a statewide observational survey of cell phone use while driving, similar to the NHTSA survey reported on earlier; (2) a pilot test of a supplemental data form for use by the N.C. State Highway Patrol to identify crashes involving cell phones; and (3) an analysis of narrative data on N.C.'s computerized crash files to identify potential cell phone-related crashes. Results from these efforts have been summarized in a final project report (17).

In a second follow-on project, we have continued to work with the N.C. Highway Patrol to collect supplementary data on cell phone-related crashes, and have linked the narrative crash data to the complete state motor vehicle crash files for further analysis. In place of the statewide observational survey (which yielded a use rate of 3.1% for hand-held phones), it was decided to conduct a telephone survey to provide an updated snapshot of cell phone use while driving in North Carolina, and to learn drivers' opinions regarding the safety of cell phones and attitudes regarding regulation.

With the exception of industry marketing surveys, which are limited in scope, only a few surveys have been carried out to gather information on cell phone use while driving, and much of this information is quickly outdated as more phones are sold and new technologies are introduced. Industry surveys have generally shown a trend of increasing cell phone use by younger and older drivers and by individuals with lower incomes. Surveys have also shown a decrease in the proportion of business or work-related calls compared to personal calls *(7, 3)*. Surveys conducted by *Prevention Magazine* in 1994 and 1995 reported that 15% of cell phone owners never use their phones while driving; 5% have had a "near miss" crash while driving and talking, and 2% have been involved in a crash where someone else was talking *(7, 3)*. An ongoing Internet-based survey being conducted by Nationwide Insurance reports that 15.2 percent of respondents "always" or "frequently" talk on cell phones while driving, while an additional 28.7 percent "occasionally" use cell phones *(18)*.

Drawing from data collected as part of its Motor Vehicle Occupant Safety Survey conducted November 1996 - January 1997, NHTSA found that 30% of respondents reported having a phone or carrying one with them when they drove. Phone use was highest among persons ages 45-54 (39%), and those ages 35-44 (36%), and among college graduates. Nine of ten cell phone owners reported using their phones while driving, with males reporting using them on a higher proportion of their trips than females *(7)*. NHTSA recently estimated that 55% of drivers routinely carry phones in vehicles, and half of these leave the phones on during their trip. It further estimated that 73% of the phones used in cars are hand-held models *(3)*.

Having up-to-date information on who is using cell phones while driving, how the phones are being used, and the perceived safety of their use can provide a useful complement to available data on cell phone-related crashes, and help guide lawmakers and the highway safety community in identifying the best approaches for promoting safety without unnecessarily curtailing the many benefits that cell phones and other new in-vehicle technologies can offer.

Methods

A North Carolina statewide telephone survey was conducted over a one-month period from mid-June until mid-July, 2002. The survey questionnaire was developed by researchers at the UNC Highway Safety Research Center, working with a marketing and survey research firm based in the area. The questionnaire was developed over a period of several months with input from NHTSA staff and others. It was pilot tested on an informal basis during the development process, and then formally pilot tested in the field before actual data collection was begun. Cell phone users were asked the full questionnaire, while non-users were asked an abbreviated version that omitted questions pertaining to cell phone use but which otherwise contained identical questions.

The survey was a random digit dial household telephone survey. Invalid, disconnected, or not-in-service numbers were screened out, as were businesses. Households were also screened out of the survey if (1) there was no adult over age 18 in the household; (2) there was no adult with NC residency in the household, and/or (3) there was no adult with a valid driver's license in the household. In addition to these screening criteria, potential participants were screened on the basis of age and their use or non-use of cell phones. A quota of at least 50 survey participants in each of five age groups (18-24, 25-39, 40-54, 55-69, 70+) was set. In addition, we targeted 500 interviews to be completed with cell phone users and 150 with cell phone non-users, for a total of 650 completed interviews. Cell phone users were oversampled to allow for more in depth analyses within this subpopulation of interest.

A copy of the questionnaire is included as an Appendix to this report. Cell phone users averaged just over nine minutes to complete the survey, while non-users completed the shorter version in six-and-a-half minutes. The survey was conducted using a Computer Aided Telephone Interviewing (CATI) system, which allowed for automatic quota allocations, skips, and validity checks on data entries. The completed database was further edited for completeness and accuracy and converted to a SAS dataset for analysis using Statistical Analysis System software, Version 8. The data were analyzed descriptively using single variable and two- and three-way crosstabulations of the data. Statistical testing was carried out using chi-square tests of association on categorical variables and t-tests or Pearson correlation coefficients for continuous data. Standard regression models were used in some limited multivariate analyses of the data.

Results

Screener Results

A total of 1,006 individuals completed the survey screener. An additional 106 individuals were contacted but did not complete the screener because of refusals to participate, language barriers, medical or physical disabilities, etc. Of the 1,006 individuals completing the survey screener, 550 (54.7 percent) reported having used a cell phone while driving, while 456 (45.3 percent) reported not having used a cell phone while driving (see Table 2.1). These numbers likely underestimate the true percentage of licensed adult drivers in North Carolina who have used a cell phone while driving, since they are based on a sample of individuals contacted by telephone. As shown in the table, this sample underrepresented drivers in the youngest two age categories (ages 18-24 and 25-39) and overrepresented those in the oldest two age categories (ages 55-69 and 70+). To the extent cell phone use is higher among younger than older drivers, the overall statewide estimate should also be higher.

TABLE 2.1 Age Distribution of Cell Phone Users and Non-Users Completing the Survey Screener and Comparison to All N.C. Licensed Drivers

Age Distribution	Cell Phone User		Cell Phone Non-user		Total Completing Screener		All Licensed NC Drivers Age 18+ *
	n	Col. %	n	Col. %	n	Col. %	Col. %
18-24	52	9.5	26	5.7	78	7.8	11.7
25-39	153	27.8	72	15.8	225	22.4	33.2
40-54	181	32.9	112	24.6	293	29.1	29.3
55-69	130	23.6	131	28.7	261	25.9	16.6
70+	34	6.2	115	25.2	149	14.8	9.2
Total	550	100.0	456	100.0	1006	100.0	100.0

* Based on data from "Highway Statistics 1999," published by FHWA's Office of Highway Policy Information and available on the web at http://www.fhwa.dot.gov/ohim/hs99/tables/dl22.pdf.

Figure 2.1 shows the percentage of cell phone users within each of our five identified age categories, i.e., the row percents from Table 2.1. Cell phone use was highest among adults ages 25-39, and only slightly lower for the 18-24 and 40-54 year age groups. Use rates dropped off considerably in the older age categories. If one adjusts the use rates found in Table 2.1 to reflect the overall age distribution of North Carolina licensed drivers ages 18+, the estimated percentage of drivers who have used a cell phone while driving increases to 58.8 percent.

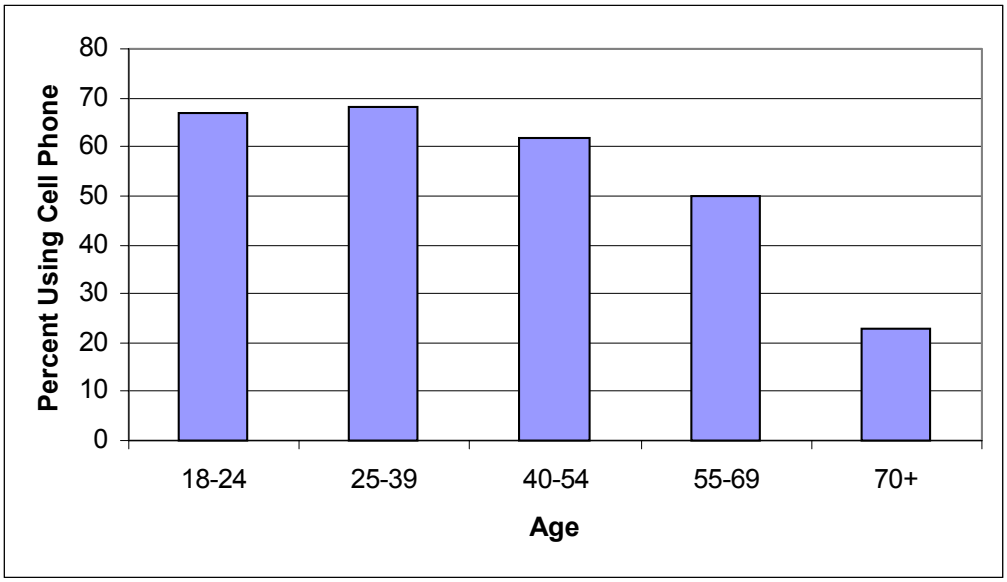

Figure 2.1. Percent of respondents to screener reporting using a cell phone while driving.

Characteristics of Cell Phone Users and Non-users

The demographic characteristics of the cell phone users and non-users *participating in the survey* are shown in Table 2.2. As described above, not everyone who was screened was asked to participate in the survey. Interviews were completed with 500 cell phone users (91 percent of those screened), but only 150 non-users (32.9 percent of those screened). In addition to user and non-user quotas, we specified that at least 50 interviews should be completed in each age group. As a result, the age distribution of the non-user participants shown in Table 2.2 differs significantly from that shown in Table 2.1. The age distribution of users remains almost identical except for a slight decrease in the percentage of participants age 70+. Compared to non-users, cell phone users participating in the survey were more likely to fall into the 25-39 and 40-54 year age categories, and less likely to be age 70 or above ($p<.0001$).

Results with respect to sex and race (which were not affected by the cell phone use and age quotas) were both non-significant. Although more females than males participated in the survey, there was a higher proportion of males among the users than among the non-users. Cell phone users were also more likely than non-users to drive sport utility vehicles (SUVs). The overall pattern for vehicle type, however, was not significantly different for the two groups.

Cell Phone Use Patterns

Results with respect to cell phone use characteristics, based only on responses from the 500 survey participants who reported having used a cell phone while driving, are summarized in Table 2.3 and discussed in the sections that follow.

TABLE 2.2 Characteristics of Cell Phone Users and Non-users Participating in the Telephone Survey

Characteristic	Cell Phone User (n=500)		Cell Phone Non-user (n=150)		P-value *
	n	Col. %	n	Col. %	
Age					
18-24	47	9.4	11	7.3	p<.0001
25-39	140	28.0	24	16.0	
40-54	168	33.6	44	29.3	
55-69	118	23.6	48	32.0	
70+	27	5.4	23	15.3	
Sex					
Male	208	41.6	52	34.7	N.S.
Female	292	58.4	98	65.3	
Race					
White	408	83.1	118	83.1	N.S.
Black	60	12.2	20	14.1	
Hispanic	6	1.2	2	1.4	
Other	17	3.5	2	1.4	
Missing / Unknown	9	--	8	--	
Vehicle type					
Passenger car	266	53.4	84	56.4	N.S.
Pickup truck	87	17.5	24	16.1	
Sport Utility Vehicle	84	16.9	17	11.4	
Van / minivan	49	9.8	16	10.7	
Other	12	2.4	8	5.4	
Missing / Unknown	2	--	1	--	

* Based on chi-square tests of association. N.S. = non-significant p-value.

Use of Hands-free versus Hand-held Phones

One in four respondents (28.2 percent) indicated that they used a hands-free device when talking on their cell phone while driving. For nearly two-thirds of these individuals, this hands-free device was a headset or earpiece connected to the phone; only one-third indicated that they had a speaker phone system. Those who had hands-free systems reported using them on most occasions. The overall mean use rate was 72.8 percent, while the median use rate was 80.0 percent. One-third reported always using their hands-free system. There were no significant differences in reported use rates by respondent age or sex, or by the type of system available. Mean use rate was 75.3 percent for those with speaker phones, compared to 71.5 percent for those with headsets and/or earpieces.

TABLE 2.3 Cell Phone Use Characteristics (n=500 Cell Phone Users)

Characteristic	n	Col. %
Use of hands-free device		
Yes	140	28.1
No	358	71.9
Unknown / missing	2	--
Type of hands-free device		
Headset or earpiece connected to phone	89	64.0
Speaker phone system	46	33.1
Other hands-free device	4	2.9
Unknown / missing	1	--
Percent of time use hands-free device when talking *		
0-29 percent	17	12.5
30-59 percent	29	21.3
60-89 percent	25	18.4
90-99 percent	19	14.0
100 percent (always)	46	33.8
Unknown / missing	4	--
Believe hands-free device makes talking on phone while driving *easier*?		
Yes	125	89.9
No	14	10.1
Unknown / missing	1	--
Believe hands-free device makes talking on phone while driving *safer*?		
Yes	121	87.7
No	17	12.3
Unknown / missing	2	--
Total driving time on typical day *		
Less than 20 minutes	32	6.4
20-29 minutes	28	5.6
30-59 minutes	101	20.2
1 hour - 1 hour and 59 minutes	163	32.6
2 hours - 2 hours and 59 minutes	84	16.8
3 hours or more	92	18.4

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TABLE 2.3 Cell Phone Use Characteristics (n=500 Cell Phone Users)

Characteristic	n	Col. %
Total time using cell phone while driving on typical day *		
Less than one minute	92	18.4
1-4 minutes	148	29.6
5-9 minutes	100	20.0
10-19 minutes	79	15.8
20-29 minutes	28	5.6
30-59 minutes	19	3.8
1 hour	16	3.2
Two hours or more	18	3.6
Percentage of calls that are work-related *		
None	260	53.3
1-24 percent	46	9.4
25-49 percent	17	3.5
50-74 percent	67	13.7
75-99 percent	67	13.7
100 percent	31	6.4
Unknown / missing	12	--
Typical number outgoing calls made while driving		
None or almost none	122	24.5
Less than 1 per day	113	22.7
1-2 calls per day	147	29.5
3-5 calls per day	76	15.3
6-10 calls per day	22	4.4
More than 10 calls per day	18	3.6
Unknown / missing	2	--
Typical number incoming calls answered		
None or almost none	174	34.9
Less than 1 per day	81	16.3
1-2 calls per day	134	26.9
3-5 calls per day	69	13.9
6-10 calls per day	24	4.8
More than 10 calls per day	16	3.2
Unknown / missing	2	--
How often pull off the road to use cell phone?		
Never	172	34.8
Rarely	95	19.2
Sometimes	116	23.5
Usually	57	11.5
Always	54	10.9
Unknown / missing	6	--

* Responses grouped for presentation.

