CELL PHONE USE WHILE DRIVING IN NORTH CAROLINA

Donald W. Reinfurt
Herman F. Huang
John R. Feaganes
William W. Hunter

The University of North Carolina
Highway Safety Research Center

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Executive Summary

This study explored several dimensions of the growing trend of talking on a cell phone while driving. It did so by (1) reviewing the recent research – epidemiological studies; case analyses of cell phone-related crashes; and driver performance studies; (2) reporting on recent legislative activity regarding the use of cell phones while driving; (3) analyzing data from an observational study of the "who, what, when, where and how many" of cell phone use while driving in North Carolina; (4) pilot-testing the use of a supplemental data form by the N.C. Highway Patrol to report additional information on crashes where a cell phone was involved; and (5) analyzing police narratives for crashes where the use of a cell phone by the driver was indicated by the investigating officer.

As part of this overall investigation, an observational study was undertaken in North Carolina to determine the characteristics of drivers who use hand-held cell phones while driving. Characteristics of cell phone users were observed at 85 sites across the State. A total of 14,059 vehicles were observed including 1,070 drivers who were using cell phones. The results of this investigation indicate that cell phone usage was associated with front seat occupancy, vehicle type, and driver age, ethnicity, and restraint usage. Drivers who were using a cell phone while driving were more likely to be driving without a front seat passenger, driving a sport utility vehicle, younger, white, and using seat belts.

Data collected concurrently indicated that the cell phone prevalence rate is 3.1 percent, which is consistent with recent studies carried out nationally by NHTSA (3.0%) and by researchers in Texas (around 5.0%). This prevalence rate is a snapshot of cell phone use by drivers statewide at any given moment during the daytime. The rate is higher in the Piedmont (4.1%) as compared to the Mountains (2.2%) and Coastal (1.5%) regions. Cell phone usage increased somewhat during the day from 2.7 percent in the morning to 3.5 percent in the late afternoon.

As seen in the review of the literature, one of the major unknowns in this area is the magnitude of the risk of a crash to a driver talking on a cell phone. This question will become more prominent in the future with the inclusion of more in-vehicle information/guidance systems brought about by the many advancements in the Intelligent Transportation Systems (ITS) arena. To date, most – if not all – crash data is inadequate to appropriately address this basic question.

Two separate studies were carried out to examine the involvement of and circumstances pertaining to cell phone use in crashes. The first involved a pilot study with the North Carolina State Highway Patrol, where investigating Troopers completed a special cell phone-related form for crashes where a cell phone was being used. Over a two-month period involving 3 Troops of the Patrol, there were a total of eleven crashes out of 6,686 (or 0.16%) for which a cell phone appeared to play a role in the crash. In other words, about one in 600 crashes in the study appeared to involve the use of a cell phone while driving. And, upon examining the hard-copy police crash reports for 10 of these crashes, "cell phone" was mentioned in the narratives for only five of these cases.

The second study was a follow-up to an earlier analysis carried out by NHTSA in 1997. In this followup, a computerized search of all hard-copy narratives for crashes occurring in North Carolina between January 1, 1996 and August 31, 2000 was carried out. There has been exponential growth in the frequency with which cell phone use is mentioned in the police narratives over the period (i.e., 22 in 1966, 35 in 1997, 53 in 1998, 111 in 1999 and 231 for the first eight months of 2000). This certainly reflects the rapid growth in cell phone use in recent years. Over the period covering both the NHTSA analysis and also the current follow-up, the most common driver action was "talking on the phone" (46%) followed by "answering the phone" (15%) and "reaching for the phone" (10%).

Clearly there is a critical need for better crash information if the risk of crashing while using a cell phone is to be appropriately estimated. Without this information, there remains a very important unanswered question: "Just how dangerous is it to be talking on a cell phone while driving?" Similar questions will be raised with respect to the distractions that are to be anticipated with the introduction of increasingly more ITS in-vehicle navigational and warning devices.

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Chapter 1. Introduction; Review of the Literature and of Legislative Actions

Introduction

The number of cell (or mobile) phone users in the United States has grown from 500,000 in 1985 to approximately 120,000,000 in 2001. And, according to the Cellular Telecommunications and Internet Association (CTIA), it is projected that there will be more than 200 million wireless phone users by 2005 (Crawford, Manser, Jenkins, Court, and Sepulveda, 2001). With the explosion in ownership has come increased use of cell phones while driving. The evidence is mounting that dividing one's attention between driving and talking on the telephone has highway safety implications.

A variety of interested parties in North Carolina are asking questions about who is using phones while driving, under what circumstances and in what sorts of vehicles, on which types of roadways and the like, and how frequent is this use. Also being asked is whether there is any indication of cell phone involvement in motor vehicle crashes in North Carolina.

This study explores these questions by conducting a literature review of current articles and reports on cell phone use and driving (chapter 1); a review of legislative actions (U.S. and internationally) regarding driving while conversing on a cell phone (chapter 1); a statewide exposure study of the "who, what, when, where and how many" of driving while talking (chapter 2); a pilot study where the N.C. Highway Patrol collected additional data for crashes where cell phones were determined to be a factor in the crash (chapter 3); and an investigation of computerized police narratives for N.C. crashes (1996-2000) where a cell phone was mentioned by the reporting officer (chapter 3). Details of these several project efforts follow.

Literature Review

This section reviews previous studies pertaining to cell phone use while driving. These studies are divided into the following categories:

- Reviews of past research
- Epidemiological studies
- Studies of driver performance
- Case analyses of cell-phone-related crashes
- Other studies: study methodology and cost-effectiveness of regulations

Reviews of Past Research

In their review of past research, Cain and Burris (1999) concluded that cell phone use adversely affects driving performance by causing driver inattention. The effects are influenced by the type of cell phone (hand-held vs. hands-free), the complexity of the conversation, and driver age. The studies reviewed by the authors indicated that cell phone use while driving increases crash risk by 34 to 300 percent. The authors suggest that most cell-phone-related crashes occur because drivers are not paying attention to driving and move from their lane or strike a stopped vehicle in their lane.

Another review concluded that using a cell phone while driving creates safety risks (Lissy, Cohen, Park and Graham, 2000). The exact level of these risks is uncertain, but the authors estimated that "a person is less likely to be killed in a crash caused by a cellular phone user than to be killed as a pedestrian, to be killed by a drunk driver, or to be killed in a crash involving a heavy truck." The authors state that it is not clear whether hands-free phones are safer than hand-held phones.

Two more reviews of past research are found in Chapter 5 of Goodman, Bents, Tijerina, Wierwillie, Lerner and Benel (1997) and in Tijerina, Johnston, Palmer and Winterbottom (2000). While Tijerina et al. (2000) is mainly a summary of the findings of several studies on cell phone use and driving, Goodman et al. (1997) conclude that the magnitude of the risk of crashes due to cell phone use cannot be determined with existing data because of inadequate reporting. The authors do present a variety of educational, research, enforcement and/or legislative options to make cell phone (as well as other in-vehicle information systems) use as compatible with safe driving as possible.

Epidemiological Studies

An epidemiological case-control design was used to compare the demographics and behaviors of 100 drivers who had crashes ("cases") and 100 drivers who did not have crashes ("controls") (Violanti and Marshall, 1996). The case group drivers were younger, had less driving experience, and talked more on cell phones than the control group drivers. Time using a cell phone, years of driving experience, and performing cognitive or motor activities while driving were all associated with increased crash risk. In fact, talking more than 50 minutes per month on a cell phone in a vehicle was associated with a 5.59-fold higher crash risk. Combinations of cell phone use and (a) time with hands off the steering wheel, (b) drinking beverages, or (c) lighting cigarettes were all associated with increased crash risks. The authors point out that their findings suggest a statistical association, not a causal relationship, between cell phone use and crashes. It is not stated whether the case group drivers were using cell phones at the time of their crashes.

Violanti (1997) performed two rate-ratio analyses, both using data from Oklahoma: (1) 492 crashes in which the driver was reported as using a cell phone at the time of the crash; and (2) 5,292 crashes in which a cell phone was reported as being present in the vehicle. Drivers with cell phones in their vehicles had significantly higher rates for crashes caused by inattention, unsafe speed, and driving on the wrong side of the road. They also had a significantly higher risk of being killed in a crash. The author notes that his findings suggest a statistical association but not causation.

In another study of Oklahoma crashes, Violanti (1998) employed an epidemiological case-control design. The cases were drivers who were killed in crashes and the controls were drivers who survived crashes. Both the use and the presence of a cell phone were associated with an increased risk of a fatality, given a crash. The increased risk was nine times for the use of a phone and twice for the presence of a phone. Cell phone use was associated with driving left of center and inattention to further increase the risk of a crash. Study limitations include the lack of exposure data, the lack of information about other potential driver distractions, and the lack of information about whether a hand-held or hands-free phone was used.

Min and Redelmeier (1993) used ecologic analysis to look at cell phone use and crash rates in Toronto, Canada. There were 75 study locations, with a total of 1,265 crashes in 1984 and 1,969 crashes in 1993. Cell phone use was estimated by the density of cell phone towers. It is not known if this is an accurate measure of cell phone use while driving. Regression analysis showed that the locations with the greatest increases in crash rates tended to have the smallest increases in estimated use. However, the authors acknowledge that "the risk or benefit associated with using a cellular telephone while driving cannot be determined by ecologic analysis because of multiple sources of bias."

A later study in Toronto, Canada, used a case-crossover design, in which each driver was his or her own control (Redelmeier and Tibshirani, 1997). The study included 699 drivers who had cell phones and were involved in substantial property damage only crashes. Cell phone billing records indicated that 170 drivers had used a cell phone during the 10-minute period just before the crash. This time period was compared with control periods on days prior to the crash. The risk of a crash when using a cell phone was 4.3 times higher than when a cell phone was not being used. Calls made within 5 minutes before the collision had a higher relative risk than calls made more than 15 minutes before the collision *(*4.8 vs 1.3, respectively*)*. Hands-free phones had no safety advantages over hand-held phones. The authors caution that their findings indicate an association, but not necessarily causation, between the use of cell telephones while driving and collisions. Also, the data do not indicate whether the drivers using the cell telephones were at fault.