Those who had hands-free systems overwhelmingly (89.9 percent) felt that the system made it *easier* for them to talk on the phone while driving. Almost as many (87.7 percent) felt that it made it *safer* for them to talk on the phone while driving. These results did not vary significantly by type of hands-free system.

Typical Daily Use

Participants in the survey spent on average 106 minutes per day driving. Driving time, however, was positively skewed, so that the median time spent driving was 60 minutes, as was the mode. Average time spent talking on a cell phone per day while driving was similarly skewed, with a mean of 14.5 minutes and median and mode of 5.0 minutes. Average time talking was significantly associated with both age and gender: usage decreased with increasing age, and was higher for males than for females ($p<.001$ for both age and gender, based on linear regression). Using mean reported times, the proportion of time survey participants spent using their cell phone while driving can be estimated at 14.5 minutes (talking) / 106 minutes (driving), or .14. A comparison of median reported talking and driving times yields a somewhat reduced ratio of .08 (i.e., 5.0 minutes talking / 60 minutes driving).

Participants were also asked what percentage of the calls they made each day were work-related calls, and what percentage were personal calls. Responses were required to total 100 percent. Just over half of the respondents (53.3 percent) reported that they made no work-related calls, while at the other extreme, 6.4 percent responded that all of their calls were work-related. The average reported percentage was 27.3 percent. There was a significant positive correlation between percent work-related calls per day and total time spent talking on phone per day (Pearson $R^2 = 0.227$, $p<.0001$).

Over three-fourths (76.7 percent) of cell phone users reported placing two or fewer calls per day. Only a few (8.0 percent) reported placing more than five calls per day. Results were similar with respect to receiving incoming calls. Both the number of outgoing calls and the number of incoming calls were significantly associated with respondent age and sex: generally, the percentages of respondents making 3-5 or 6 or more calls per day decreased with respondent age, and was higher for males than for females ($p<.001$ for both age and sex crosstabulations).

A final question pertaining to cell phone use was how often the respondents pulled their car off the road to use their cell phone. Over a third of the respondents (34.8 percent) said that they never pulled their car off the road, whereas 22.4 percent said that they usually or always pulled off. Results were strongly associated with age ($p<.0001$), with older drivers much more likely to respond that they always or usually pulled over (60.0 percent for drivers age 70+, decreasing to only 4.3% for drivers age 18-24). Responses did not vary by sex, and were not associated with the various measures of cell phone use (total time talking per day, average number incoming and outgoing calls per day) once age was incorporated into the regression model.

Driving Safety and Use of Cell Phone

Those who reported using a cell phone while driving were asked if they had ever "had to make a sudden evasive maneuver to avoid being in an accident" while driving and talking on their phone. A "sudden evasive maneuver" was described as slamming on the brakes or jerking the steering wheel. Nearly one in eight (11.8 percent) respondents said that they had. Although

the likelihood of a positive response was highest for drivers ages 18-24 and lowest for those ages 55-69, the results were only marginally associated with driver age (p=.068), and were not at all associated with use of a hands-free versus a hand-held phone system. Results were, however, significantly associated with likelihood of pulling off the road to use a phone: those who reported usually or always pulling over to use their cell phone were less likely than those who never or rarely pulled over to have made an evasive maneuver while on the phone. These results held even after adjusting for driver age (p=.018), as well as total driving time and total talking time (p=.044).

Use of Other Electronic Services

Cell phone users were also asked about other electronic services they might access while driving. These included voice mail, e-mail, or the Internet; vehicle navigation systems such as On-Star; PDAs or "personal digital assistants" like Palm Pilot or Handspring; and reading text or instant messages. Accessing voice mail received the highest positive response, with 19.4 percent of cell phone users indicating that they also accessed voice mail while driving. Results were strongly associated with age, ranging from a high of 42.6 percent for respondents ages 18-24 to only 3.7 percent for respondents ages 70 and older (p<.001).

Results with respect to the other services generally hovered in the one to two percent range: accessing e-mail 1.4 percent; accessing the Internet 0.8 percent; use of a vehicle navigation system 1.8 percent; and use of a PDA 2.2 percent. None of these findings was significantly associated with respondent age. A somewhat higher percentage of cell phone users said that they read text or instant messages while driving. These results were especially high among the 18-24 year-old respondents, with 14.9 percent indicating that they read text or instant messages while driving (p=.0013).

Cell phone non-users were only questioned about their use of in-vehicle navigational equipment while driving. Only one of the 150 non-user respondents indicated using such a system.

Opinions on Cell Phone Safety and Regulation

Both cell phone users and non-users were asked to rate how distracting they thought various activities were to driving. The specific instructions were, "Please rate how distracting you think the following activities are to a driver. Use a scale of 0 to 10, where 0 means 'not at all distracting' and 10 means 'extremely distracting.'" A total of ten activities was presented in random order, except that "talking on a cell phone with a hands-free device" and "talking on a cell phone without a hands-free device" were always asked consecutively. Results are summarized in Table 2.4, roughly ordered from least distracting to most distracting based on ratings assigned by the non-cell phone users.

All of the activities except for finding a location using a road map were significantly associated with cell phone user status, with non-users rating the activities more distracting than users. In the case of finding a location using a road map, cell phone users rated this the most distracting of the ten activities, while non-users rated it somewhat less distracting than either talking on a cell phone without a hands-free device or dialing a cell phone. Talking with other passengers in the vehicle received the lowest overall distraction rating from both groups.

TABLE 2.4 Opinions on Level of Distraction of Various Activities While Driving

Driving Activity	Average Rating on Scale of 0 to 10 where 0=Not at all distracting and 10=Extremely distracting		P-value for Cell Phone Use Status *
	Cell Phone Users (n=500)	Cell Phone Non-Users (n=150)	
Talking with passengers	3.68	4.30	p=.029
Changing the station on the radio	3.75	4.99	p<.001
Talking on a cell phone with a hands-free device	3.36	6.03	p<.001
Drinking a cup of coffee	4.45	6.36	p<.001
Eating a sandwich	5.46	6.70	p<.001
Answering an incoming call on a cell phone	5.62	8.29	p<.001
Reading driving directions	7.62	8.51	p=.001
Finding a location using a road map	8.23	8.51	N.S.
Talking on a cell phone without a hands-free device	6.53	8.74	p<.001
Dialing a cell phone	7.28	9.25	p<.001

* For cell phone use status, based on regression models incorporating age and gender.
N.S.=Non-significant

Also, both groups rated talking on a cell phone with a hands-free device much less distracting than talking on a cell phone without a hands-free device. Still, for the non-users especially, cell phone use and in particular dialing a cell phone were considered extremely distracting activities.

Ratings for the various potential distractions were also significantly associated with respondent age and gender: females gave higher distraction ratings than males, and ratings increased with age.

In addition to rating how distracting they thought various activities, including cell phone use, were to driving, respondents were asked to use the same 0-10 scale to indicate the extent to which they agreed or disagreed with the following three statements:

1. Most people can carry on a conversation on their cell phone and still drive safely.

2. Cell phones are more beneficial to drivers than they are harmful.

3. Using a hands-free device with a cell phone is safer than using a hand-held cell phone.

In this case, a rating of "0" corresponded to "completely disagree" while a rating of "10" corresponded to "completely agree." Results were again differentiated by cell phone use status. As expected, cell phone users were more likely than non-users to agree with the various statements, indicated by their higher average ratings (see Table 2.5). However, it is interesting that except for the benefits of a hands-free phone system, even users did not demonstrate strong agreement with the two statements related to cell phone safety. Younger respondents were the most likely to feel that drivers could carry on a conversation on a cell phone and still drive safely, but otherwise these opinions did not vary significantly by age or gender.

TABLE 2.5 Extent Agree with Statements Regarding Cell Phone Safety While Driving

Cell Phone Safety Issue	**Average Rating on Scale of 0 to 10 where 0=Completely Disagree and 10=Completely Agree**		**P-value for Cell Phone Use Status ***
	Cell Phone Users (n=500)	**Cell Phone Non-Users (n=150)**	
Most can carry on a conversation on their cell phone and still drive safely.	4.76	3.40	p<.001
Cell phones are more beneficial to drivers than they are harmful.	5.40	3.92	p<.001
Using a hands-free device is safer than using a hand-held cell phone.	8.09	6.72	p<.001

* For cell phone use status, based on regression models incorporating age and gender.

A final set of "opinion" questions related to possible legislative issues. Participants were asked whether they would vote "for" or "against" the following (hypothetical) driving laws in North Carolina:

1. A new law making it illegal to talk on a hand-held cell phone while driving, except in case of emergency, but still allowing talking if using a hands-free device.

2. A new law making it illegal to talk on any type of cell phone (hand-held or hands-free) while driving, except in case of emergency.

3. A new law requiring that drivers in accidents while talking on a cell phone automatically be cited for careless and reckless driving and be heavily penalized on their insurance premiums.

Results are summarized in Table 2.6. Cell phone users as well as non-users generally supported legislation that would make it illegal to use a hand-held phone while driving, but still allow use of a hands-free system (70.6 percent of users, 76.7 percent of non-users). Older respondents were especially likely to support such legislation (p=.003), while there were no significant gender differences. In contrast, cell phone users and non-users held sharply different opinions about legislation that would make *all* cell phone use illegal: whereas 63.3 percent of non-users said they would vote for such legislation, only 26.8 percent of users would vote for it. Older respondents were again more likely to support such legislation (p<.001), as were females (p=.043). Users and non-users also gave different responses with regard to stricter penalties for persons involved in crashes while talking on a phone, with just over half (53.8%) of users supporting such legislation, compared to three-fourths (78.0 percent) of non-users. The same age and sex distinctions also held (p=.014 for age, p=.003 for gender).

TABLE 2.6 Support for Possible Legislation Regarding Self Phone Use While Driving

Cell Phone Legislation		**Cell Phone Users (n=500)**	**Cell Phone Non-Users (n=150)**	**P-value ***
Illegal to talk on hand-held phone except in emergency, talking using hands-free device O.K.	% For	70.6	76.7	N.S.
	% Against	25.8	20.7	
	% Unknown	3.6	2.7	
Illegal to talk on any type cell phone (hand-held or hands-free) except in case of emergency.	% For	26.8	63.3	p<.001
	% Against	69.8	32.7	
	% Unknown	3.4	4.0	
Drivers in accidents while talking on phone automatically cited for careless and reckless driving and heavily penalized on insurance premiums.	% For	53.8	78.0	p<.001
	% Against	39.8	15.3	
	% Unknown	6.4	6.7	

* For cell phone use status, based on regression models incorporating age and gender. N.S.=Non-signif.

Discussion

This chapter has reported on the results of a statewide survey to gather information on the characteristics of adults ages 18 and older who report using a cell phone while driving and the nature of their reported cell phone use. Additionally, information was gathered on opinions of users and non-users regarding the safety of using a phone while driving and support for legislation regulating cell phone use. While carried out in North Carolina to help guide its own highway safety efforts, the survey should have relevance to safety professionals and policy makers beyond the state seeking to better understand the risks associated with cell phone use and ways these risks might be reduced.

Nearly six out of ten North Carolina drivers were estimated to have used a cell phone while driving. Reported cell phone use was highest in the younger age groups, dropping significantly with age. Still, more than one in five "senior" drivers ages 70+ reported having used a cell phone while driving. Although a few users reported high levels of "talk time" on their phones, most reported much more modest times of less than 10 minutes per day. Three-fourths reported placing or receiving two or fewer calls per day. Use levels were highest in the youngest age groups, and were higher for males than for females.

Two of the more interesting survey topics from an educational and/or policy perspective pertain to the use of hand-held versus hands-free phone systems, and the likelihood of pulling off the roadway to use a phone rather than trying to place a call or carry on a conversation while driving. One in four of our cell phone users reported having a hands-free device, although they did not always use it when talking on their phone. Despite the inconsistent use, the vast majority of those with hands-free devices felt that the devices made it both easier and safer to talk on a phone while driving. One concern is that, by passing legislation that prohibits the use of hand-held phones but allows the use of hands-free systems, lawmakers may be sending the message that the hands-free systems are, in effect, "risk-free." This might not only encourage more individuals to use cell phones while driving, but also encourage longer and more frequent conversations. Research has shown, however, that conversing on either a hand-held or a hands-free phone leads to significant decrements in simulated driving performance, a result of "the diversion of attention from driving to the phone conversation itself" *(8)*. Among the participants in our survey, use of a hands-free phone system was not associated with lower reported incidences of "sudden evasive maneuvers" while driving and talking on a cell phone. Users of the hands-free systems also did not report significantly higher use levels in terms of either total talk time or numbers of outgoing and incoming calls. Further research is needed to clarify the risks and benefits associated with use of hands-free versus hand-held phone systems.

One in five respondents said that they usually or always pulled off the road to use their cell phone, while a third said that they never did so. Older respondents were much more likely than younger respondents to report always or usually pulling over. Safety advocates differ on whether to advise people to pull off the road while using their cell phone, recognizing that both pulling off the road and merging back into traffic can pose hazards, as can being parked along a roadside. Most safety literature simply advises cell phone users to try to place their calls before beginning a trip, or when stopped in traffic. Among our survey participants, however, pulling off the road was associated with a *lower* likelihood of having made a sudden evasive maneuver while talking on a cell phone. It could be that participants are pulling off to relatively "safe" locations such as parking lots or service stations. It is also possible that people who elect to pull over are generally more safety conscious than those who do not. Regardless, this option should be communicated to cell phone users as one way of potentially reducing their risk of crashing.

In-vehicle use of wireless equipment other than cell phones remains low, at least in our sample of North Carolina drivers. However, this situation may change in the near future if the rapid proliferation of cell phones is any indication. One area of special concern is the relatively high percentage of young drivers in our survey who reported using text or instant messaging. Given the generally high crash risks already faced by young drivers, one can hardly envision increasing this risk by condoning the use of potentially distracting technologies while driving.

Some states are already considering enacting legislation prohibiting novice drivers with provisional licenses from talking on a cell phone while driving. This legislation might well be extended to cover other wireless communication technologies. In its consensus report dealing with driver focus and in-vehicle wireless technologies, the National Conference of State Legislatures acknowledged that, "Because teenage and novice drivers lack driving experience, they are more susceptible to the distractions caused by communications, entertainment and information technology in motor vehicles," but stops short of recommending any legislation that would restrict their use of such equipment *(3)*. Our survey made no attempt to interview minors under the age of 18, but this is clearly an area where further research is warranted.

Finally, the results of this survey generally confirm a willingness by the driving public to accept some restrictions on their use of cell phones while driving. However, there were clear differences among users and non-users in their perceptions of risk associated with cell phone use, and in their support for legislation that might restrict cell phone use. As cell phone ownership and use becomes more "mainstream," one can expect less support for any legislation that would place a total ban on cell phone use while driving, or that would bring automatic penalties to cell phone users in crashes. Instead, the public is much more likely to continue its support for restrictions on hand-held phone use, believing the hands-free systems to confer some level of safety. Again, public education is needed regarding the potential distracting nature of cell phone conversations regardless of the type of phone being used.

The growth of cell phones and other wireless communications technologies in vehicles appears inevitable. Although research has demonstrated that use of these technologies can impair driving performance and increase risk of crash involvement, the magnitude of this risk remains unknown. More data are needed both with regard to the safety implications of cell phone (and other technology) use while driving, and levels of exposure to these technologies. This statewide survey of cell phone users and non-users represents a step in this direction.

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Chapter 3. The Characteristics of Cell Phone-Related Motor Vehicle Crashes in North Carolina

(Adapted from a paper prepared for presentation at the Annual Meeting of the Transportation Research Board, Washington, D.C., January 2003)

Background

The number of cell (or mobile) phone users in the United States skyrocketed from 500,000 in 1985 to 137,000,000 in November 2002 (*1*). This explosion in cell phone ownership has been accompanied by an increase in the use of cell phones while driving. According to three recent studies, about 3 to 5 percent of drivers were observed to be using a hand-held cell phone while driving (*2, 3, 4*). Each percentage should be interpreted as a snapshot (at a given time) of cell phone use while driving. It is not the percentage of drivers who used a cell phone on a given trip, nor the percentage who ever use a cell phone while driving.

The increased use of cell phones while driving has heightened interest in the safety aspects of using a cell phone while driving. Motorists who are busy dialing or talking on cell phones may not be paying attention to the road or keeping both hands on the steering wheel. They may not notice a red light, veer into another lane, etc., possibly resulting in a crash. Many state legislatures in the U.S. are considering restrictions on the use of cell phones while driving. Questions of interest to researchers include how much cell phone use occurs while driving, how driver performance is affected, and how many crashes result.

This chapter compares the characteristics of cell phone and non-cell phone police-reported motor vehicle crashes that occurred in North Carolina. A cell phone crash is defined as a crash in which at least one of the drivers involved was using a cell phone at the time of the crash. Cell phone crashes were identified through a narrative search of police crash report narratives. A non-cell phone crash is defined as a crash in which none of the drivers was using a cell phone at the time of the crash.

The growing number of research studies provides convincing evidence that cell phone use while driving impairs driver performance and increases the risk of a crash. Driver performance studies – using either driving simulators or on-road vehicles – concur that using a cell phone does slow reaction times and degrades tracking abilities (*5-7*). Epidemiological studies agree that the risk of a crash rises when a driver is engaged in a cell phone conversation, but the magnitude of that increased risk is uncertain (*8-10*). Whether hands-free is safer than hand-held is debatable (*3, 7, 11, 12*).

Goodman *et al.* did a computerized search of almost 900,000 crash narratives from North Carolina (*9*). The narratives covered the years 1989, 1992 through 1994, and the first part of 1995. The search retrieved 3,892 narratives, of which 87 were determined to be cell phone-related crashes. The number of cell phone-related crashes per year was adjusted according to the total number of crashes in each year. Regression analysis was carried out using the number of cell phones in use in the U.S. as the independent variable and the adjusted number of cell phone-

related crashes as the dependent variable. The results showed that the number of cell phone-related crashes is increasing as cell phones become more common.

The Fatality Analysis Reporting System (FARS) is a census of all fatal motor vehicle crashes in the U.S. It contains data on about 40,000 annual fatalities. FARS relies on police crash reports from each state for information on fatal crashes. Thus, FARS data are only as complete and accurate as the original state data. Oklahoma and Minnesota were the first states to specify cell phone use on their police crash reports. At least 15 additional states now track cell phone crashes. In the FARS data, there were 36 crashes in 1994 and 40 crashes in 1995 that included cell phone use as a "possible distraction inside the vehicle." (*9*)

The National Automotive Sampling System (NASS) contains data on a stratified random sample of about 5,000 police-reported crashes in the U.S. per year. The NASS data files for 1995 contained eight cell phone-related crashes. It is estimated that these cases represented 3,837 similar cases nationally (*9*).

Goodman *et al.* also analyzed 28 cell phone-related crashes (*9*). Data for 11 crashes were included in FARS or NASS, and data for the remaining 17 crashes were obtained from other sources. The cell phone user was considered to be at fault in all 28 crashes. With regard to crash circumstances, 15 crashes occurred when drivers strayed out of their lanes, 8 crashes occurred with stopped vehicles in the same lane, and 5 crashes occurred when drivers failed to stop for red lights.

Reinfurt *et al.* conducted a two-month pilot study with the North Carolina State Highway Patrol, where investigating troopers filled out a supplemental data form for crashes where there was any indication of cell phone involvement (*2*). For 11 crashes out of 6,686 (or 0.16 percent), the trooper indicated that a cell phone was being used at the time of the crash. The data on the supplemental forms were interpreted to determine the driver action, driver contributing factor, crash type, and vehicle maneuver. The most common driver actions were answering phone (3 crashes) and talking on phone (2 crashes). Driver contributing factors included the driver taking his/her eyes off the road and/or losing control because both hands were not on the steering wheel (5 crashes) and driver inattention (2 crashes). Ran-off-road was the most common (5 crashes) crash type, followed by rear-end (3 crashes). With respect to vehicle maneuver, the driver was going straight in 10 crashes and turning left in one crash.

Methods

Data Collection

Since 1971, information from North Carolina police crash reports, including the officers' narratives, have been entered into a computerized data base. To identify cell phone crashes for analysis, crash narratives for a study period from January 1, 1996 through August 31, 2000 were searched. Four search words from Goodman *et al.* (*9*) were used: (1) answer, (2) carphone, (3) cell, and (4) dial. The "hits" (narratives containing one or more search words) were printed and read to determine their relevance. Some crashes turned out to be not cell phone-related. For example, the search word "answer" retrieved several narratives containing expressions such as

"answering machine" and "did not answer [officer's] questions." The narrative search identified a total of 452 cell phone crashes that occurred during the study period (Table 3.1).

TABLE 3.1 Narrative-indicated Cell Phone Crashes in North Carolina by Year and by Driver Action

Driver Action	Goodman et al. *(9)*					Current Study					Total	
	1989	1992	1993	1994	1995	1996	1997	1998	1999	2000*	N	%
Dialing phone	1	0	3	3	0	4	5	4	13	11	44	8.2
Answering phone	2	3	3	1	1	3	6	11	18	31	79	14.7
Talking on phone	6	7	5	12	7	12	15	19	44	120	247	45.8
Hanging up phone	2	1	3	0	1	0	4	3	3	9	26	4.8
Reaching for phone	1	2	4	0	4	1	1	8	12	20	53	9.8
Dropping phone	0	0	0	0	0	1	0	1	2	0	4	0.7
Picking up dropped phone	0	1	2	3	4	1	1	2	5	15	34	6.3
Looking at or for phone	0	0	2	0	1	0	2	4	11	19	39	7.2
Startled by ringing phone	0	0	0	0	0	0	0	1	3	4	8	1.5
Pulled over to use phone	0	0	0	1	1	0	1	0	0	2	5	0.9
TOTAL CASES	12	14	22	20	19	22	35	53	111	231	539	100.0

* January 1 through August 31, 2000.

After the narratives were read, a driver action (such as "talking on phone" or "reaching for phone") was assigned to each crash. Table 3.1 lists the number of cell phone crashes by year and driver action. The data and assigned driver actions for 1989 through 1995 are from Goodman *et al.* (*9*), and the data for 1996 through August 31, 2000 are from the current study. The number of cell phone crashes was roughly 20 per year from 1993 through 1996, and then increased dramatically after 1996. In fact, the number more than doubled from 1998 to 1999, and again from 1999 to 2000. Over the 10-year period, the most common driver action was "talking on the phone," which accounted for 46 percent of cell phone crashes. In another 15 percent, the driver was "answering the phone." "Reaching for the phone" (10 percent) was the third most common action.

The actual number of cell phone crashes is undoubtedly higher than the 452 that were identified. Many drivers may not admit that they were using a cell phone when they crashed. In addition, the investigating officer may not think to record cell phone use in the narrative or may use words other than "answer," "carphone," "cell," or "dial" to indicate that a cell phone was somehow involved. The extent of underreporting and the number of cell phone crashes that were not identified by the narrative search are not known. Because of these difficulties in identifying cell phone crashes, it is likely that some were erroneously classified as non-cell phone crashes.

Data Analysis

During the study period, there were 452 cell phone crashes (identified through the narrative search) and about 1,080,000 non-cell phone crashes, involving about 1,900,000 vehicles. Thus, the identified cell phone crashes were 0.04 percent of all crashes. As would be expected from the increase in cell phone ownership, the proportion of cell phone crashes increased year-by-year. In 1996, there were 22 out of about 228,000, or 0.01 percent. In the first 8 months of 2000, there were 231 out of about 151,000, or 0.15 percent.

Cross-tabulations were constructed to compare cell phone and non-cell phone crashes for each of several crash, roadway, driver, and vehicle variables. The findings are discussed below. Each figure shows the sample sizes of crashes or vehicles that were used in the analysis for that variable. The sample sizes vary because some crashes had missing data. The chi-square statistic was computed to determine whether the differences were statistically significant. The reader is advised that with large sample sizes, a small percentage difference may be statistically significant. It is up to the reader to decide whether the differences are meaningful or of practical significance.

A revised crash report form was implemented in North Carolina on January 1, 2000. For some variables, the categories remained the same both before and after the revision. One example is "road class." The number of crashes for each road class (Interstate, US route, etc.) in 1996-1999 was added to the corresponding number of crashes in 2000 to obtain the 1996-2000 numbers for use in the analysis described below. For other variables, categories were changed and new ones were added. One example is "most harmful event." In 1996-1999, there were 23 categories, including one for fixed object. In 2000, there were 64 categories, as 32 fixed objects (tree, utility pole, etc.) were now specified. To maintain consistency in the analyses, some categories were combined so that they could be matched. The 32 categories of fixed objects in 2000 were combined into one. Then the numbers of fixed-object crashes in 1996-1999 and in 2000 were added to obtain the 1996-2000 number for use in the analysis.

Results

The results described in this section pertain to crashes occurring from January 1, 1996 through August 31, 2000. Crash variables are presented first, followed by roadway, driver, and vehicle variables. The term "cell phone crash" refers to a crash in which a driver was using a cell phone at the time of the crash. A "cell phone driver" is one who was using a cell phone at the time of the crash. A "cell phone vehicle" is one whose driver was using a cell phone at the time of the crash.

Crash Severity

Injury severity is determined using the KABCO injury scale. For each person involved in the crash, the investigating officer determines the level of injury. In descending order of severity, they are as follows:

K Fatal
A Incapacitating injury
B Non-incapacitating injury
C Possible injury
O No injury

Crash severity is defined as the most severe injury that any driver, passenger, or non-occupant involved in the crash received. Cell phone crashes were more likely to result in a C-level injury (36.2 percent), compared to non-cell phone crashes (27.3 percent) (Figure 3.1). Cell phone crashes were less likely to result in a more severe injury (9.0 percent vs. 14.3 percent). Only two cell phone crashes (0.5 percent) were fatal. This finding can be understood by examining the types of cell phone and non-cell phone crashes that occur. Most notably, cell phone crashes are more likely to be rear-end than non-cell phone crashes, and rear-end crashes are generally less severe than some other crash types. The difference by crash severity was significant ($\chi^2_{4df} = 21.9068$, $p = 0.0002$).