An analysis of billing records of 285,561 cell phone subscribers found that mortality rates from motor vehicle crashes increased with increasing minutes of cell phone use per day (Dreyer, Loughlin and Rothman, 1999). On the other hand, mortality rates decreased with increasing number of years of cell phone service. Note that the authors were not able to determine which calls were made from a vehicle and whether a cell phone was being used immediately before a fatal crash.

Studies of Driver Performance

Cell phones can distract motorists from the driving task. For example, instead of looking at the road ahead, a motorist may be looking around the inside of the vehicle for his or her phone. Instead of keeping both hands on the steering wheel, he or she may be picking up a dropped phone, dialing a call, or holding the phone while talking. Instead of paying attention to the road, the motorist may be engaged in a phone conversation. Because the motorist is busy performing these cell-phone-related activities, he or she may veer into another lane or off the roadway without knowing it, not notice a red light, or engage in a myriad of other dangerous driving maneuvers.

On-road study

Lamble, Kauranen, Laakso and Summala (1999) measured brake reaction times for 19 drivers as they performed cell-phone-related tasks. On average, the brake reaction times were about 0.5 second slower when drivers were performing either a visual task (dialing numbers on a keypad) or a non-visual task (memorizing and adding numbers) than when they were paying attention to a lead vehicle. These tasks may simulate distractions associated with using a cell phone while driving. The authors conclude that neither a hands-free nor a voice-controlled cell phone removes the problem of impaired driver performance when using a cell phone in the car.

Studies using driving simulators

Driving simulators are intended to replicate real-life driving conditions but without exposing drivers to the real-life risks. Thus, studies of driver performance are usually simpler to conduct using simulators than actual on-road driving. In fact, Haigney and Westerman (2001) tout the use of simulators as being the most effective and the most ethical method compared with on-road studies. However, it is possible that drivers will be less cautious while in a simulator because they know that they are in no danger of a real-life crash or injury. Several studies using driving simulators are discussed below; additional reviews can be found in chapter 5 of Goodman et al. (1997) and in Tijerina et al. (2000).

Alm and Nilsson (1995) found that crash risk can increase when a driver is using a cell phone while following another car. Forty drivers participated, of whom 20 were required to answer a cell phone and listen to and respond to the verbal information given. Among younger drivers (under 60 years of age), the reaction time to the lead vehicle maneuvers was 0.56 seconds slower when they were “using the phone” than when they were not. For older drivers (60 and over), the reaction time was 1.46 seconds slower. The subjects did not compensate for slower reaction times by increasing following distance. The authors conclude that being “on the phone” increased the drivers’ mental workload.

In another study, 150 subjects “drove” a simulator while watching a videotape of an actual driving scene (McKnight and McKnight, 1993). The subjects used simulated vehicle controls to respond to 45 traffic situations (such as vehicles stopping or turning) on the video. When no distractions were present, the subjects failed to respond to 34 percent of the situations. This increased to 41 percent when they were placing a call on a cell phone or carrying on a casual cell phone conversation, and to 44 percent when engaged in an intense conversation. Older subjects (ages 46 to 80) had higher non-response rates than younger subjects (ages 17 to 25).

The authors also conclude that the effects of cell phones on driving performance are not limited to dialing and do not disappear with hands-free phones.

Parkes and Hooijmeijer (2001) investigated the driving performance of 15 subjects on a simulated rural road. They were able to maintain their speed and lateral position on the roadway while engaged in a cell phone conversation. However, situational awareness was degraded as many subjects had no idea of what was going on around them while they were on the phone. Reaction time was also slower, especially when near the beginning of a cell phone conversation.

Strayer and Johnston (2001) assessed how cell phone use affected performance of a simulated driving task in which a joystick was used to track a moving target on a computer screen. In the first experiment, red and green lights were flashed on the screen. The 48 subjects were instructed to press a "brake button" on the joystick if they saw a red light. When the subjects were talking on a cell phone, they were more than twice as likely to "miss" a red light. Their reaction times were also slower. There were no differences in performance according to whether a hands-free or hand-held phone was used. The second experiment used 24 subjects where, this time, no lights were flashed on the screen. Subjects committed more tracking errors when they performed an active word generation task that was intended to simulate an intensive cell phone conversation. The authors suggest that cell phone use degrades driving performance by diverting attention away from the driving task to the phone conversation.

Case Analyses of Cell Phone-Related Crashes

The Fatality Analysis Reporting System (FARS) is a census of all fatal motor vehicle crashes in the United States. It contains data on about 40,000 annual fatalities. Among these, there were 36 cases in 1994 and 40 cases in 1995 that included cell phone use as a "possible distraction inside the vehicle." (Goodman et al., 1997).

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. In particular, Oklahoma and Minnesota are the only states that specify cell phone use on their police crash reports. On Oklahoma's form, the officer is asked to indicate whether a telephone was installed and whether it was in use in the vehicle. In Minnesota, the officer can mark "Driver on car phone/CB/2-way radio" as a contributing factor. In other states, cell phone use may be mentioned in the officer's narrative of the crash. In any case, the officer must rely on statements from drivers, passengers, and witnesses. Because drivers and passengers may be reluctant to admit cell phone use and witnesses may not be present, the crash data on cell phone use while driving are certainly conservative. Despite this limitation, if more states were to include cell phone use as an item on their crash reports, more cell phone-related crashes would be identifiable in FARS and in NASS (National Automotive Sampling System). As a result, researchers would be able to better understand how cell phone use relates to crashes and to better estimate the crash risks that are involved with cell phone use while driving.

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 8 cell phone-related crashes. It is estimated that these cases represented 3,837 similar cases nationally (Goodman et al., 1997).

Goodman et al. (1997) also analyzed 28 cell-phone-related crashes. Data for 11 were included in FARS or NASS, and data for the remaining 17 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.

In most states, cell phone use may be mentioned in the officer's narrative of the crash. If the narratives have been entered into a data base, they can be searched by using keywords such as "cell" or "phone." Narratives that contain these keywords will be retrieved. The narratives are then read to determine whether the crash was in fact cell-phone-related.

This methodology was used by Goodman et al. (1997) to search almost 900,000 crash narratives from North Carolina. 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, not surprisingly, that the number of cell phone-related crashes is increasing as cell phones become more common. Here, again, the extent of underreporting is not known.

Goodman et al. (1997) report that the National Police Agency of Japan identified 129 cell-phone-related crashes that occurred in June 1996. Of these, 76 percent were rear-end crashes. Only 16 percent of the drivers were talking on the phone at the time of the crash. Drivers were most likely to be answering a call (42%) or dialing (32%). The authors do not state how crashes were determined to be cell phone-related, or if there is a standard crash report form used throughout Japan. They do caution that the results cannot be extrapolated to the U.S. because of differences in cell phone design, traffic conditions, etc. They also remark that "the study does show that concern for the effects of cellular telephone use while driving is of international interest."

Other Studies

Study methodology

By examining billing records from cell phone companies and surveying over 5,500 account holders on their cell phone use, Funch, Rothman, Loughlin and Dreyer (1996) found that billing records are a reasonable measure of cell phone use by the account holder. However, billing records do not reveal which calls are made from a vehicle, nor, if from a vehicle, whether the account holder or another person is driving at the time.

Haigney and Westerman (2001) explored several methodological issues that may affect the validity of studies that consider the effects of cell phone use on driving. These issues include which specific cell-phone-related task demands (such as dialing and conversing) are studied and how to measure distraction caused by cell phone use. To facilitate comparisons among different studies, the authors recommend that investigators provide more detailed descriptions of phone type, task demands, and automatic vs. manual transmission.

Cost-effectiveness of regulations

Cell phones provide benefits to users but crashes related to cell phones result in health care and lost productivity costs. Regulations on cell phone use while driving can reduce these costs but incur their own costs, mostly lost benefits to users. An analysis by Redelmeier and Weinstein (1999) conclude that regulations would be more expensive than other measures to save lives. They measured the losses from fatalities and permanent injuries in terms of quality-adjusted life years (QALY's), which take into account both actual years of life and the person's health status. The estimated cost-effectiveness ratio for restricting cell telephone use while driving ranged from $50,000 to $700,000 per QALY saved, depending on the assumptions used. The authors suggest that increasing the price of a call would result in fewer discretionary calls and thereby reduce the societal costs of cell-phone-related crashes.

Cell Phone Legislation in the U.S. and Internationally

U.S. States

The rapidly-increasing number of cell phone users in the U.S. has been accompanied by heightened interest in the safety aspects of driving while using a cell phone. This interest is evident in state legislatures. As of August 24, 2001, 144 cell-phone-related bills in 44 states, the District of Columbia, and Puerto Rico had been under consideration this year (NCSL, 2001; Sundeen, 2001). During the year, nine bills were enacted, 86 were listed as active (usually waiting for committee action or carried over to next year), and the rest were listed as inactive (usually died in committee). By comparison, just last year (2000), only 27 states considered cell phone legislation. In 1999, there were cell phone bills in 15 states, none of which passed.

Among the bills that were enacted, New York's "requires that no person operate a motor vehicle while using a hand-held mobile phone." An exception is made for emergency situations. The bill also prohibited "local governments" from regulating the use of mobile telephones in motor vehicles." The New York ban was signed into law on June 28, 2001 (and became effective November 1, 2001). Soon thereafter, New Jersey enacted a more limited ban, in which only holders of a driver examination permit were prohibited from using a cell phone. Actions in other states are listed in the following:

- Two states **restricted** the use of related devices while driving:

IL	Prohibits the use of headsets while driving except for single-sided headsets or earpiece used for cellular phones.
TN	Permits computer or other electronic displays in utility motor vehicles to be used by utility employee only while vehicle is stopped, standing, or parked.

! Bills for **further study** were enacted in three states:

LA	Creates a task force to study and make recommendations concerning driver distractions.
NJ	Requires the Commissioner of Transportation to annually compile information on cellular phone use in vehicles during an accident and whether the operator was using the phone.
VA	Requests the Department of Motor Vehicles to study the dangers imposed by distracted drivers and to specifically examine the use of telecommunications devices by motor vehicle operators.

! Two states sought to **pre-empt local efforts** to regulate cell phone use while driving:

OK	Provides for state pre-emption of legislation relating to inattentive driving and cellular telephone usage in automobiles.
OR	Prohibits local governments from passing or enforcing any provision regulating the use of cellular telephones in motor vehicles.

In North Carolina, the following two bills were considered during the current legislative session:

HB 62	Prohibits drivers from using a hand-held cellular telephone while operating a motor vehicle. Allows one minute grace period and exceptions for emergency situations.
HB 74	Prohibits the use of hand-held phones while driving.

Both bills died in committee.

U.S. Counties and Municipalities

Thirteen counties and municipalities in the U.S. have passed restrictions that require motorists to use hands-free devices while driving. These are: Brookline, MA; Brooklyn, OH; Carteret, NJ; Conshocken, PA; Hilltown Township, PA; Lebanon, PA; Marlboro, NJ; Nassau County, NY; Sandy, UT; Santa Fe, NM; Suffolk County, NY; Westchester County, NY; and West Conshocken, PA. The restrictions in Hilltown Township were struck down by court action, and the attorney general for Massachusetts issued an opinion against the restrictions in Brookline. The restrictions in Nassau, Suffolk, and Westchester Counties will be superseded by the statewide ban in New York. It is of interest to note that Brooklyn, OH (a suburb of Cleveland) was the first jurisdiction in the U.S. with a seat belt law and also the first with cell phone legislation.

Restrictions on cell phone use while driving will be forthcoming in other cities and counties. For example, Miami-Dade County, FL, is planning to ban motorists from talking on a cell phone while driving on county roads. Chicago, Cleveland, Philadelphia, and San Francisco are among the cities that are considering cell phone legislation.

Other Countries

Many countries have implemented restrictions on cell phone use while driving. In Israel, Japan, Portugal, and Singapore, all cell phone use is prohibited while driving. The use of hand-held phones is prohibited while driving in Austria, Brazil, Chile, Denmark, Germany, Greece, Hong Kong, Hungary, India (New Delhi), Italy, the Philippines, Poland, Romania, Slovenia, South Africa, Spain, Switzerland, and Turkey. In addition, drivers in the Czech Republic, France, the Netherlands, and the United Kingdom can be fined if they are involved in a crash while using a cell phone. Drivers in Germany and the United Kingdom can lose their insurance if they are involved in a crash while using a cell phone.

Chapter 2. Cell Phone Observational Study

Method

The purpose of this data collection was to describe characteristics of drivers who are using cell phones while driving, by comparing cell phone users to non-users. The term "cell phone" is used here to include hand held, hands free, cellular, digital, wireless communication device. Two observers collected data at each of 85 sites in North Carolina. Drivers entered the study as they were identified by the observer. Based on the results of the pilot study which indicated a paucity of drivers using cell phones, the observers were instructed to target cell phone users first and then to collect data on the non-users if there were no cell phone users to observe.

There are several advantages to this method. First, data for both groups can be collected at the same time and by the same observer. Since the objective of the data collection is the comparison of cell phone users with non-users, the observers do not have to collect information on every vehicle that passes by their viewing position. Secondly the method (basically a case-control study) controls for region, road type, time of day and day of week, rural/urban, and traffic volume as the non-users are observed concurrently. Lastly, the additional cost of collecting information on the non-users over the cost of just collecting information on cell phone users is minimal.

Site Selection

The UNC Highway Safety Research Center, under the auspices of the North Carolina Governor's Highway Safety Program, selected a random sample of 85 intersections for the purpose of the current study. This sample of sites is a sub-sample of sites from the National Highway Traffic Safety Administration (NHTSA)-approved stratified random sample of sites for carrying out the statewide seat belt use surveys. Pilot studies of the data collection forms and procedures pointed to a low prevalence rate, perhaps 2 percent to 10 percent. This low prevalence created a focus on obtaining an adequate sample of cell phone users. To obtain as large a sample of cell phone users as possible, the five sites in each of the 17 NHTSA belt survey counties with the highest volumes of vehicles were selected. The sites were required to be controlled by a stop light as the amount and nature of the data collected necessitated stopped vehicles. The sample of the entire state includes a representative mix of urban and rural traffic on various road types such as US and NC routes along with city streets. In addition, sites were observed on week days during either morning (7:00 am - 11:00 am), midday (11:00 am-3:00 pm) or late afternoon (3:00 pm-6:00 pm) periods. For each of the 17 counties, no more than 2 sites were observed at any of the three time periods.

Data Collection

The data were collected in two parts. The first part was a 5 minute before and a 5 minute after traffic flow count and the second part was the collection of information on driver and vehicle characteristics and cell phone usage. Data were collected by the survey research firm

Johnston, Zabor, and McManus (JZM). Pairs of observers were stationed at each of the 85 sites collecting data for vehicles in both directions for the primary roadway through the intersection for a total of 90 minutes per site.

For 5 minutes before the main observations and 5 minutes following the main observations, the observers counted the total number of passenger vehicles and the number of drivers in those vehicles that were talking on, dialing, or manipulating a cell phone. Passenger vehicles include cars, utility vehicles, mini-vans, pickup trucks, minivans, vans, or convertibles; it excludes buses, commercial trucks, and motorcycles. Vehicles were observed in the lane adjacent to the observer only. This was to establish vehicle flow counts and to estimate the prevalence of cell phone use by drivers. This then gives a snapshot of cell phone use statewide at any given moment in time.

In the main data collection the observers collected data for 80 minutes. They did not collect information on all vehicles in the adjacent lane. Observers collected data for vehicles **stopped** at the intersection **and** in the immediately-adjacent lane to their observational positions. All data were collected when the vehicles were stopped for a stop light because results from our pilot study demonstrated that not all the information could be reliably collected on moving vehicles.

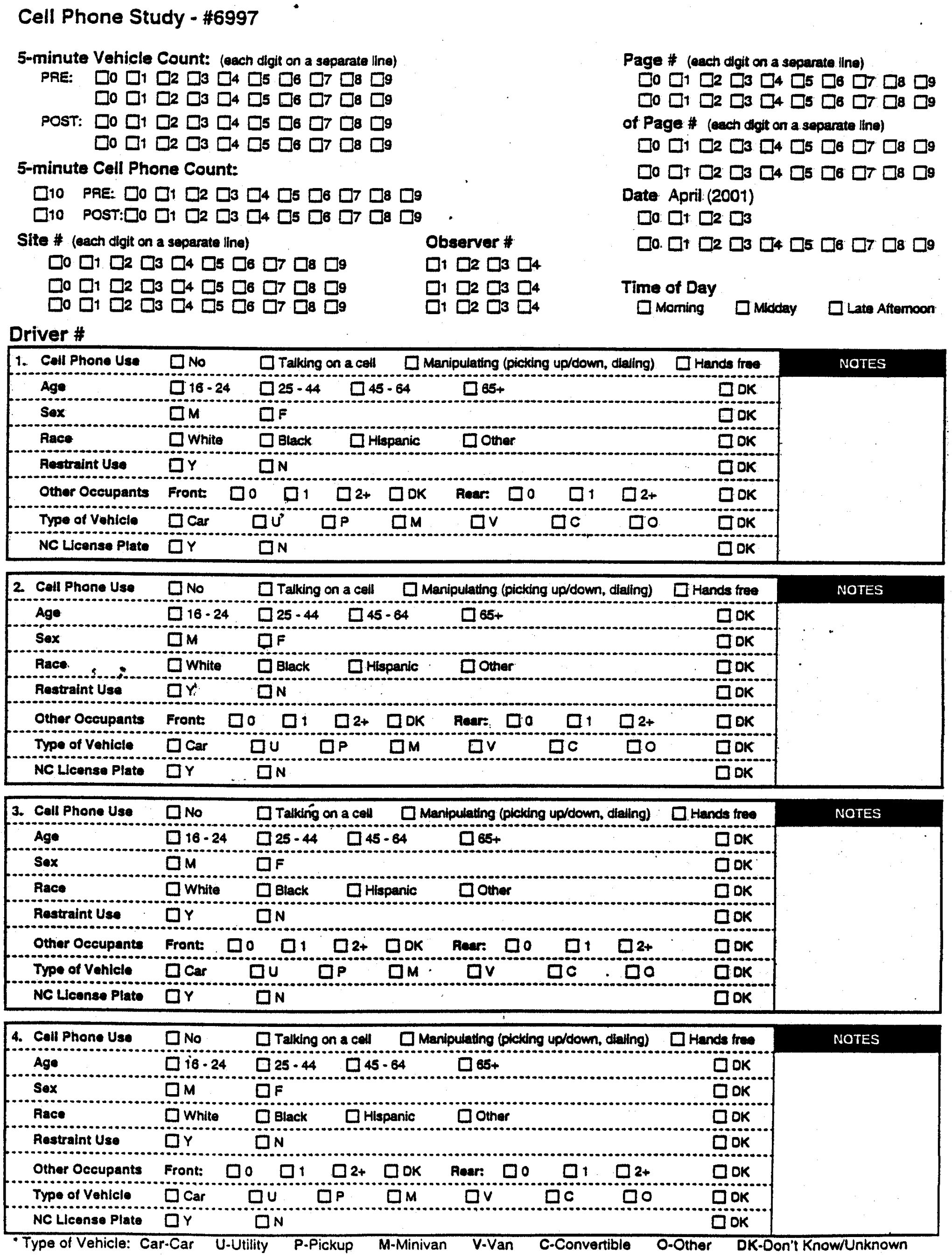
Because observing a cell phone in use is a relatively rare event (2%-10%) the cell phone users were observed first. Then, as time permitted, information on non-users was collected. These data were collected for a total of 1 hour and 20 minutes at each site. Information that was collected included cell phone use; driver age, sex, race and restraint use; number of occupants in the front seat and number of occupants in the back seat; and whether the vehicle had a North Carolina license plate along with time of day, day of week, and location information (from the assigned site number). All observations were recorded on machine readable forms (see figure 2.1) and converted to computer tape by JZM.

A more detailed account of the data collection protocol follows. When the traffic stopped for the red light, the data collectors were to first obtain information on a cell phone user. They looked down the queue of stopped vehicle(s) to try to spot a driver using a cell phone. If none, then the data collector would observe a non-user, then check again for newly-arriving drivers using a cell phone. The selected non-user vehicle is either the first passenger vehicle behind the cell phone user or the second vehicle stopped at the stop light. Each red light cycle allowed enough time for only a few observations.

Analysis Plan and Results

The goal of this survey is to provide a description of the “who, what, when, where” of cell phone use by drivers in North Carolina. The analysis provides detailed descriptive statistics with respect to differences between cell phone users and non-users on driver age, race, sex, and restraint use; vehicle occupancy (front and rear); type of vehicle, North Carolina vs. other registration; region of North Carolina; and time of day.