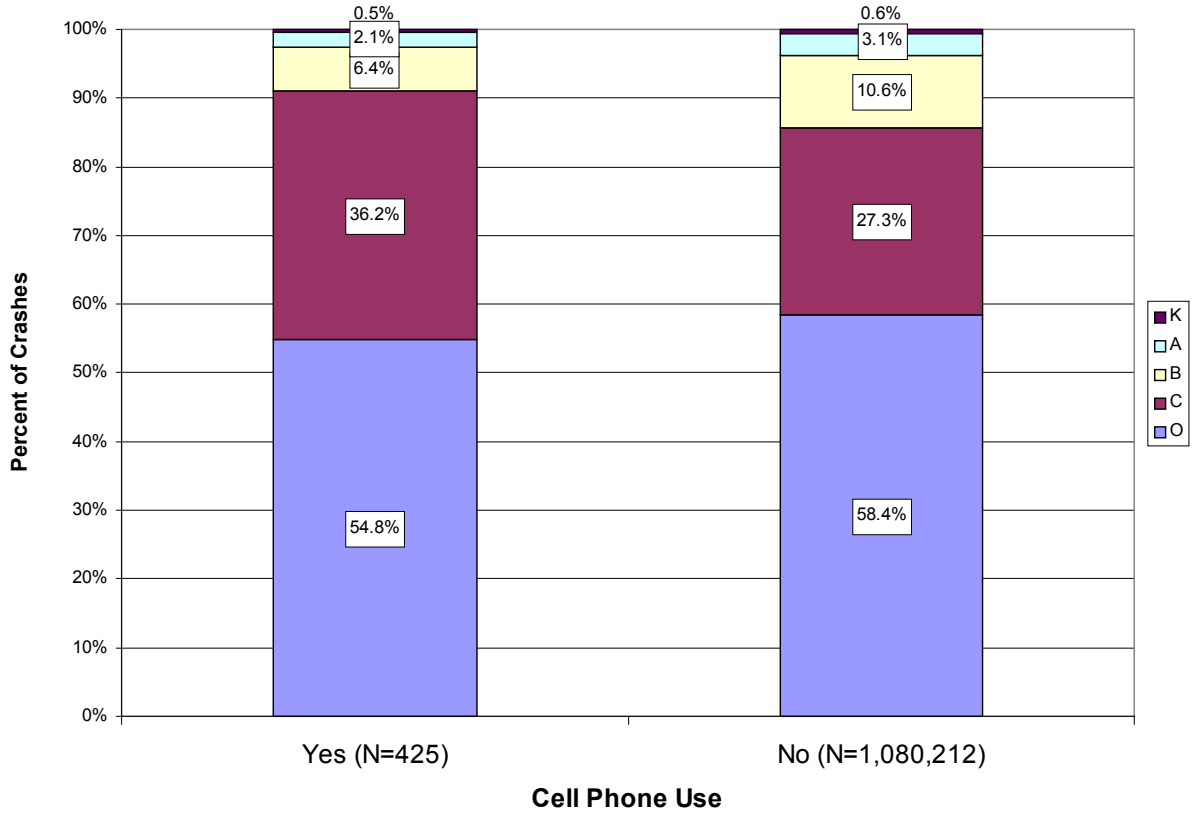

Figure 3.1. Crash severity by cell phone use.

Crash Type

In this study, crash type is defined as the "first harmful event," as recorded on the police crash report form. A common scenario involves a driver who is distracted while using a cell phone and does not notice that the vehicle in front has stopped (at a traffic light, for instance) until it is too late to avoid a collision. Indeed, cell phone crashes were nearly twice as likely to be rear-end crashes than non-cell phone crashes (45.1 percent vs. 25.6 percent) (Figure 3.2). The second most common crash type was ran-off-road (18.5 percent of cell phone crashes and 20.5 percent of non-cell phone crashes). Only 3.9 percent of cell phone crashes were left-turn crashes, compared to 13.8 percent of non-cell phone crashes. A possible explanation is that drivers may be less likely to be talking on a cell phone when turning left than when going straight, because turning left is a more complex maneuver. The difference by crash type was significant ($p<0.0001$).

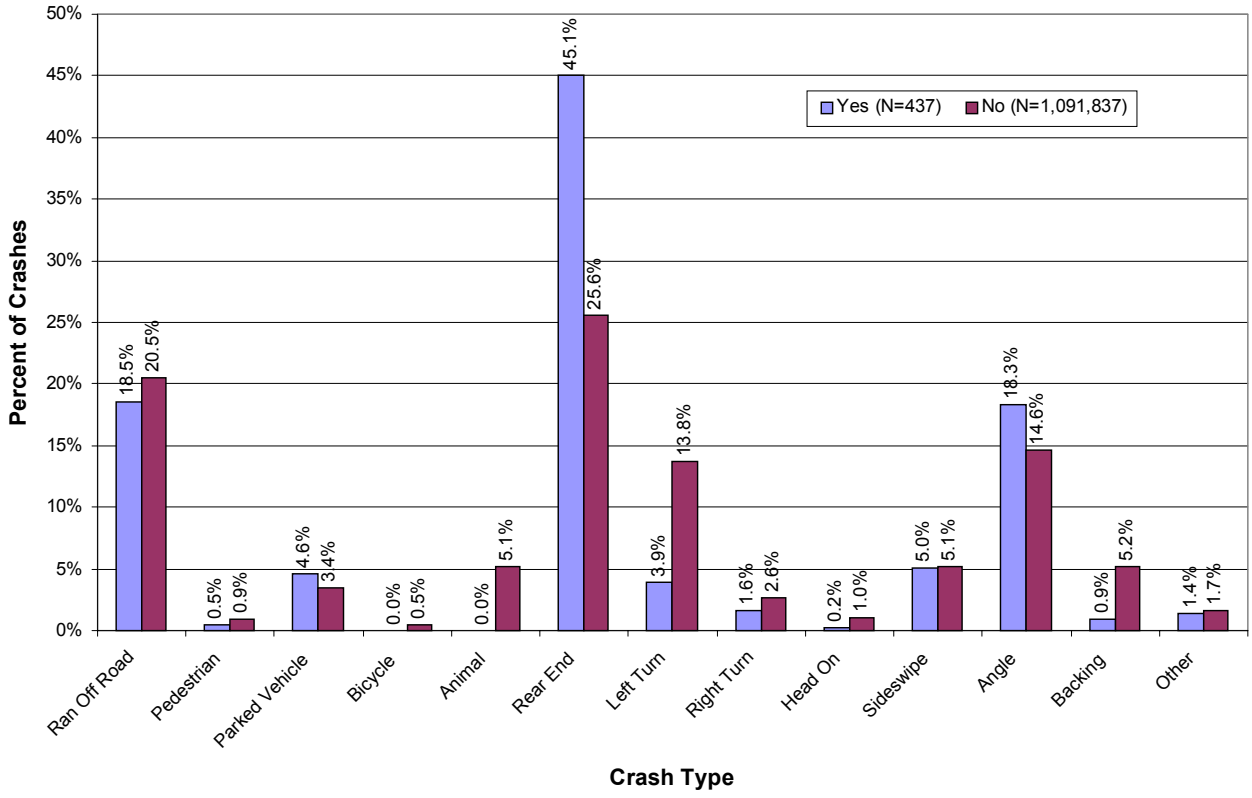

Figure 3.2. Crash type by cell phone use.

Crash types were examined for urban cell phone crashes (N=396) and rural cell phone crashes (N=41). Rear-end accounted for 47.0 percent of urban, but only 26.8 percent of rural cell phone crashes. Ran-off-road accounted for 14.9 percent of urban, but 53.7 percent of rural cell phone crashes. This finding suggests a rural scenario in which a driver who is distracted while using a cell phone may not notice a curve in the road or that he or she is drifting off the roadway. The reader is advised that there was a low sample size of rural cell phone crashes available for analysis.

Time of Day

About 60 percent of cell phone crashes occurred during the mid-day (10 AM - 1:59 PM) or afternoon hours (2 PM - 5:59 PM), compared with about 54 percent of non-cell phone crashes (Figure 3.3). Fewer cell phone crashes occurred during the morning hours (6 AM - 9:59 AM), compared with non-cell phone crashes (12.4 percent vs. 16.8 percent). This is consistent with an increase in cell phone use while driving as the day progresses, as found in the statewide observational survey conducted by Reinfurt *et al.* (*2*). The difference by time of day was significant ($\chi^2_{5df} = 16.2955$, $p = 0.0060$).

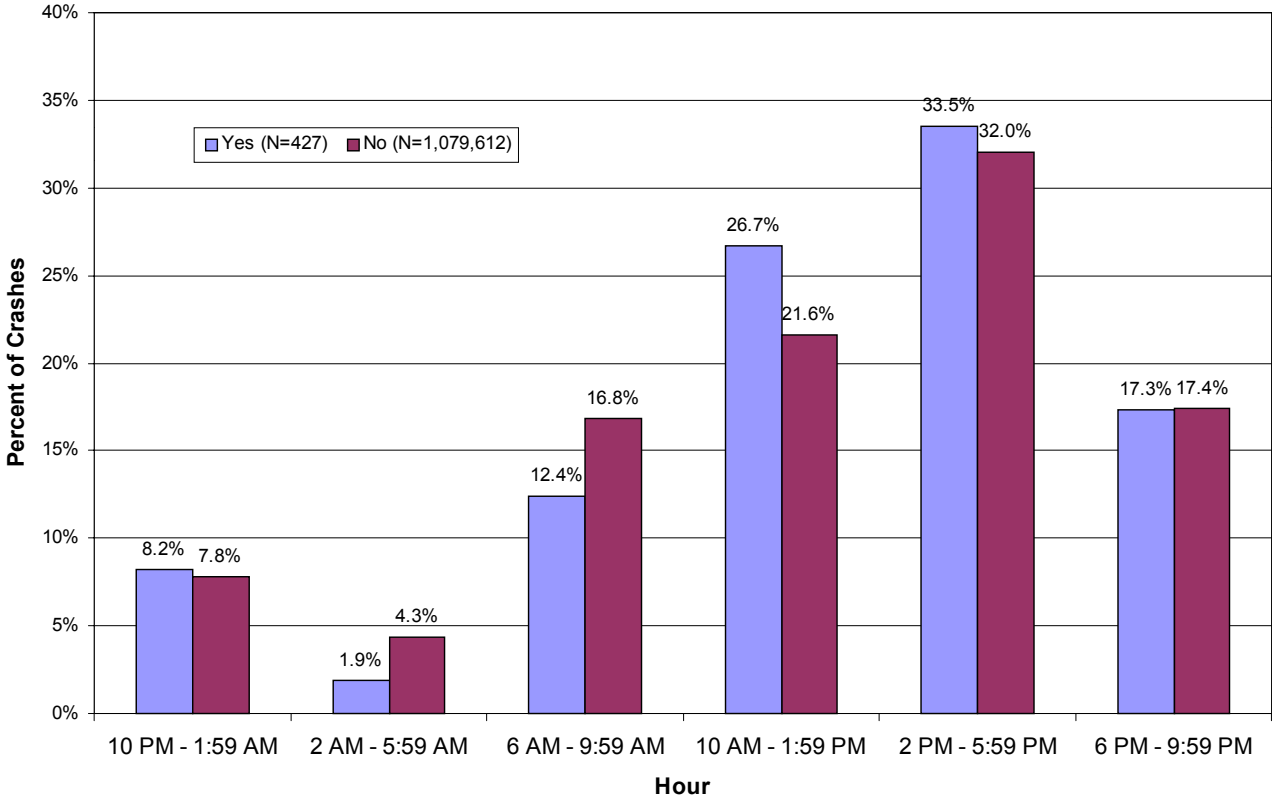

Figure 3.3. Time of day by cell phone use.

Urban and Rural

The North Carolina police crash report form allows the investigating officer to indicate whether a crash occurred within a municipality or outside of the municipality. For this analysis, a crash is considered to be "urban" if it occurred within a municipality; otherwise, the crash is considered to be "rural." This analysis included 427 cell phone crashes and 1,083,828 non-cell phone crashes. Cell phone crashes were predominantly urban (90.6 percent vs. 62.3 percent for non-cell phone crashes). Drivers may be more likely to use cell phones within municipalities (than outside) for reasons such as better cell phone reception, traffic delays, conducting business, etc. The urban-rural difference was significant ($p<0.0001$).

Road Class

As shown in Figure 3.4, most cell phone crashes occurred on local streets (69.8 percent vs. 37.9 percent for non-cell phone crashes). Only 6.3 percent of cell phone crashes occurred on secondary routes, compared to 20.6 percent of non-cell phone crashes. Cell phone crashes were also less likely to occur on other road classes, like North Carolina state routes and other public roads. The difference by road class was significant ($p<0.0001$), and can be explained by noting that local streets are within municipalities, where most cell phone crashes took place. On the other hand, most secondary routes are outside of municipalities.