Figure 2.1,
Facsimile of machine readable data collection form
Used by Johnson, Zabor, and McManus



Cell Phone Study - #6997

5-minute Vehicle Count: (each digit on a separate line)
PRE: ☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9
☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9
POST: ☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9
☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9

5-minute Cell Phone Count:
☐10 PRE: ☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9
☐10 POST: ☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9

Site # (each digit on a separate line)
☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9
☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9
☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9

Observer #
☐1 ☐2 ☐3 ☐4
☐1 ☐2 ☐3 ☐4
☐1 ☐2 ☐3 ☐4

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Date April (2001)
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Time of Day
☐ Morning ☐ Midday ☐ Late Afternoon

Driver #

1. **Cell Phone Use** ☐ No ☐ Talking on a cell ☐ Manipulating (picking up/down, dialing) ☐ Hands free — NOTES
Age ☐ 16 - 24 ☐ 25 - 44 ☐ 45 - 64 ☐ 65+ ☐ DK
Sex ☐ M ☐ F ☐ DK
Race ☐ White ☐ Black ☐ Hispanic ☐ Other ☐ DK
Restraint Use ☐ Y ☐ N ☐ DK
Other Occupants Front: ☐ 0 ☐ 1 ☐ 2+ ☐ DK Rear: ☐ 0 ☐ 1 ☐ 2+ ☐ DK
Type of Vehicle ☐ Car ☐ U ☐ P ☐ M ☐ V ☐ C ☐ O ☐ DK
NC License Plate ☐ Y ☐ N ☐ DK

2. **Cell Phone Use** ☐ No ☐ Talking on a cell ☐ Manipulating (picking up/down, dialing) ☐ Hands free — NOTES
Age ☐ 16 - 24 ☐ 25 - 44 ☐ 45 - 64 ☐ 65+ ☐ DK
Sex ☐ M ☐ F ☐ DK
Race ☐ White ☐ Black ☐ Hispanic ☐ Other ☐ DK
Restraint Use ☐ Y ☐ N ☐ DK
Other Occupants Front: ☐ 0 ☐ 1 ☐ 2+ ☐ DK Rear: ☐ 0 ☐ 1 ☐ 2+ ☐ DK
Type of Vehicle ☐ Car ☐ U ☐ P ☐ M ☐ V ☐ C ☐ O ☐ DK
NC License Plate ☐ Y ☐ N ☐ DK

3. **Cell Phone Use** ☐ No ☐ Talking on a cell ☐ Manipulating (picking up/down, dialing) ☐ Hands free — NOTES
Age ☐ 16 - 24 ☐ 25 - 44 ☐ 45 - 64 ☐ 65+ ☐ DK
Sex ☐ M ☐ F ☐ DK
Race ☐ White ☐ Black ☐ Hispanic ☐ Other ☐ DK
Restraint Use ☐ Y ☐ N ☐ DK
Other Occupants Front: ☐ 0 ☐ 1 ☐ 2+ ☐ DK Rear: ☐ 0 ☐ 1 ☐ 2+ ☐ DK
Type of Vehicle ☐ Car ☐ U ☐ P ☐ M ☐ V ☐ C ☐ O ☐ DK
NC License Plate ☐ Y ☐ N ☐ DK

4. **Cell Phone Use** ☐ No ☐ Talking on a cell ☐ Manipulating (picking up/down, dialing) ☐ Hands free — NOTES
Age ☐ 16 - 24 ☐ 25 - 44 ☐ 45 - 64 ☐ 65+ ☐ DK
Sex ☐ M ☐ F ☐ DK
Race ☐ White ☐ Black ☐ Hispanic ☐ Other ☐ DK
Restraint Use ☐ Y ☐ N ☐ DK
Other Occupants Front: ☐ 0 ☐ 1 ☐ 2+ ☐ DK Rear: ☐ 0 ☐ 1 ☐ 2+ ☐ DK
Type of Vehicle ☐ Car ☐ U ☐ P ☐ M ☐ V ☐ C ☐ O ☐ DK
NC License Plate ☐ Y ☐ N ☐ DK

* Type of Vehicle: Car-Car U-Utility P-Pickup M-Minivan V-Van C-Convertible O-Other DK-Don't Know/Unknown

Pre and Post 5 Minute Counts

The prevalence of cell phone use in North Carolina was estimated at 3.1 percent using 5-minute counts of cell phone use and total vehicles both before and after the main data collection, for a total of 10 minutes per 85 sites each with two observers. This was based on observing 352 cell phone users and observing a total of 11,286 vehicles. The percentages reported here should be interpreted as a snapshot of cell phone use in North Carolina at any given point during the daytime. It is neither the percent of drivers who ever use a cell phone, nor the percent of drivers who used a cell phone while driving on that trip, nor the percent of drivers with access to a cell phone.

Regional differences in cell phone usage

The Piedmont had the highest percentage of cell phone users (4.1%), greater than the mountains (2.2%) or the coast (1.5%) (see figure 2.2).

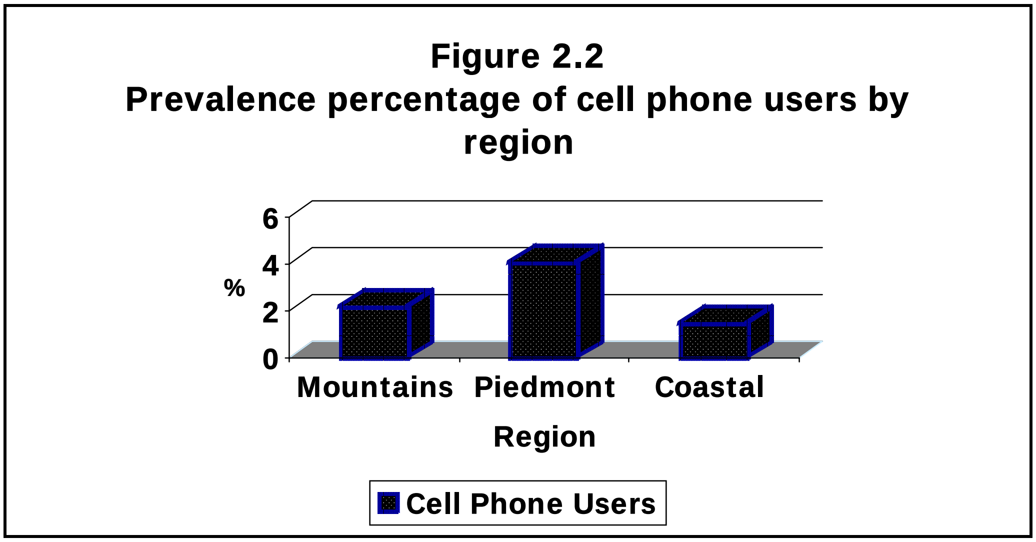


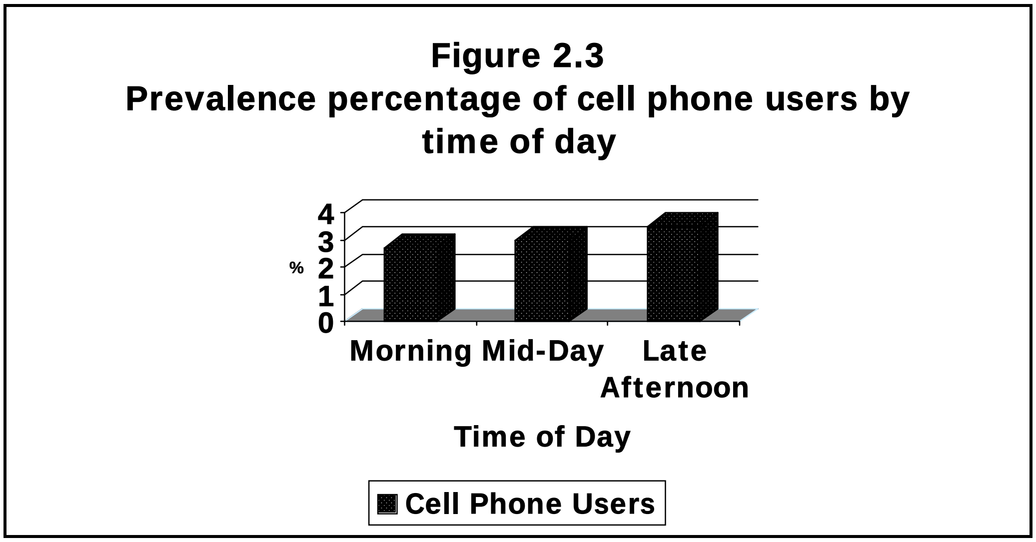
Figure 2.2
Prevalence percentage of cell phone users by region

Cell phone usage by time of day

There appeared to be a temporal trend during the day, with cell phone usage increasing during the day (see figure 2.3). From 2.7% in the morning to 3.0% at mid-day to 3.5% in the late afternoon.

Comparison of driver and vehicle characteristics of users vs. non-users

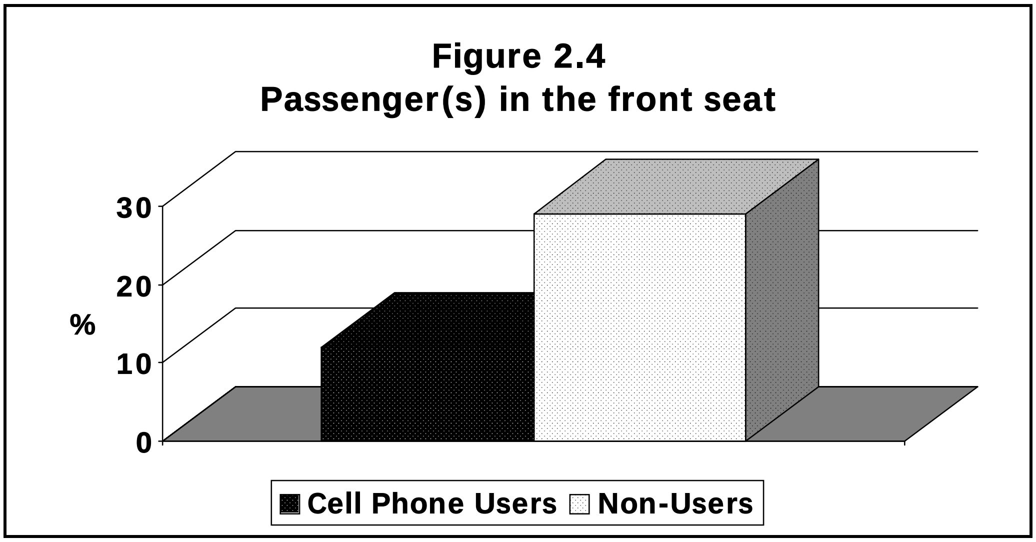
There were a total of 14,059 vehicles observed at the 85 sites: 1070 vehicles whose drivers were observed using a cell phone and 12,989 vehicles whose drivers were not using a cell phone. Using chi-square tests (at p=0.05), the characteristics that were found to be statistically associated with cell phone use were: front seat occupancy; vehicle type; and driver age,



ethnicity, and use of restraints. North Carolina plates and gender were not associated with using a cell phone. Details follow:

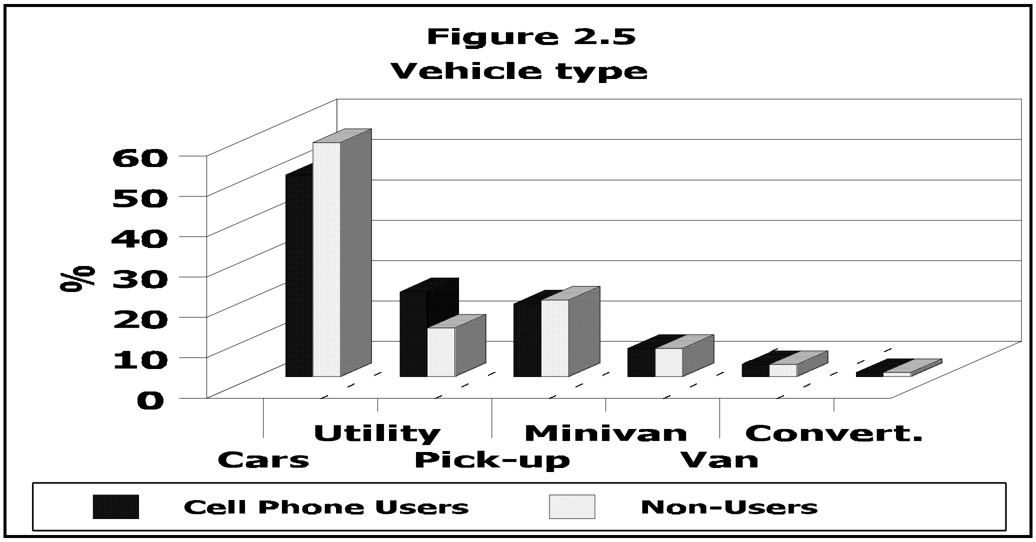
Front seat occupancy; Back seat occupancy

There was a front seat passenger present for 12 percent of vehicles with cell phone users compared with 30 percent for non-users (see figure 2.4). Back seat occupancy followed a similar pattern with 5 percent of cell phone users with at least one passenger in the back seat, while 8 percent of non-users had at least one passenger in the back seat; however, the difference in back seat occupancy was not statistically significant due, in part, to the relative scarcity of back seat occupants in general.



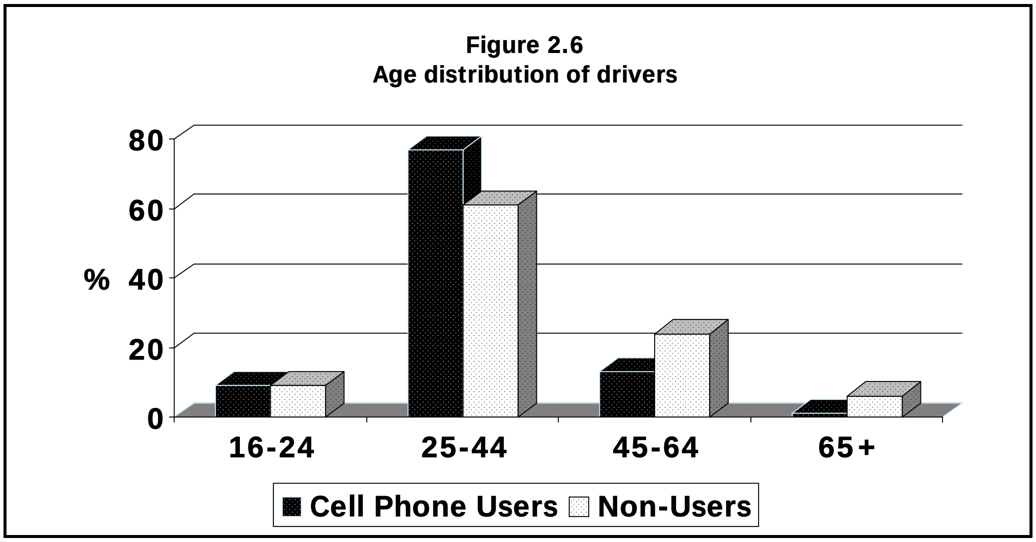
Vehicle type

There was a statistically significant difference in vehicle type, namely, 21 percent of the cell phone users were driving a utility vehicle, while among non-users 12 percent were driving a utility vehicle (see figure 2.5).



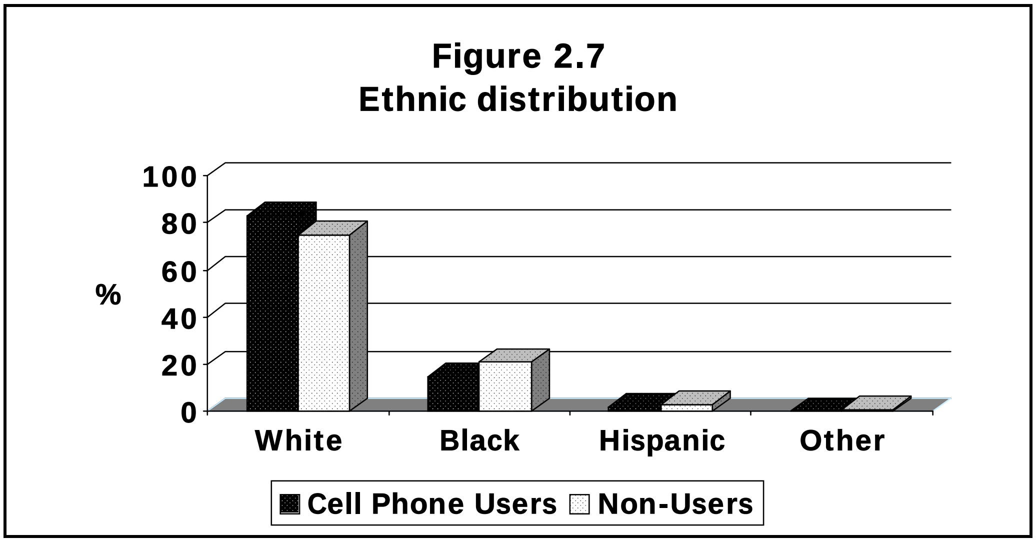
Age of driver

There is a difference in the age distribution for drivers observed using a cell phone and drivers not observed using a cell phone (see figure 2.6). The cell phone users were more likely to be in the 25-44 years of age group than the non-users, while the non-users were more likely to be in the 45-64 years of age group and the 65+ age group than the cell phone users.



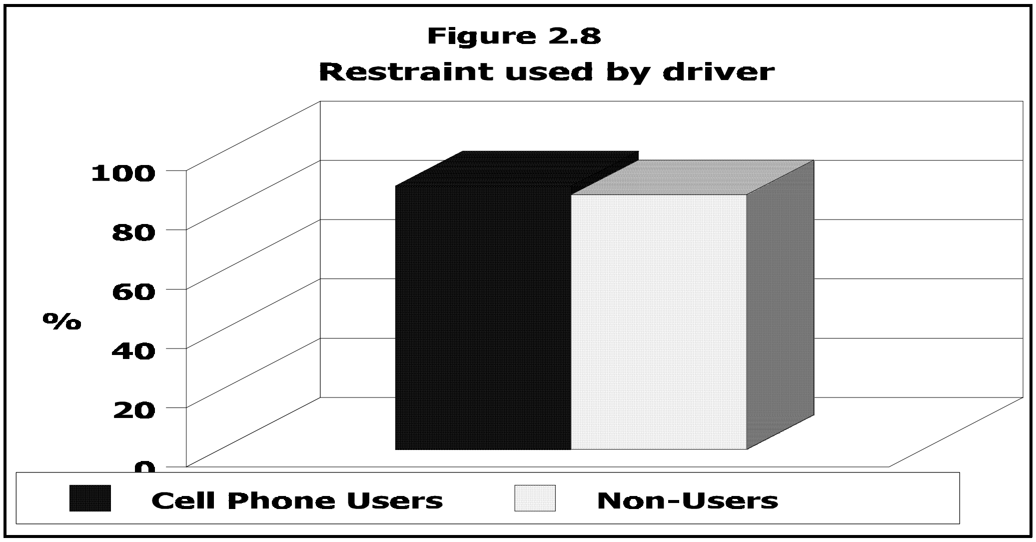
Ethnicity of driver

Cell phone users were more likely to be White than non-users with 83 percent of cell phone users being White and 75 percent of non-users being White (see figure 2.7). Non-users were more likely to be Black or Hispanic than cell phone users.