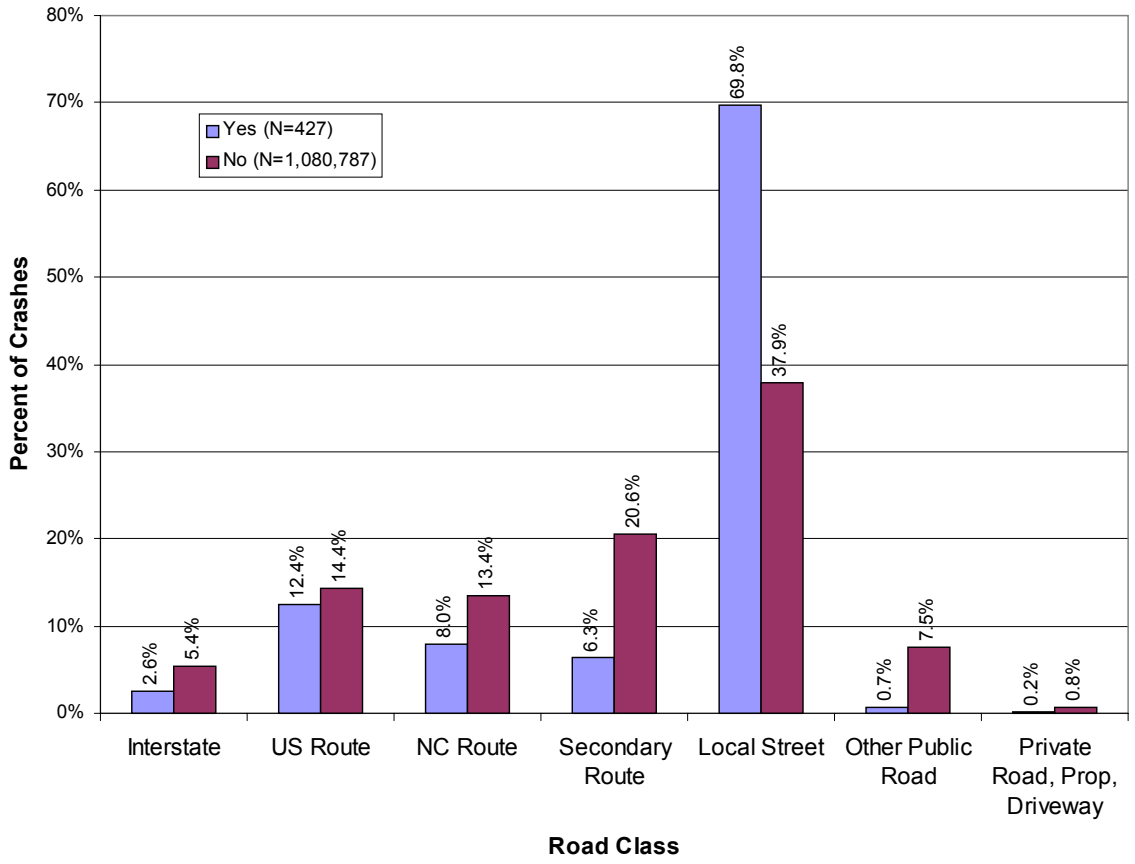

Figure 3.4. Road class by cell phone use.

Road Feature

Because cell phone crashes are more likely to be rear-end crashes than non-cell phone crashes, it was thought that cell phone crashes would be more likely to occur at intersections. Instead, cell phone and non-cell phone crashes were about equally likely (29.3 percent vs. 28.0 percent) to occur at intersections (Figure 3.5). In fact, "no special feature" was more likely to be coded for cell phone crashes (64.4 percent) than for non-cell phone crashes (55.7 percent). A possible reason relates to the definition of an intersection for crash-reporting purposes in North Carolina. An intersection includes both (1) the "box" formed where two roadways meet by extending the curb or edge lines of one roadway across the other roadway and (2) sections of each roadway within 10 meters (33 feet) of the "box." If a driver rear-ends the back of a queue

with several vehicles, the road feature could be coded as "no special feature" instead of "intersection." Also, driveways are a separate road feature, so if a vehicle is slowing to turn into a driveway and is rear-ended by another vehicle, that crash would not be at an intersection. Turning crashes (which usually do occur at intersections) were found to be a lower percentage of cell phone crashes than non-cell phone crashes. Road feature was coded as "driveway" for only 2.3 percent of cell phone crashes, but 10.2 percent of non-cell phone crashes. Perhaps drivers have a heightened expectancy of vehicles when they are driving through intersections, driving on a road with many driveways, or entering and exiting driveways, and therefore they pay more attention to their driving and less attention to their cell phones. The difference by road feature was significant ($\chi^2_{5df} = 37.2410$, $p<0.0001$).

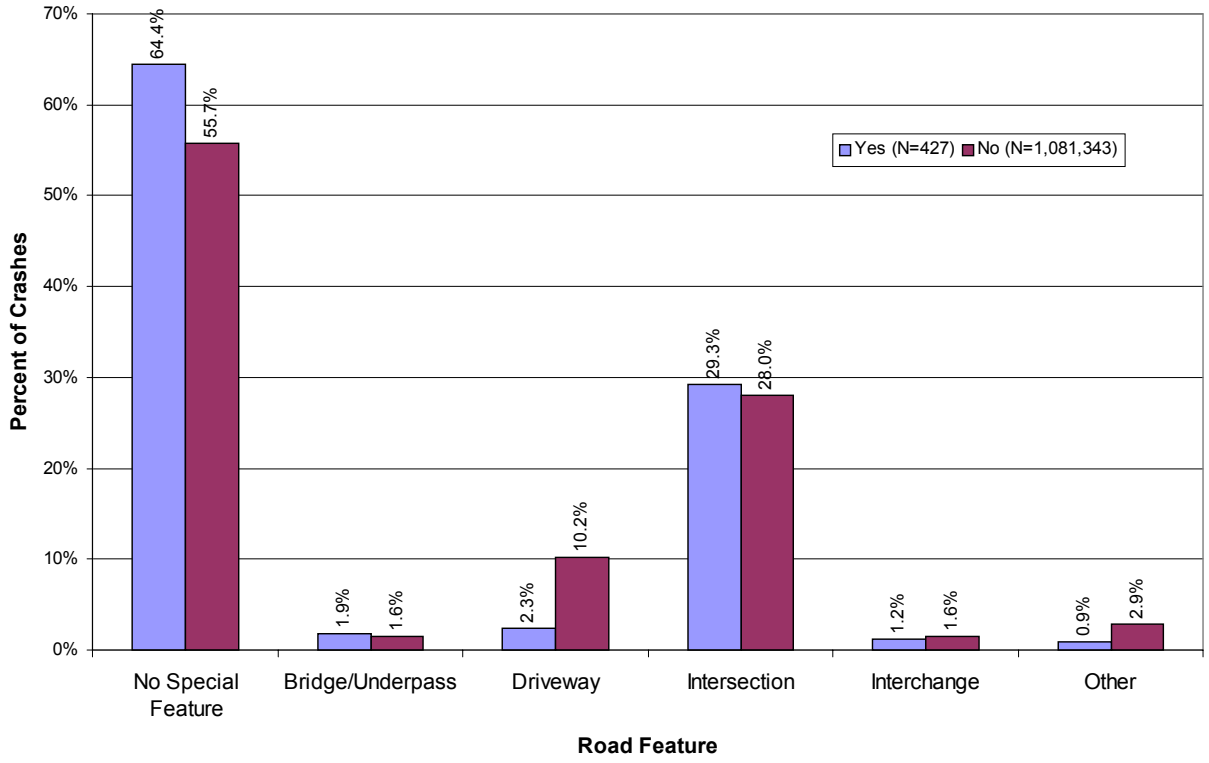

Figure 3.5. Road feature by cell phone use.

Driver Gender

Given that a crash occurred, cell phone drivers were more likely to be male (65.2 percent) than non-cell phone drivers (58.1 percent). This analysis included 431 cell phone drivers and 1,828,613 non-cell phone drivers. The difference by driver gender was significant ($\chi^2_{1df} = 8.9956$, $p = 0.0027$). The statewide telephone survey reported on in Chapter 2 revealed that there was a higher proportion of males among cell phone users than non-users, and that males spent more time talking on cell phones while driving than females. Thus, males may have greater exposure, in terms of using cell phones while driving, compared to females.

Driver Age

Figure 3.6 shows that only 1.2 percent of crash-involved cell phone drivers were 65 years or older, compared to 8.1 percent of non-cell phone drivers. The difference by driver age was significant ($\chi^2_{8df} = 34.5265$, $p<0.0001$). These findings are consistent with the telephone survey results, which showed that only 23 percent of respondents aged 70 and older used cell phones, compared to 67 to 68 percent of respondents aged 18-39. Younger drivers spent more time talking on cell phones while driving than older drivers, and also placed and received more calls. Thus, younger drivers have greater exposure (i.e., they are more likely to use a cell phone and to talk longer while driving) compared to older drivers.

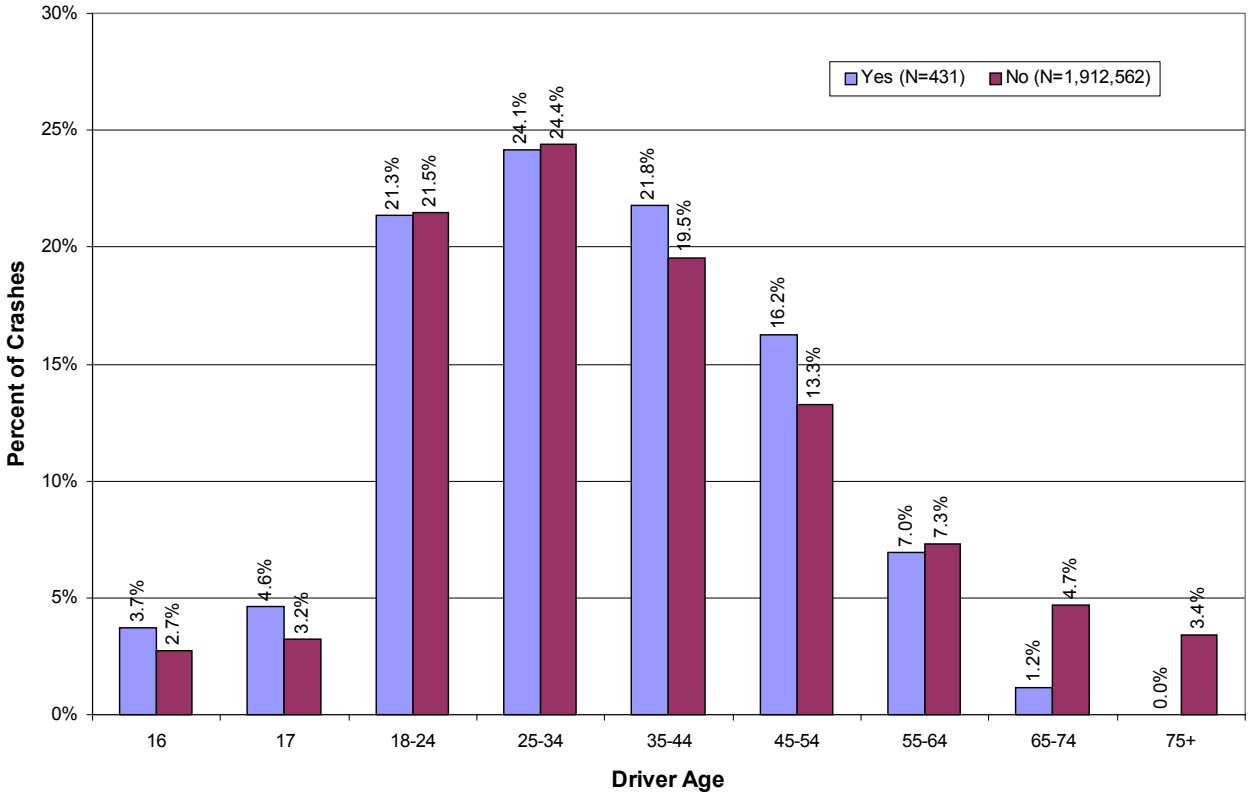

Figure 3.6. Driver age by cell phone use.

Driver Violation

"No violation" was coded for only 7.5 percent of cell phone drivers, but for 49.4 percent of non-cell phone drivers (Figure 3.7). The three most common violations for cell phone drivers were (1) safe movement and other violations (42.1 percent), (2) failure to reduce speed (23.5 percent), and (3) traffic signal (9.6 percent), for a total of 75.2 percent. By comparison, these three violations were noted for only 18.3 percent, 12.5 percent, and 1.8 percent, respectively, of non-cell phone drivers. These violations may be committed by drivers who are not paying attention to the road while they are using cell phones. Among cell phone drivers, the higher percentages of failure to reduce speed and following too close are reflected in the higher number of rear-end crashes. The difference by driver violation was significant ($p<0.0001$).

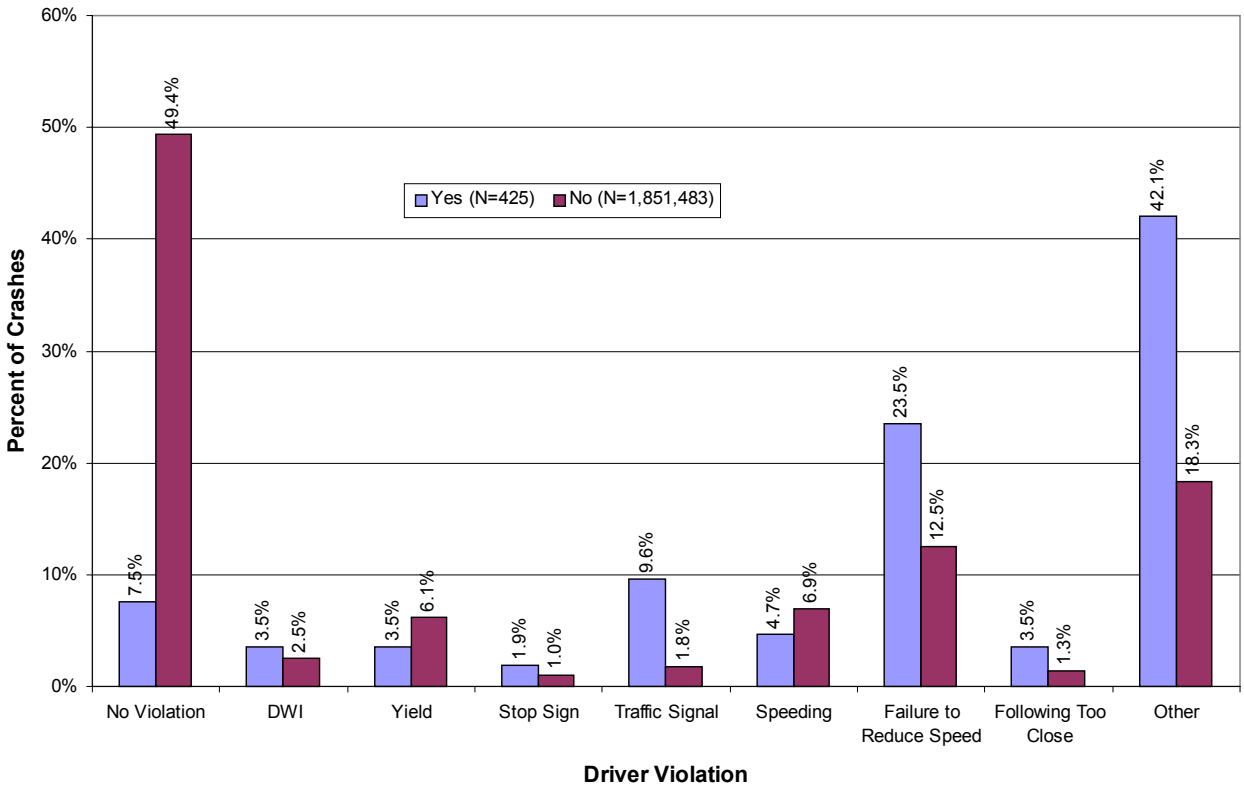

Figure 3.7. Driver violation by cell phone use.