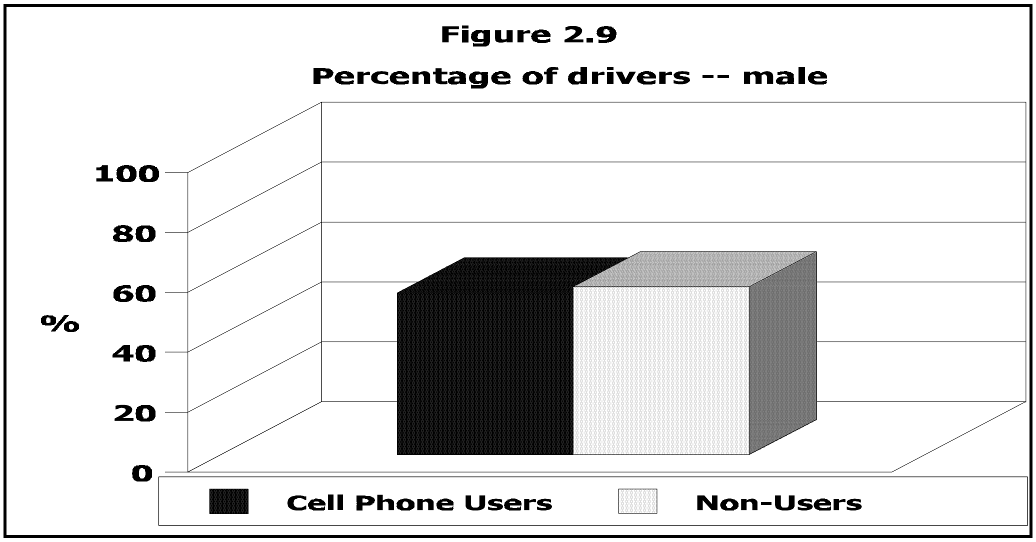
Use of restraint by driver

There was a statistically significant difference in the percentage of drivers using seat belts, with 89 percent of cell phone users using some form of restraint, as compared with 85 percent of non-users (see figure 2.8).



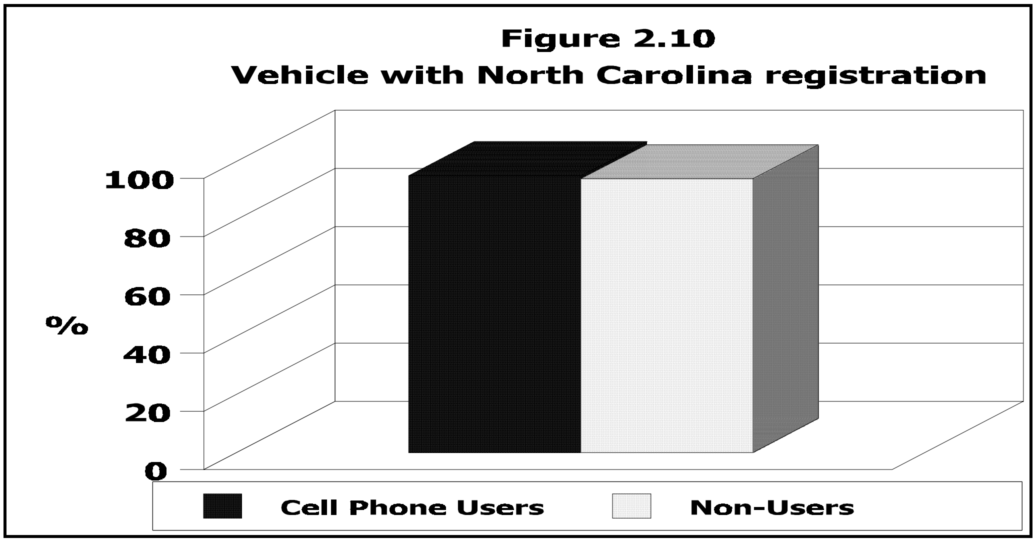
Gender of driver

Cell phone users and non-users are equally likely to be male with 54 percent of cell phone users being male, compared to 56 percent of non-users (see figure 2.9).



North Carolina plates

Cell phone users displayed North Carolina license plates 95 percent of the time, as compared to 94 percent of non-users (see figure 2.10).



Thus front seat occupancy, vehicle type, age of driver, ethnicity, and use of restraints were associated with using a cell phone. Gender and state of vehicle registration (NC vs other) were not associated with the driver using a cell phone while driving.

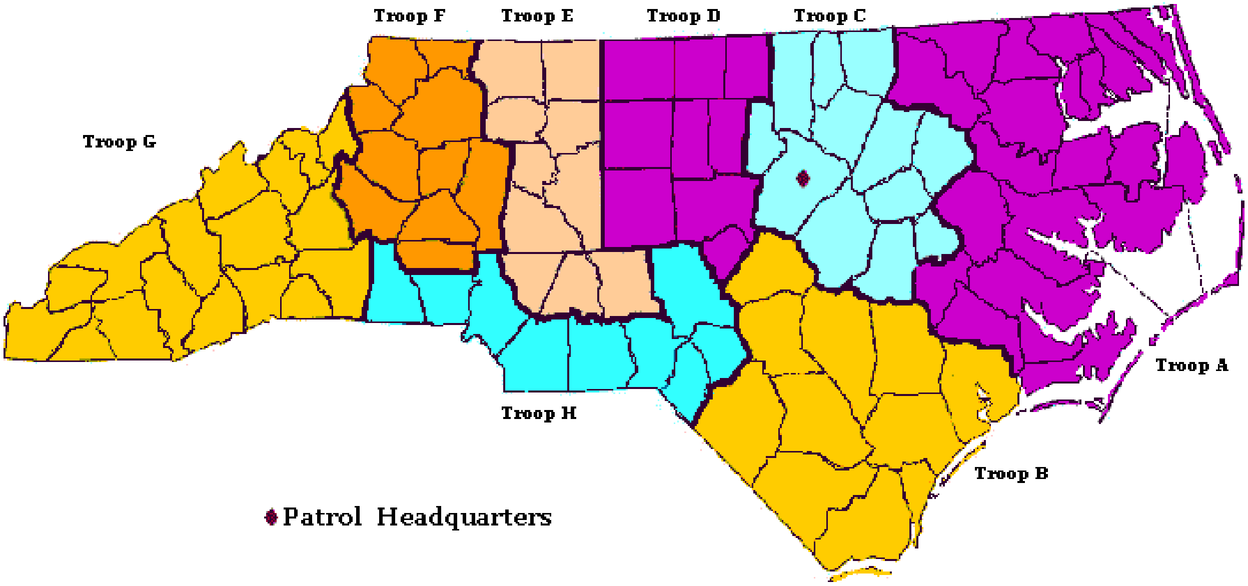
Chapter 3. An Investigation of Cell Phone Use in North Carolina Crashes

Two separate studies were carried out to examine the involvement of and circumstances pertaining to cell phone use in crashes. The first involved a pilot study with the North Carolina State Highway Patrol where investigating Troopers completed a special cell phone-related form for crashes where a cell phone was being used. The second examined police crash narratives to follow up on the earlier Goodman et al. (1997) study (see chapter 4 of that study). The details of these two studies follow.

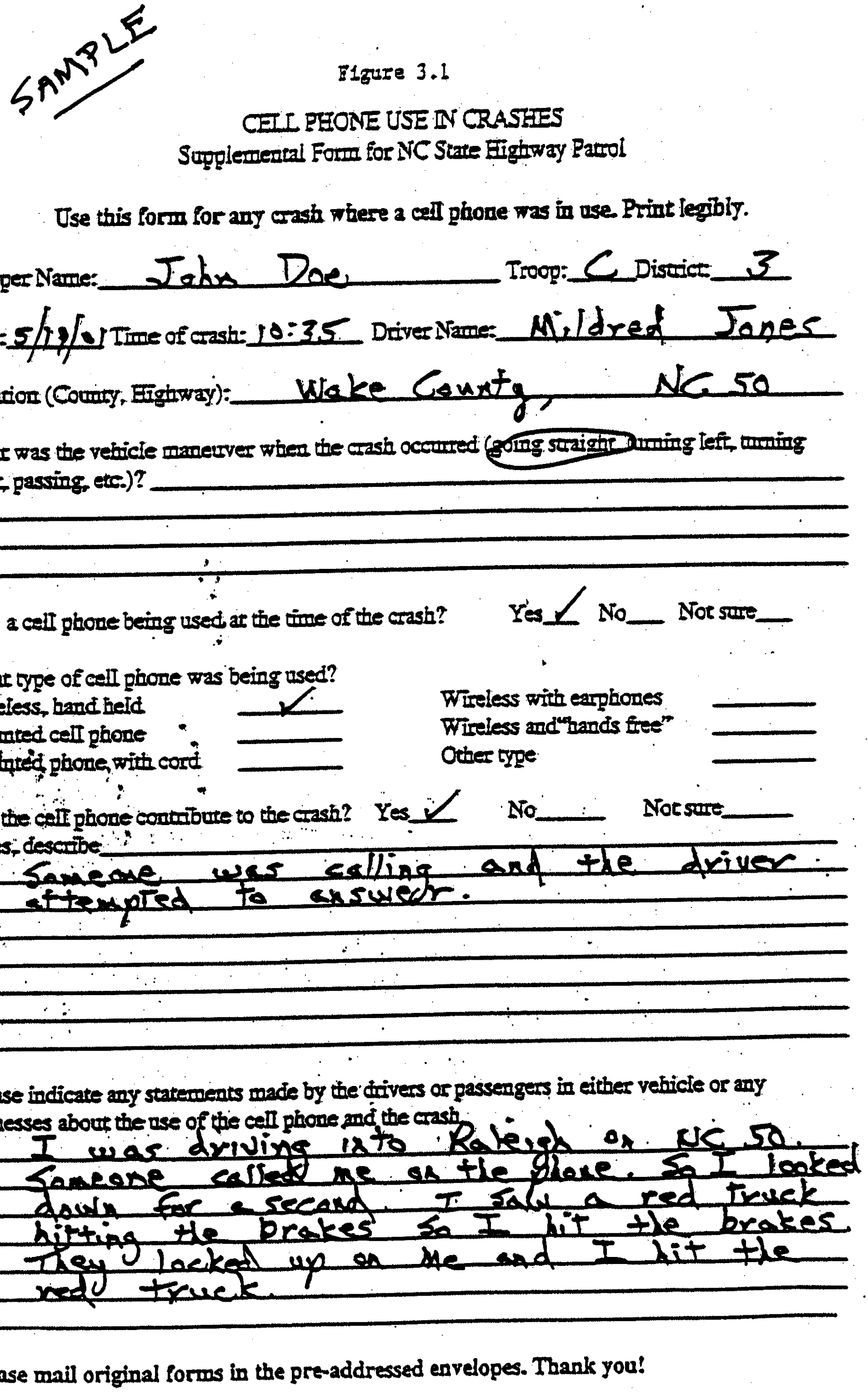
Cell Phone Crashes Reported by the North Carolina State Highway Patrol

This phase of HSRC's study on "Cell Phone Use and Driving in North Carolina" pertained to the investigation of actual cell-phone-related crashes. After the North Carolina State Highway Patrol agreed to participate in a pilot study, a supplemental data collection form (see figure 3.1) was developed and copies were provided to State Highway Patrol Troops A, C, and F (see figure 3.2). The Troopers were asked to fill out this supplemental form whenever there was any indication of cell phone involvement in the crash. The data collection period started on May 1, 2001, and ended on June 30, 2001. The districts within each Troop returned the forms as they were completed.

Figure 3.2 North Carolina State Highway Patrol Troops



A total of 66 forms – four from Troop A, four from Troop C, and 58 from Troop F – were filled out and returned. For 11 crashes, the Trooper indicated that a cell phone was being used at the time of the crash. For one additional crash, the Trooper noted that a cell phone was used to call 911 after the crash. There were 10 crashes in which the Trooper indicated that a cell



SAMPLE

Figure 3.1

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

Use this form for any crash where a cell phone was in use. Print legibly.

Trooper Name: John Doe Troop: C District: 3

Date: 5/19/01 Time of crash: 10:35 Driver Name: Mildred Jones

Location (County, Highway): Wake County, NC 50

What was the vehicle maneuver when the crash occurred ([✓ going straight], turning left, turning right, passing, etc.)?

Was a cell phone being used at the time of the crash? Yes ✓ No ___ Not sure ___

What type of cell phone was being used?

Wireless, hand held	✓	Wireless with earphones	
Mounted cell phone		Wireless and "hands free"	
Mounted phone, with cord		Other type	

Did the cell phone contribute to the crash? Yes ✓ No ___ Not sure ___

If yes, describe: Someone was calling and the driver attempted to answer.

Please indicate any statements made by the drivers or passengers in either vehicle or any witnesses about the use of the cell phone and the crash.

I was driving into Raleigh on NC 50. Someone called me on the phone. So I looked down for a second. I saw a red truck hitting the brakes so I hit the brakes. They locked up on me and I hit the red truck.

Please mail original forms in the pre-addressed envelopes. Thank you!

phone was not being used, but did mark the type of cell phone. These 10 were interpreted as crashes where a cell phone was present but not in use. For the remaining 44 crashes, a cell phone was not being used, and there was no indication of cell phone presence. Most of these 44 crashes came from one district in Troop F. It appears that some Troopers in that district filled out the forms for every crash that they investigated. Thus, the relevant cell phone crashes were distributed as four from Troop A, four from Troop C, and three from Troop F. The total number of crashes that the three Troops of the State Highway Patrol investigated during the two-month period was 6,686.

The data from the three Troops can be summarized as follows:

	Cell Phone Crashes	Total Crashes	Percent Cell Phone Crashes
Troop A	4	2,003	0.20%
Troop C	4	2,722	0.15%
Troop F	3	1,961	0.15%
TOTAL	11	6,686	0.16%

For all Troops combined, the rate of cell phone crashes per total crashes was 11 / 6,686 = 0.16%, or about one reported cell phone crash per 608 reported crashes.

The 11 cell-phone-related crashes are summarized in table 3.1. The data on the supplemental forms were interpreted to determine the **driver action**, **driver contributing factor**, and **crash type**. The 11 crashes were determined to involve these **driver actions**:

Answering phone	3 crashes
Picking up dropped phone	1 crash
Reaching for phone (not stated if driver was getting ready to make a call or answering a call)	1 crash
Reaching for phone (by driver's wife)	1 crash
Talking on phone	2 crashes
Using phone (not stated if driver was making a call or talking on the phone)	1 crash
Unable to determine	2 crashes

For two crashes, the **driver contributing factor** was the driver taking his eyes off the road to answer the phone. The Troopers attributed two crashes to driver inattention. In one crash, the driver became distracted when his wife reached behind her seat for a ringing cell phone. Three crashes appeared to be the result of either the driver taking his/her eyes off the road or the driver losing control because one hand was reaching for the phone and not on the steering wheel.

Table 3.1.Summary of cell-phone-related crashes

CRASH NO.	DRIVER ACTION	VEHICLE MANEUVER	CRASH TYPE	TYPE OF PHONE	DRIVER CONTRIBUTING FACTOR	DRIVER / PASSENGER STATEMENT
1	Answering phone	Going straight	Ran-off-road	Wireless, hand-held	Driver took eyes off road	Phone rang and driver answered it
2	Answering phone	Going straight	Rear-end	Wireless, hand-held	Driver took eyes off road	Phone rang, driver looked down
3	Answering phone	Going straight	Ran-off-road	Wireless, hand-held	Driver took eyes off road / driver lost control	Driver was trying to answer phone
4	Picking up dropped phone	Going straight	Ran-off-road	Not stated	Driver took eyes off road / driver lost control	Driver reached down to pick up phone that fell
5	Reaching for phone	Going straight	Ran-off-road	Wireless, hand-held	Driver took eyes off road / driver lost control	Driver was reaching for phone
6	Driver's wife was reaching for phone	Going straight	Ran-off-road	Wireless, hand-held	Driver was distracted when his wife reached for ringing phone	Driver was distracted when his wife reached for ringing phone
7	Talking on phone	Going straight	Rear-end	Wireless, hand-held	Unable to determine	Driver was talking on phone
8	Talking on phone	Going straight	Unable to determine	Wireless, hand-held	Inattention	Driver was talking on phone
9	Using phone	Going straight	Rear-end	Wireless, hand-held	Inattention	Driver #2 said Driver #1 was on phone, but #1 denied it
10	Unable to determine	Turning left	Turning	Wireless, hand-held	Unable to determine	Driver didn't see other vehicle
11	Unable to determine	Going straight	Unable to determine	Not stated	Unable to determine	None

With regard to **crash type**, there were five ran-off-road crashes, three rear-end crashes, and one turning crash. Two forms did not provide any clues as to the crash type. With respect to vehicle maneuver, the driver was going straight in 10 crashes and turning left in one crash.

The type of cell phone was recorded as "wireless / hand-held" in nine crashes and was not stated in two crashes.

This supplemental form provided an opportunity to capture information about cell-phone-related crashes that otherwise might not have been recorded by the investigating Troopers. However, the Troopers had to elicit information from passengers and/or witnesses since most drivers appeared reluctant to admit that they were using a cell phone (see table 3.1 for DRIVER/PASSENGER STATEMENT). Most vehicles do not have other passengers, and passengers may well "cover" for the driver anyway. Witnesses would probably be more honest than drivers or passengers, but may not notice cell phone use. Therefore, it is believed that the actual number of cell-phone-related crashes is higher than what was reported on the supplemental form, but no basis for estimating that number is available.

Hard-copy police crash reports were obtained for 10 of the 11 cell-phone-related crashes as determined from the supplemental form. As Table 3.2 shows, "cell phone" was mentioned in the officer's narrative for five of these 10 crashes. "Cell phone" was not mentioned in the narratives for the remaining five crashes. Because the supplemental form specifically asked about cell phones, some cell-phone-related crashes were identified that would have been missed by relying exclusively on the officer's narrative. However, with such small sample sizes, it is not known how many additional cell-phone-related crashes might be identified if the supplemental form were adopted statewide.

Narrative Search for Cell Phone-Related Crashes in North Carolina

Cell phone use may well be mentioned in the officer's narrative of the crash. If the narratives have been entered into a data base (as has been the case in North Carolina since 1971), they can be searched by using keywords such as "cell" or "phone." Narratives that contain these keywords are identified and can be printed. The narratives are then read to determine whether the crash was in fact cell phone-related.

Goodman et al. (1997) used this methodology to search almost 900,000 crash narratives from North Carolina. The narratives covered the years 1989, 1992-1994, and the first part of 1995. The data bases for 1990 and 1991 were not used as the Division of Motor Vehicles cut back on entering the narratives due to manpower shortages during that time period. The search retrieved 3,892 narratives, of which 88 were determined to be cell phone-related crashes. In three crashes, the authors could not determine whether the driver or the front-seat passenger was handling the cell phone at the time of the crash. These crashes were deleted from the current report. By reading the narratives, the authors attributed each cell-phone-related crash to a specific driver action, such as talking on a cell phone or answering a cell phone.

Table 3.2.Officer's narratives for cell-phone-related crashes

CRASH NO.	DRIVER ACTION	OFFICER'S NARRATIVE
1	Answering phone	V1 was trav N on RP 1308. D1 stated that his **cell phone** rang and he reached to get it and ran off R side of road and struck a mailbox. D1 then lost control. V1 overturned and came to rest on its side on rdwy.
2	Answering phone	V1, V2, and V3 were trav S on NC50. V1 struck V2 and forced V2 into V3 which had stopped for traffic. After impact V1 and V2 came to rest in rdwy. V3 trav to shoulder of RP1830.
3	Answering phone	V1 was trav E on RP1309. V2 was parked facing N on shoulder of RP1309. V1 ran off R side of road and struck V2. Both V1 and V2 came to rest on shoulder.
4	Picking up dropped phone	V1 was trav S on RP1544. D1 reached to pick up **cell phone** and ran off R side of rdwy. V1 then came back onto rdwy and crossed centerline. V1 then ran off to R again and struck a ditchbank. V1 came to rest in ditch W of RP1544.
5	Reaching for phone	V1 trav W on US64 ran off road on R, then off road on L and struck guardrail. V1 came to rest on entrance ramp of RP1003. D1 stated that she was reaching for **cell phone** when she ran off rdwy.
6	Driver's wife was reaching for phone	V1 was trav W on US64. V1 ran off R side of road and lost control before sliding across the road and into median. V1 then rolled over one time and came to rest on driver side in median. D1 stated that he lost control after hearing his **cell phone** ring.
7	Talking on phone	V1 and V2 were trav NW on RP1822. V2 was stopped waiting on traffic signal. V1 struck V2 in rear after trav over hillcrest of RP1822. After impact V1 and V2 came to rest near point of impact. A **cell phone** was in V1 and very active during my presence at scene.
8	Talking on phone	V2 was slowing to merge onto NC16. V1 failed to reduce speed and struck V2. Both V came to rest near impact.
9	Using phone	V1, trav W on US70, was stopped behind traffic waiting on signal at intersection of RP1167. V2, trav W, failed to reduce speed and rear ended V1. Both V were moved to N side shoulder of US70 after impact.
10	Unable to determine	V1 was trav N on RP1247. V2 was trav N behind V1, attempting to pass. V1 failed to yield and made a L turn into side of V2. V1 came to rest in a private drive on the SB shoulder of RP1247. V2 came to rest on the NB shoulder of RP1247.