Driver violations were examined for urban (N=386) and rural cell phone crashes (N=39). Cell phone drivers were cited for speeding in 2.8 percent of urban and 23.1 percent of rural cell phone crashes. On the other hand, failure to reduce speed was more common in urban than in rural cell phone crashes (24.6 percent vs. 12.8 percent). Traffic signal violations were also more common in urban crashes (10.1 percent vs. 5.1 percent). Perhaps speeding is associated with open stretches of rural road, whereas failure to reduce speed and traffic signal violations are associated with urban intersections. The reader is advised that there was a low sample size of rural cell phone crashes available for analysis.

Vehicle Type

As shown in Figure 3.8, cell phone drivers were less likely to be driving passenger cars than non-cell phone drivers (62.6 percent vs. 70.5 percent), and more likely to be driving sport utility vehicles (8.4 percent vs. 3.1 percent). The difference by vehicle type was significant ($p<0.0001$). This finding is consistent with the observational survey, which found that more cell phone users were driving a sport utility vehicle (21 percent) than non-users (12 percent) (*2*). It is also consistent with the telephone survey, which found that more cell phone users drove sport utility vehicles (16.9 percent) than non-users (11.4 percent).

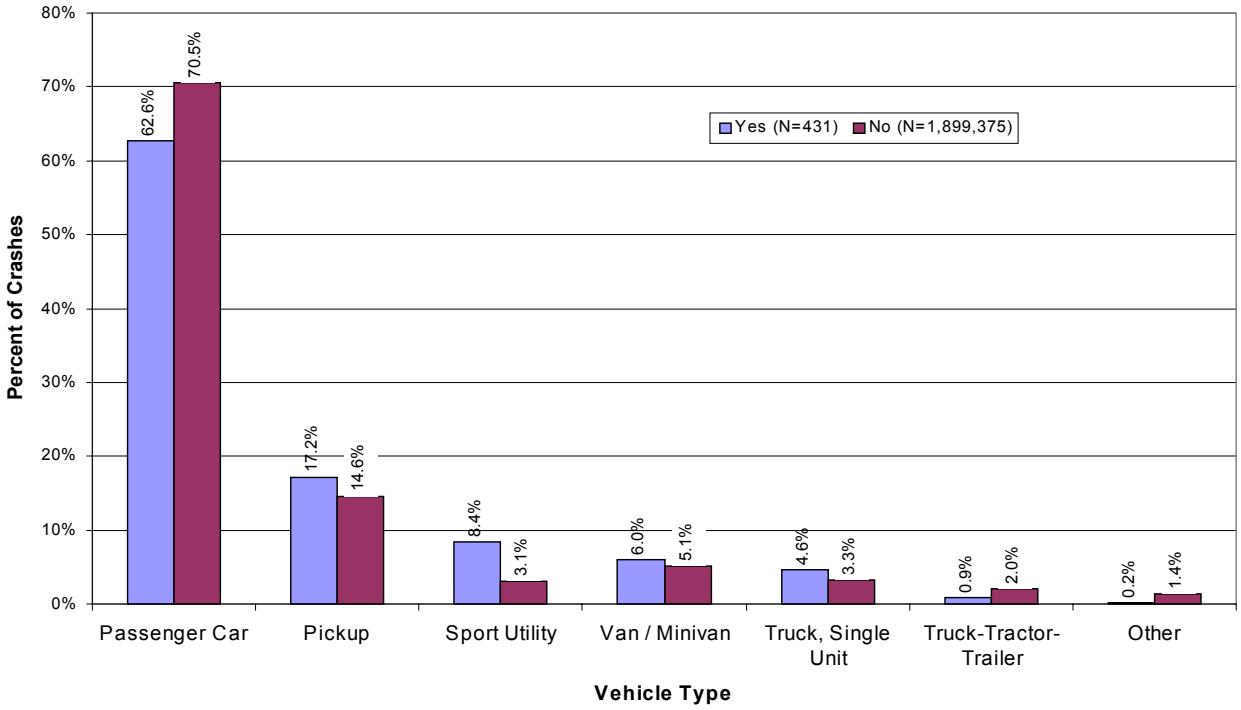

Figure 3.8. Vehicle type by cell phone use.

Vehicle Maneuver

Figure 3.9 shows that cell phone drivers were more likely to be going straight (76.1 percent) than non-cell phone drivers (54.5 percent). This finding can be explained by remembering that cell phone drivers are more likely to have rear-end crashes, and a driver is usually going straight immediately before he or she rear-ends a vehicle in front. Cell phone drivers were less than half as likely to be slowing or stopping (8.8 percent vs. 20.1 percent), perhaps because they are less likely to notice a traffic light or other situation that requires slowing or stopping. Cell phone drivers were about half as likely to be turning left (5.3 percent vs. 9.7 percent). A possible explanation is that drivers may be less likely to be talking on a cell phone when turning left than when going straight, because turning left is a more complex maneuver. The difference by vehicle maneuver was significant ($p<0.0001$).

Discussion

This paper compared the characteristics of cell phone and non-cell phone motor vehicle crashes that occurred in North Carolina. By searching crash narratives from the period January 1, 1996 through August 31, 2000, a total of 452 cell phone crashes was identified. The total number of reported crashes during the same period was approximately 1,080,000, so 0.04 percent were cell phone crashes. The actual percentage will be at least somewhat higher because of underreporting as well as crashes that the narrative search missed. On an annual basis, identified

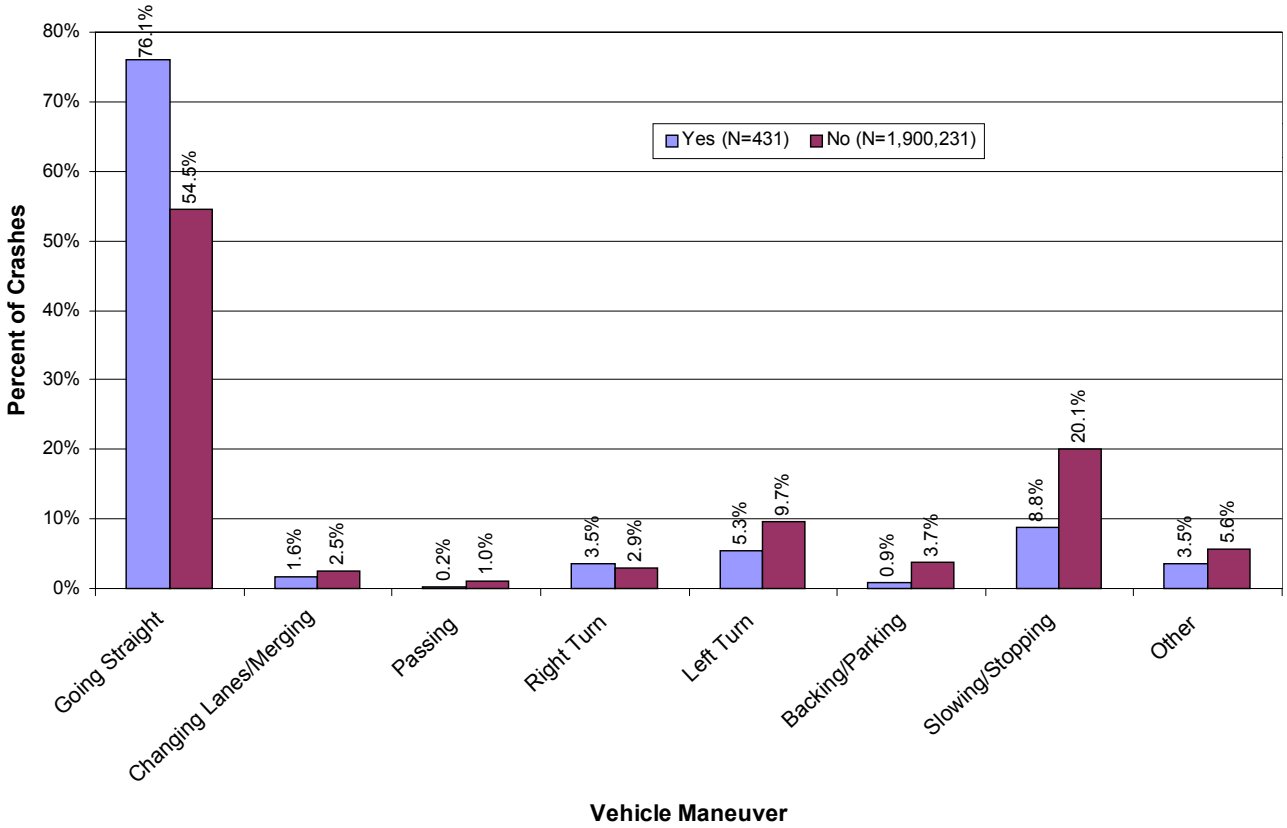

Figure 3.9. Vehicle maneuver by cell phone use.

cell phone crashes increased from 0.01 percent of all reported crashes in 1996 to 0.15 percent in the first 8 months of 2000. This increase reflects the rapid growth in cell phone use in recent years. Another explanation is greater publicity regarding cell phones and safety. As a result, investigating officers may be looking more closely now for evidence of cell phone use than they did in earlier years. They may be more likely to ask drivers, passengers, and witnesses about cell phone use.

Exposure data pertaining to how much time drivers spend talking on cell phones while driving were not available for this study. Without exposure data, the risk of a driver crashing while talking on a cell phone cannot be estimated. Therefore, a very important question remains unanswered: "Just how dangerous is it to be talking on a cell phone while driving?"

About 28 percent of the participants in the statewide telephone survey reported on in Chapter 2 said that they used a hands-free phone when driving. Of these hands-free users, the vast majority believed that using a hands-free phone while driving was safer than using a hand-held phone. Most crash narratives do not specify whether the driver was using a hand-held or a hands-free phone. Hence, it is not known if hand-held and hands-free cell phone crashes have different characteristics. Drivers who use a hands-free phone can keep both hands on the steering

wheel and maintain better control of their vehicles. An increase in the use of hands-free phones can potentially reduce the number of crashes that are the result of drivers not maintaining control of their vehicles. Regardless of whether hands-free or hand-held phones are used, phone conversations impose cognitive demands upon drivers, distracting their attention from the driving task. An increase in the use of hands-free phones is not expected to reduce the number of crashes that are the result of drivers not paying attention to their driving.

As cell phones continue to proliferate in the U.S., it is expected that the prevalence of cell phone use while driving at any given time will rise above the current 3 to 5 percent level (*2-4*). The number of cell phone crashes is also likely to increase. It is not known if the number of cell phone crashes will stabilize at some number in the future.

Several approaches could be taken to reduce the occurrence of cell phone crashes. For example, drivers could be encouraged to limit their cell phone use while driving, and to place calls only when their vehicle is stopped or pulled over out of traffic. Automobile insurance companies could raise premiums for drivers who use cell phones while driving, or lower premiums for drivers who do not own cell phones. Drivers would then have a monetary incentive to not use cell phones while driving.

Laws could be enacted to restrict cell phone use while driving. Although many states have considered legislation to prohibit the use of cell phones while driving, only New York State currently has a law in place. That law bans the use of a hand-held phone while driving, except in emergency situations. This year (as of November 14, 2002), 102 cell phone-related bills in 31 states have been under consideration (*13*). For example, New Jersey prohibited holders of learner's permits "from using any interactive wireless device while operating a motor vehicle," with emergency exceptions. Both Illinois and Rhode Island prohibited school bus drivers from using a cell phone while operating a school bus, with emergency exceptions.

It remains to be seen if, and by how much, the level of cell phone use while driving will decline in response to restrictions. It also remains to be seen if the number of cell phone crashes will decrease, and by how much. Because relatively few crashes appear to be cell phone crashes, any effect of restrictions on the total number of crashes will be very small. Nevertheless, any decrease in the number of cell phone crashes will translate into lower health care and lost productivity costs to society.

Two points are worth keeping in mind when considering how to reduce cell phone crashes. First, cell phones can provide benefits to drivers. For instance, drivers can report disabled vehicles and crashes in a more timely manner. The time spent driving is an opportunity for drivers to conduct business or socialize. More benefits are identified in Lissy *et al.* (*12*). The question is whether the increased crash risk outweighs the benefits. Second, using a cell phone is only one of many potentially distracting activities in which drivers may engage. They may use other devices such as vehicle navigation systems or personal data assistants, or they may talk with passengers, eat, reach into the back seat, etc. Therefore, educational and legislative efforts should not focus solely on cell phones, but also include other devices and distractions. The challenge facing lawmakers, researchers, and the cell phone industry is to come up with

approaches that not only minimize the risks associated with using cell phones while driving, but also allow drivers to continue enjoying the benefits of cell phones.