In this study, North Carolina crash narratives from January 1, 1996 through August 31, 2000 were searched. Four keywords from Goodman et al. (1997) 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 were 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." Table 3.3 lists the number of unique, relevant "hits" for each search word by year.

Table 3.3 Cell phone "hits" by search word and crash year

Search Word	1996	1997	1998	1999	2000 (January-August)	TOTAL
Answer	1	5	8	11	18	43 (9.5%)
Carphone	0	1	0	1	0	2 (0.4%)
Cell	21	29	44	97	212	403 (89.2%)
Dial	0	0	1	2	1	4 (0.9%)
TOTAL	22	35	53	111	231	452 (100.0%)

Table 3.4 lists the number of cell-phone-related crashes by year and driver action. The data for 1989 through 1995 are from Goodman et al. (1997), and the data for 1996 through August 31, 2000 are from this study. The total number of cell phone-related crashes was roughly 20 per year from 1993 through 1996, and then increased dramatically after 1996. In fact, the total number more than doubled from 1998 to 1999, and again from 1999 to August 31, 2000 (see figure 3.3, where the curve was fit using SAS Proc Gplot*).* This certainly reflects the rapid growth in cell phone use in recent years. Over the 10-year period, the most common driver

Figure 3.3 Number of crashes attributed to cell phone use in North Carolina

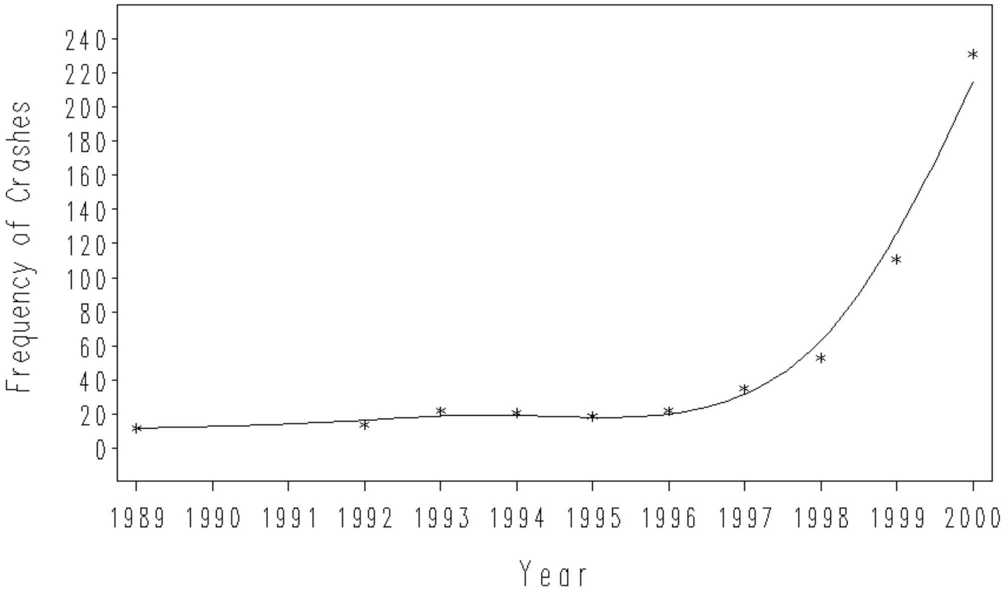


Table 3.4 Narrative-indicated cell phone crashes in North Carolina by year and by driver action

Driver Action	Goodman *et al.* (1997)					Follow-up Search (2001)					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 N	12	14	22	20	19	22	35	53	111	231	539	(100.0%)
%	2.2%	2.6%	4.1%	3.7%	3.5%	4.1%	6.5%	9.8%	20.6%	42.9%	100.0%	

* January - August, 2000 narratives

action was “talking on the phone,” which accounted for 46 percent of cell-phone-related crashes. In another 15 percent, the driver was “answering the phone.” “Reaching for the phone” (10%) was the third most common action.

The actual number of cell-phone-related crashes is undoubtedly higher because many drivers will not admit that they were using a cell phone. Or perhaps the investigating officer either did not think to record cell phone use in the narrative or used words other than “answer”, “carphone”, “cell” or “dial” to indicate that a cell phone was somehow involved. However, the extent of underreporting is not known.

* January-August, 2000 narratives

Chapter 4. Summary and Discussion

This study explored several dimensions of the growing trend of talking on a cell phone while driving. It did so by (1) reviewing the recent research – epidemiological studies; case analyses of cell phone-related crashes; and driver performance studies; (2) reporting on recent legislative activity regarding the use of cell phones while driving; (3) analyzing data from an observational study of the "who, what, when, where and how many" of cell phone use while driving in North Carolina; (4) pilot-testing the use of a supplemental data form by the N.C. Highway Patrol to report additional information on crashes where a cell phone was involved; and (5) analyzing police narratives for crashes where the use of a cell phone by the driver was indicated by the investigating officer.

After examining the literature, it has become abundantly clear that talking on a cell phone while driving does elevate the risk of a crash. However, what is far from clear is the extent to which that risk increases. The laboratory (simulation) studies generally concur that using a cell phone does slow reaction times and degrades tracking abilities. The epidemiological as well as case studies of cell phone-related crashes agree that the risk rises when engaged in a cell phone conversation while driving but disagree considerably on the magnitude of that increased risk. And whether hands-free cell phone use is safer than hand-held remains debatable.

Notwithstanding the lack of clear evidence on the issue, there has been a flurry of cell phone-related legislation both at the local and state level in the United States as well as, to varying degrees, in 26 countries around the world. Presently, 13 counties and municipalities in the U.S. have passed restrictions that require motorists to use hands-free devices while driving. In 2001, 144 cell phone-related bills in 44 states, the District of Columbia and Puerto Rico have been under consideration. Among the bills that were enacted, New York's "requires that no person operate a motor vehicle while using a hand-held mobile phone" except for emergency situations. That law went into effect November 1, 2001. In North Carolina, two bills died in committee.

As part of this overall investigation, an observational study was undertaken in North Carolina to determine the characteristics of drivers who use hand-held cell phones while driving. Characteristics of cell phone users were observed at 85 sites in North Carolina. A total of 14,059 vehicles were observed including 1,070 drivers who were using cell phones. The results of this investigation indicate that cell phone usage was associated with front seat occupancy, vehicle type, and driver age, ethnicity, and restraint usage. Drivers who were using a cell phone while driving were more likely to be driving without a front seat passenger, driving a sport utility vehicle, younger, white, and using seat belts.

Data collected concurrently indicated that the cell phone prevalence rate is 3.1 percent; this is a snapshot of cell phone use by drivers statewide at any given moment during the daytime. The prevalence rate is higher in the Piedmont (4.1%) as compared to the Mountains (2.2%) and Coastal (1.5%) regions. Cell phone usage increases somewhat during the day from 2.7 percent in the morning to 3.5 percent in the late afternoon.

Two recent studies also address the prevalence of driving while speaking on a hand-held cell phone. Utter (2001) reports on NHTSA's national survey of passenger vehicle driver cell phone use carried out in conjunction with their fall 2000 National Occupant Protection Use Survey (NOPUS). NHTSA concluded that overall hand-held cell phone use by drivers nationally was 3 percent. This means that at any given time during daylight hours, about 3 percent of drivers of passenger vehicles are actively using a cell phone – very close to the 3.1 percent found on North Carolina highways. This translates into approximately 500,000 drivers nationally.

In the other study, Crawford et al. (2001) observed traffic between 4:00 pm and 6:00 pm at five randomly chosen locations on Dallas County, Texas freeways. They conclude that about 5 percent of drivers were using a hand-held cell phone during the afternoon peak period. This is consistent with the North Carolina findings with higher use in the late afternoon commuting hours.

As indicated in the review of the literature, one of the major unknowns in this area is the magnitude of the risk of a crash to a driver talking on a cell phone. This question will become more prominent in the future with the inclusion of more in-vehicle information/guidance systems brought about by the many advancements in the Intelligent Transportation Systems (ITS) arena. To date, most – if not all – crash data is inadequate to appropriately address this question. There is effort at the national level at NHTSA. Other special studies are underway. Many states are specifically addressing cell phone use on their accident report forms. However, as chapter 3 of this study illustrates, we are a long way from solving this data problem.

Two separate studies were carried out to examine the involvement of and circumstances pertaining to cell phone use in crashes. The first involved a pilot study with the North Carolina State Highway Patrol where investigating Troopers completed a special cell phone-related form for crashes where a cell phone was being used. Over a two-month period involving 3 Troops of the Patrol, there were a total of eleven crashes out of 6,686 (or 0.16%) for which a cell phone appeared to play a role in the crash. In other words, about one in 600 crashes in the study appeared to involve the use of a cell phone while driving. And, upon examining the hard-copy police crash reports for 10 of these crashes, "cell phone" was mentioned in the narratives for only five of these cases.

The second study was a follow-up analysis to that reported in Goodman et al. (1997) using a computerized search of all hard-copy narratives for crashes occurring in North Carolina between January 1, 1996 and August 31, 2000. There has been exponential growth in the frequency with which cell phone use is mentioned in the police narratives over the period (i.e., 22 in 1996, 35 in 1997, 53 in 1998, 111 in 1999 and 231 for the first eight months of 2000). This certainly reflects the rapid growth in cell phone use in recent years. Over the period covering both the NHTSA analysis and also the current follow-up, the most common driver action was "talking on the phone (46%) followed by "answering the phone" (15%) and "reaching for the phone" (10%).

The actual **number** of cell phone-related crashes is undoubtedly higher than what was observed in these two studies because it appears that many drivers will not admit or volunteer that they were using a cell phone at the time of the crash. Or perhaps the investigating officer either did not think to record it in the narrative or used words other than our search words (i.e, “answer,” “carphone”, “cell” or “dial”). However, the extent of this underreporting remains unknown.

Clearly there is a critical need for better crash information if the risk of crashing while talking on a cell phone is to be appropriately estimated. Without this information, there remains a very important unanswered question: “Just how dangerous is it to be talking on a cell phone while driving?” Similar questions will be raised with respect to the distractions that are to be anticipated with the introduction of increasingly more ITS in-vehicle navigational and warning devices.

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