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Chapter 4. Cell Phone Crashes Reported by the North Carolina State Highway Patrol

Background and Methods

This study was carried out with the cooperation of the North Carolina State Highway Patrol to examine the involvement of and circumstances pertaining to cell phone use in crashes. A supplemental data collection form was developed, and copies were provided to all eight State Highway Patrol Troops, A through H. Troopers were instructed to fill out this supplemental form whenever there was any indication of cell phone involvement in a reportable crash. Figure 4.1 shows a map of the eight Highway Patrol districts participating in the data collection effort, and Figure 4.2 a copy of the supplemental report form (modified slightly from a form piloted the previous year). Data were collected over a two-month period beginning May 15, 2002 and ending July 14, 2002.

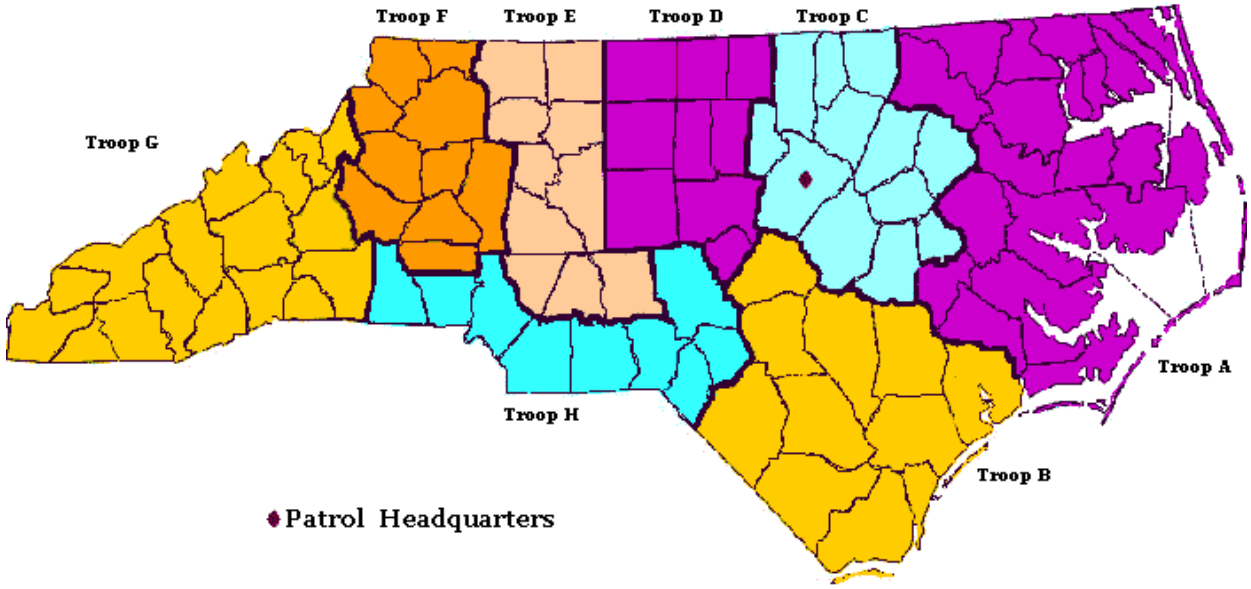

Figure 4.1. North Carolina State Highway Patrol Troops.

Results and Discussion

A total of 29 completed forms were received as of August 12, 2002. A copy of the official police crash report was attached to each form. The data from the eight Troops are summarized in Table 4.1. For all eight Troops combined, the percentage of cell phone crashes was 0.16 percent, or about one reported cell phone crash per 625 reported crashes.

Table 4.2 provides information about each of the reported cell phone crashes. Results are summarized in the sections that follow.

CELL PHONE USE IN CRASHES
Supplemental Form for NC State Highway Patrol

Complete this form for any crash where a cell phone was in use.
Attach a copy of the crash report with the completed form. Please print legibly.

Trooper Name: _____ Troop: _____ District: _____

Date: _____ Time of crash: _____ Driver name: _____

What type of cell phone was the driver using? *(Check one)*
- ____ Hand-held, no headset or microphone
- ____ Hand-held, with headset and/or microphone
- ____ Hands free phone system / phone mounted in car
- ____ Other / Uncertain (please describe) _____

What was the driver doing at the time of the crash? *(Check one)*
- ____ Talking/listening on the cell phone
- ____ Dialing the cell phone
- ____ Answering the cell phone
- ____ Other (please describe) _____
- ____ Uncertain

In your opinion, how important was the cell phone in causing the crash? *(Check one)*
- ____ Very important
- ____ Somewhat important
- ____ Not at all important
- ____ Uncertain

How did you obtain your information about cell phone use in this crash? *(Check all that apply)*
- ____ Observed phone in vehicle
- ____ Driver volunteered the information
- ____ Passenger(s) in vehicle volunteered the information
- ____ Questioned the driver
- ____ Questioned other drivers/passengers involved in the crash
- ____ Witness reports
- ____ Other (please describe) _____

Please indicate any statements made by the drivers or passengers in any of the vehicles or by witnesses about the use of the cell phone and the crash:

_____

_____

_____

_____

Please mail this original form, along with a copy of the crash report, using the pre-addressed State Courier envelope.
THANK YOU!

Figure 4.2. Supplemental data collection form used by NC State Highway Patrol.

TABLE 4.1 Cell Phone Crashes and Total Crashes Reported by the NC State Highway Patrol, May 15 - July 14, 2002.

Troop	Cell Phone Crashes	Total Crashes	Percent Cell Phone Crashes
A	4	2,111	0.19
B	7	3,332	0.21
C	4	2,690	0.15
D	2	2,015	0.10
E	3	2,021	0.15
F	3	1,966	0.15
G	4	2,385	0.17
H	2	1,875	0.11
Total	29	18,395	0.16

Type of Phone

The first question on the supplemental form asked, "What type of phone was the driver using?" In all except one of the crashes, the driver was using a hand-held phone:

Portable phone brought into vehicle, no hands-free device for talking	28 crashes
Portable phone brought into vehicle, with hands-free device for talking	1 crash
	29 crashes

Driver Action

A second question asked the Trooper to indicate, "What was the driver doing at the time of the crash?" The most common action was talking or listening on the cell phone.

Talking/listening on the cell phone	9 crashes
Dialing /preparing to dial the cell phone	4 crashes
Answering/preparing to answer the cell phone	3 crashes
Checking messages	1 crash
Hanging up phone	1 crash
Looking down at phone	2 crashes
Picking up dropped phone	2 crashes
Reaching for phone	5 crashes
Retrieving phone	2 crashes
	29 crashes

Table 4.2. Summary of Crashes Reported by North Carolina State Highway Patrol

TROOP	Date	Time	Type of phone	What was driver doing?	How significant was cell phone?	How did you obtain info?	Driver/passenger statement	Crash type (#10 on crash report form)	Driver contributing factor (#14 or #17 on crash report form)	Cell phone noted in narrative?
A	5/21/02	10:00 AM	Portable, hand-held	Reaching for cell phone	Somewhat	Driver volunteered	I was reaching for the cell phone and ran off the road. Then I tried to steer back on the road and ran off the other side.	1 - Ran off road - right	20 - Inattention	Yes
A	5/27/02	4:55 PM	Portable, hand-held	Looked down to grab cell phone	Very	Observed phone, questioned driver	None	19 - Fixed object	7 - Exceeded safe speed	No
A	5/31/02	5:15 PM	Portable, hand-held	Hanging up cell phone	Very	Driver volunteered	Driver stated cell phone rang; she answered it. The subject said wrong number. Driver went to disconnect when she realized she was left of center.	27 - Head-on	11 - Crossed centerline	Yes
A	6/8/02	1:20 PM	Portable, hand-held	Dialing cell phone	Very	Driver volunteered	I reached for my cell phone and took my eyes off the road and ran off the road.	19 - Fixed object	20 - Inattention	Yes
B	5/17/02	3:00 AM	Portable, hand-held	Talking on cell phone	Very	Driver volunteered	Driver stated he was using cell phone and this was the reason he ran off the road and overturned.	19 - Fixed object	7 - Exceeded safe speed	No
B	5/17/02	5:15 PM	Portable, hand-held	Looking down to see who was calling	Very	Driver volunteered	Driver stated he looked down to see who was calling on his cell phone and when he looked back up he was too close to the vehicle he struck.	21 - Rear end, slow or stop	6 - Exceeded speed limit	Yes
B	5/29/02	11:20 AM	Portable, hand-held	Retrieving cell phone	Very	Driver volunteered	Driver was entering a curve while attempting to retrieve a cell phone. Operator lost control and crashed.	19 - Fixed object	7 - Exceeded safe speed	No
B	6/2/02	9:20 PM	Portable, hand-held	Answering cell phone	Very	Driver volunteered	Mr. McKay stated his cell phone began to ring and reached for it, taking his eyes off the road.	29 - Sideswipe, opposite direction	11 - Crossed centerline	Yes
B	6/8/02	10:44 PM	Portable, hand-held	Checking messages on phone face	Very	Driver volunteered	The driver stated he was checking the messages on his cell phone, looked away from the roadway and struck the other vehicle in the rear.	21 - Rear end, slow or stop	20 - Inattention	Yes

(Continued on next page)

TROOP	Date	Time	Type of phone	What was driver doing?	How significant was cell phone?	How did you obtain info?	Driver/passenger statement	Crash type (#10 on crash report form)	Driver contributing factor (#14 or #17 on crash report form)	Cell phone noted in narrative?
B	6/22/02	9:45 AM	Portable, hand-held	Dropped phone while talking, and reached down to pick it up	Very	Questioned driver	The driver stated she was talking on the cell phone, dropped it, reached down to pick it up and lost control of the vehicle.	19 - Fixed object	26 - Erratic, reckless, careless, negligient, aggressive	Yes
B	7/5/02	6:40 PM	Portable, hand-held	Dialing cell phone	Somewhat	Questioned other drivers/passengers	The driver of the vehicle that was not at fault wrote in her statement that she believed that Ms. George "was on a cell phone." When questioned about her cell phone use, Ms. George admitted that she was "preparing to use her phone."	24 - Left turn, different roadways	19 - Failed to yield	No
C	6/10/02	11:55 PM	Portable, hand-held	Reaching for cell phone	Very	Driver volunteered, questioned driver	Driver indicated in writing that she reached into the floorboard to grab the phone, taking her eyes off the road, causing the vehicle to swerve off the road.	19 - Fixed object	20 - Inattention	Yes
C	6/9/02	3:01 PM	Portable, hand-held	Talking on cell phone	Very	Observed phone, witness reports	Witness stated that the driver was talking on the cell pone at the time of the crash and it appeared to her that the driver wasn't paying attention to what was going on in front of her.	23 - Left turn, same roadway	26 - Erratic, reckless, careless, negligient, aggressive	Yes
C	5/21/02	4:45 PM	Portable, hand-held	Answering cell phone	Very	Driver volunteered, questioned driver	I had the cell phone in my hand and it rang. As I went to answer it, I struck the other vehicle.	21 - Rear end, slow or stop	8 - Failure to reduce speed	No
C	6/27/02	5:25 AM	Portable, hand-held	Retrieving phone from his side to turn on	Very	Driver volunteered	Driver stated he reached for his phone, crossed into left lane, and struck a man jogging.	14 - Pedestrian	11 - Crossed centerline	Yes
D	6/2/02	2:15 PM	Portable, hands-free	Talking on cell phone	Somewhat	Driver volunteered	None	19 - Fixed object	14 - Overcorrected/ oversteered	Yes

(Continued on next page)

TROOP	Date	Time	Type of phone	What was driver doing?	How significant was cell phone?	How did you obtain info?	Driver/passenger statement	Crash type (#10 on crash report form)	Driver contributing factor (#14 or #17 on crash report form)	Cell phone noted in narrative?
D	6/13/02	7:04 PM	Portable, hand-held	Reaching for cell phone	Very	Driver volunteered	Driver stated he was reaching for his cell phone when he ran off the roadway, struck a mailbox and overturned.	19 - Fixed object	20 - Inattention	Yes
E	5/17/02	6:43 AM	Portable, hand-held	Talking on cell phone	Very	Driver volunteered, questioned driver, witness reports	Tractor trailer drivers talked on the CB about the female talking on the phone and how the wreck occurred.	19 - Fixed object	20 - Inattention	Yes
E	5/30/02	2:40 AM	Portable, hand-held	Reaching for phone that had fallen into floorboard	Very	Driver volunteered, questioned driver	Fatality crash, where driver of tractor-trailer stated, during at-scene interview, that he had taken his attention off the roadway, to retrieve a cell phone that fallen from his dashboard onto the floorboard of his truck. When he "looked up," he observed two vehicles on the shoulder of the roadway, but was unable to avoid them.	1 - Ran off road - right	20 - Inattention	No
E	7/8/02	12:00 N	Portable, hand-held	Talking on cell phone	Very	Witness reports	The other driver advised he was on the cell at time of the crash. CELL PHONE DRIVER WAS HIT AND RUN	21 - Rear end, slow or stop	8 - Failure to reduce speed	No
F	5/19/02	10:00 AM	Portable, hand-held	Answering cell phone	Very	Driver volunteered	Driver stated the phone was on the passenger seat ringing and he was attempting to answer it.	19 - Fixed object	6 - Exceeded speed limit	Yes
F	5/30/02	4:05 PM	Portable, hand-held	Talking on cell phone	Very	Driver volunteered	The driver said this was the second time he has been in a crash where he was on his cell phone.	30 - Angle	4 - Disregarded traffic signals	No
F	6/5/02	7:45 PM	Portable, hand-held	Talking on cell phone	Very	Driver volunteered	Driver stated that he had only had the phone a few days.	19 - Fixed object	34 - Unknown	No
G	5/22/02	7:15 AM	Portable, hand-held	Preparing to dial cell phone	Very	Driver volunteered	Driver stated she "looked away from roadway as she reached across into the passenger seat to retrieve her cell phone to make a call."	21 - Rear end, slow or stop	20 - Inattention	Yes

(Continued on next page)

TROOP	Date	Time	Type of phone	What was driver doing?	How significant was cell phone?	How did you obtain info?	Driver/passenger statement	Crash type (#10 on crash report form)	Driver contributing factor (#14 or #17 on crash report form)	Cell phone noted in narrative?
G	5/22/02	4:10 PM	Portable, hand-held	Reaching for cell phone	Very	Driver volunteered	Stated she was reaching for the cell phone as she was pulling out onto the roadway, and did not see the approaching vehicle.	24 - Left turn, different roadways	19 - Failed to yield	N
G	7/8/02	8:15 AM	Portable, hand-held	Dialing cell phone	Very	Observed phone, driver volunteered	Drove upon another crash and was attempting to dial 911 for help when she struck a vehicle in the back.	21 - Rear end, slow or stop	8 - Failure to reduce speed	Y
G	7/12/02	7:20 PM	Portable, hand-held	Talking on cell phone	Very	Other (sounds like witness)	None	5 - Overturn/ rollover	6 - Exceeded speed limit	N
H	5/23/02	11:45 AM	Portable, hand-held	Talking on cell phone	Very	Driver volunteered	Driver of Vehicle 2 stated that he saw driver of Vehicle 1 on a cell phone. Driver of Vehicle 1 also stated that he was using his cell phone at the time of the crash.	21 - Rear end, slow or stop	20 - Inattention	N
H	7/2/02	6:00 AM	Portable, hand-held	Reaching for cell phone	Somewhat	Questioned driver	Driver was DWI.	5 - Overturn/ rollover	30 - Alcohol use	Y

Significance of Cell Phone in Causing Crash

The third question on the supplemental form asked the Trooper to give his or her opinion as to the significance of the cell phone in causing the crash. The cell phone was considered to be "very significant" in 25 crashes (86.2%) and "somewhat significant" in four crashes (13.8%).

Information Sources

The fourth question asked the Trooper, "How did you obtain your information about cell phone use in this crash?" In most cases, the driver volunteered the information to the Trooper.

Observed phone in vehicle	3 crashes
Driver volunteered the information	22 crashes
Questioned the driver	7 crashes
Questioned other drivers / passengers involved in the crash	1 crash
Witness reports	4 crashes

The total adds to more than 29 crashes because two or more information sources were indicated for some crashes.

Driver Contributing Factor

The hard-copy police crash reports were examined to determine the driver contributing factor. When two or more drivers were involved in a crash, the contributing factor pertains to the driver who was reported to be using a cell phone. The most common contributing factor noted by the Troopers was driver inattention.

Disregarded traffic signals	1 crash
Exceeded speed limit, exceeded safe speed	6 crashes
Failure to reduce speed	3 crashes
Crossed centerline	3 crashes
Overcorrected	1 crash
Failed to yield	2 crashes
Inattention	9 crashes
Erratic, reckless, careless, negligent, or aggressive	2 crashes
Alcohol	1 crash
Unknown	1 crash
	29 crashes

Crash Type

The crash type was determined from the hard-copy police crash reports. Over half of the crashes involved the cell phone driver's vehicle running off the road, and another seven cases involved the cell phone driver's vehicle rear-ending the car ahead.

Ran off road	15 crashes
Pedestrian	1 crash
Rear end	7 crashes
Turning	3 crashes
Head-on	1 crash

Sideswipe	1 crash
Angle	1 crash
	29 crashes

Mention of Cell Phone in Narrative

"Cell phone" was mentioned in the officer's narrative for 17 of the 29 crashes. "Cell phone" was not mentioned in the narratives for the remaining 12 crashes. It is not known if "cell phone" would have been mentioned in any of those 12 narratives, had there not been a supplemental form for the Troopers to fill out. However, it is thought that through the use of the supplemental form, some cell phone crashes were identified that would have been missed by relying exclusively on the officer's narrative. In other words, using the supplemental form may somewhat reduce underreporting of cell phone crashes.

Chapter 5. Summary and Conclusions

As a follow-on to an earlier study funded by the North Carolina Governor's Highway Safety Program, the current study was carried out to further understanding regarding the safety implications of cellular telephone use while driving. The study involved three separate tasks: (1) a statewide telephone survey to gather information on cell phone use and user characteristics, along with drivers' opinions regarding the safety and potential regulation of cell phone use while driving; (2) an analysis of the characteristics of cell phone-related crashes, based on 452 cell phone crashes identified from an earlier computerized narrative search of N.C. crash data; and (3) a supplementary data collection activity by the North Carolina State Highway Patrol to identify and report cell phone-related crashes occurring statewide over a two-month period.

The statewide telephone survey was conducted during the early summer of 2002 and targeted 500 users and 150 non-users of cell phones. All participants were licensed North Carolina drivers ages 18 and older. Key findings from the survey include the following:

- An estimated 58.8 percent of the state's licensed drivers have used a cell phone while driving.

- Cell phone use levels were highest among drivers in the 25-39 and 40-54 year age categories. Other demographic characteristics, including driver gender, race, and vehicle type, did not differ significantly for users versus non-users, although a higher proportion of users than non-users drove sport utility vehicles.

- The average reported time per day spent talking on a cell phone while driving was 14.5 minutes; while the median reported time was much lower at 5.0 minutes. Talk time decreased with increasing age, and was higher for males than for females.

- One in four users reported having a hands-free device, although they did not always use the device when talking on their cell phones.

- Users generally perceived talking on cell phones while driving to be less distracting and less of a safety concern than did non-users. Users were also less likely than non-users to support legislation that would prohibit anything other than hand-held phone use, and were less likely to support stricter penalties for cell phone users involved in crashes.

To examine the characteristics of cell phone-related crashes, a computerized narrative search of all reported crashes occurring in the state from January 1, 1996 through August 31, 2000 resulted in the identification of 452 cell phone-related crashes. The characteristics of these crashes were compared with the nearly 1.1 million non-cell phone crashes occurring in the state during the same time period. Results showed that:

- Cell phone crashes were less likely than non-cell phone crashes to result in serious or fatal injury. They were nearly twice as likely to involve rear-end collisions (45.1% versus 25.6%), but involved approximately equal proportions of ran-off-road and angle collisions.

- Cell phone crashes were somewhat more likely to occur during the mid-day or afternoon hours. They were also more likely to occur in urban areas, on local streets, and at roadway locations with "no special feature." They were not found to be overrepresented at intersection locations.

- Compared to non-users, drivers who were using their cell phone at the time of their crash were more likely to be male, under the age of 55, and driving a sport utility vehicle. The vast majority were at least partially responsible for their crash, based on information noted under the "driver violation" variable of the crash report form.

- The most commonly identified driver violations for cell phone users involved in crashes were failure to reduce speed (23.5%), traffic signal violation (9.6%), speeding (4.9%), following too closely (3.5%), and failure to yield (3.5%).

Finally, results of the special two-month data collection activity by the North Carolina State Highway Patrol revealed the following:

- Of the 29 identified cases, all but one involved a hand-held cell phone.

- The largest number of reported crashes involved simply talking or listening on the cell phone. Smaller numbers involving reaching for the phone, dialing or preparing to dial the phone, and answering the phone. However, a range of other activities was also identified, including retrieving a phone, picking up a dropped phone, looking down at the phone, hanging up the phone, and checking messages.

- Based on the reported cases, it was estimated that cellular telephones are involved in *at least* 0.16 percent of crashes occurring in non-metropolitan areas of the state, or about one in 623 reported crashes. This is almost identical to the estimate generated from the pilot data collection activity carried out the previous year, and reported in Reinfurt et al., 2001.

For the special two-month data collection activity, the total of 29 reported cell phone crashes projects to 174 crashes annually. From the analysis of cell phone-related crashes reported in Chapter 3, it was shown that 90.6 percent of the crashes occurred within municipal boundaries. The vast majority of these crashes would have been reported by municipal police, rather than State Highway Patrol troopers. In fact, only an estimated 11.8 percent of the crashes identified from the 1996-2000 narrative search were reported by the Highway Patrol. Thus, the total number of cell phone-related crashes projected for the state would be 174 ÷ .118, or **1,475 crashes annually**.

Drawing again from the Chapter 3 results (Figure 3.1), one can estimate that 38 of these crashes (2.6%), would result in incapacitating or fatal injury to one or more of the involved drivers, passengers, or non-vehicle occupants (pedestrians or bicyclists). An additional 628 crashes (42.6%) would result in non-incapacitating or possible injuries to one or more persons. The remaining 808 crashes would result in property damage of $1,000 or more, but no personal injuries.

These numbers, although representing less than one percent of the crashes occurring in the state, nevertheless reflect significant personal and societal losses. Due to difficulties in law enforcement identification of cell-phone related crashes, they also are likely to underestimate the magnitude of the problem. While there are clearly benefits to having cell phones available in personal vehicles, the results of this research reinforce the very real risks associated with using a cell phone while driving. They also suggest that the problem may worsen in the coming years, as cell phones and other wireless technologies continue to proliferate in people's cars.

According to recent data, at least 25 countries have passed laws restricting cell phone use while driving, including four (Israel, Japan, Portugal, and Singapore) that prohibit all use of phones while driving. In the United Kingdom and Germany, drivers can lose their insurance coverage if involved in a crash while using their cell phone.[2] In the U.S., only New York State and some local jurisdictions have passed laws requiring the use of hands-free phone systems. It is still too early to ascertain what effects, if any, such legislation has on driving safety. Even without special legislation, existing "careless and reckless" driving laws in most states can be used to reinforce the need for drivers not to allow their cell phones to distract them from their primary task of driving.

Currently 17 states collect data on cell phone involvement in traffic crashes (up from just two states four years ago).[2] Research is needed to evaluate the completeness and accuracy of these data, as well as to explore other approaches to gathering such information. In North Carolina, computerized searches of crash narratives remain the only way of routinely identifying cell phone-related crashes. However, given the high level of cooperation by the North Carolina State Highway Patrol, consideration might be given to extending the supplemental data collection efforts used in the current study to one or more urban police departments, especially since the vast majority of cell phone crashes were found to occur in urban areas.

Cell phones are not the only thing distracting drivers and contributing to crashes. Interacting with other passengers in the vehicle, changing CDs, eating and drinking, smoking, looking at road maps, reaching or searching for something in the vehicle – all are potential driving distractions. However, cell phones represent the "tip of the iceberg" in terms of new wireless technologies and communication and entertainment devices that are rapidly becoming available in today's vehicles. It is therefore critical that the highway safety community work to educate drivers about the importance of maintaining focus while driving. Only if properly used can the benefits of these new technologies be reaped without increased risk to ourselves and others.

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[2] Sundeen, M. *Cell Phones and Highway Safety. 2002 Legislative Update.* Denver, CO: National Conference of State Legislatures, August 2001. Available on the web at http://www.ncsl.org/programs/esnr/2002statelegupdate.pdf.

APPENDIX

Telephone Survey on Cell Phone Use and Driving

SCREENER

QUOTA:	**650 NC drivers to include at least 500 cell users, soft quota on age by users and non-users separately**
LENGTH:	**10 minutes**
HONORARIUM:	**None**
TOPIC:	**Effect of cell phone usage while driving**

(DO NOT ALLOW DK, NULL, OR REF FOR ANY SCREENER QUESTIONS)

Introduction
Hello. My name is _____. I'm calling on behalf of the North Carolina Governor's Highway Safety Program. We are conducting an important survey about driving safety in our state, and we are very interested in your opinions.

The survey should take 10 minutes or less. Your responses to our questions will be combined with the responses of others and presented in summary form – we will not be asking for your name or any information that would identify you as a participant.

(Ask for participation)

A. Just to verify, do you currently live in North Carolina?

1. Yes……..**SKIP TO QC**
2. No

B. Is there an adult in your household whom I can speak with that currently lives in North Carolina?

1. Yes……..**ASK TO SPEAK WITH THAT PERSON AND RETURN TO INTRO**
2. No……**THANK AND TERMINATE IMMEDIATELY**

C. Which of the following categories describes your age? **(READ LIST)**

1. Less than 18 years old
2. 18-24 years old……**SKIP TO QE, CHECK QUOTA**
3. 25-39 years old……**SKIP TO QE, CHECK QUOTA**
4. 40-54 years old……**SKIP TO QE, CHECK QUOTA**
5. 55-69 years old……**SKIP TO QE, CHECK QUOTA**
6. 70 years old or older……**SKIP TO QE, CHECK QUOTA**

D. Is there an adult in your household whom I can speak with that is at least 18 years old?

3. Yes……..**ASK TO SPEAK WITH THAT PERSON AND RETURN TO INTRO**
4. No……**THANK AND TERMINATE IMMEDIATELY**

E. Do you have a valid driver's license?

1. Yes……..**SKIP TO QG**
2. No

F. Is there another adult in your household whom I can speak with that has a valid driver's license?

1. Yes……..**ASK TO SPEAK WITH THAT PERSON AND RETURN TO INTRO**
2. No……**THANK AND TERMINATE IMMEDIATELY**

G. Do you talk on a cell phone while driving? **(Interviewer Notes: digital phones, car phones, mobile phones, etc. are all considered cell phones.)**

1. Yes……..**ADD TO USER QUOTA**
2. No……...**ADD TO NON-USER QUOTA**