



Comparative Accident Study
Cell Phone Usage and Inattention

R E S U L T S

A-1 Limousine



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DISCUSSION

History of Study

In the Fall of 1999, while attending a round table discussion at the NJ Highway Safety Council the subject matter of cell phones and their causal relationship to auto accidents was introduced. It became evident during this discussion of the lack of statistical information available. A-1 Limousine informed the NJ Highway Safety Council they had recently incorporated cell phones into their business. Liberty Mutual agreed to conduct an accident study to provide some statistical insight into this perceived problem of cell phone usage as part of their ongoing Loss Prevention efforts in reducing frequency and cost of accidents and share the findings with the NJ Highway Safety Council. This study was also an attempt to identify Best Practices and compare safety program elements employed by A-1 Limousine as they addressed accident costs and frequency as part of on going Loss Prevention service.

This study included a behavioral questionnaire completed by chauffeurs, an analysis of two years of loss information, which consisted of one year without cell phone usage and one year with cell phone usage.

Cell Phone Use Study Profile

The chauffeur's survey addressed elements of distraction and driver dexterity. It also allowed for input as to perceived positive uses and negative drawbacks of cell phone usage. Over 100 surveys were distributed to the chauffeurs, with an overall response rate of 33%.

Of those returned surveys, we used only those that had been driving/employed over the period of the study (two years). We did not use surveys that provided incomplete answers.

By looking at those practices and procedures, which appear to address the exposures of mental distraction and physical distraction, we refined the Best Practices cited in this report.

The accidents used for statistical purposes in this report covered calendar years 1998 and 1999. A further breakdown by accident type to gauge Hit Other in Rear and Sideswipe Accidents was conducted to evaluate the elements of distraction and distraction.

Further more this was a study that deals with drivers who drive as the essential component of their employment. Taking this into consideration these drivers historically will have received additional training than the average driver on the road, and also have a vested interest in accident prevention in the course of their employment.

DISCUSSION

The difficulty in conducting the study centered on the lack of available statistical information relating to cell phone use and causal factors in accidents. We were unable to determine the time of phone calls either outgoing or incoming in relation to the accident time. This concurs with the current obstacle throughout the nation for data compilation in trending and analyses. As of this report only two states (Oklahoma & Minnesota) note cell phone presence and/or use on their accident reports.

It is estimated cellular phone use is growing at a rate of 40-50% per year. Whereas in the early 1990's majority of cellular phone use was in the business sector, current estimates are that within a few years there will be over 80 million cell phone users in the United States. At the time of this report only two states include specific "check boxes" on their accident investigation forms to identify mobile phone use as a factor in crashes. Thus data collection on a national scale should be a primary focus to accurately evaluate the risk associated with cell phone use. In the interim, States can change their accident forms, and business can track cell phone use and accident data internally in their own investigations.

In assessing the need for any legislative regulations on usage it is imperative that cell phone presence and use data start to be collected in accident reports and safety education/information be disseminated so that Best Practices can be formulated and awareness raised on this issue. Cell phone use will continue to increase in the future as it is perceived to be beneficial in the event of emergencies, convenience etc, and thus the safety of driving while using a cell phone will become a very visible and political safety issue. It is essential to begin to collect better data on the risks associated with using a cell phone while driving. This can be accomplished through further studies, simulations and increased data compilation that will help in a more accurate measurement or benchmark of this risk in determining the need for legislation.

Various studies were read to provide a foundation for comparison of the accident data and correlation to chauffeur's knowledge and awareness of the potential hazard of cell phone use. A bibliography of various reference sources and studies is included in the Appendix of this report as well as the salient points of the studies that are included in the next section.

EXECUTIVE SUMMARY

In comparing A-1 Limousine's accident experience with the information and projected accident rate increases purported by the studies, two types of accidents were utilized for statistical analysis. Hit Other in Rear and Sideswipe types of accidents were chosen in the benchmarking analyses as they best illustrate the type of accidents that can be attributed to distraction and detraction.

Individuals and other companies with different approaches and behavioral traits can obtain similar results to those illustrated in this report. The practices detailed in the Best Practices section of the report are those that have been incorporated by A-1 Limousine through enhancement of their fleet safety program from formalizing procedures and completing recommendations of Liberty Mutual.

The following is a summary of the various articles and references used in this report:

- Car telephone use increases the variation of lateral position and increases driving errors, especially when the keypad is held in the hand or is placed on the middle console. Performance tends to deteriorate also during the phone conversation, shown primarily by increased reaction time and reduced headways. (Source "Car Telephone Use, Driver Behavior and Accident Risk", *Nordic Road & Research Transport Research*, No. 1, 1996)
- The risk of a collision when using a cellular telephone was four times higher than the risk when a cellular telephone was not being used. The relative risk was similar for drivers who differed in personal characteristics such as age and driving experience; calls close to the time of the collision were particularly hazardous and units that allowed the hands to be free offered no safety advantage over hand-held units. (Source: "Association between Cellular-Telephone Calls and Motor Vehicle Collisions" by Donald A. Redelmeier, Robert J. Tibshirani, *New England Journal of Medicine* 1997)
- Part of the Motorola Cellular Impact Survey indicates that there is a broad range of perceived safety benefits available to cell phone users, as many in the survey have used their cell phone for several safety purposes. (i.e. called for help in another's or one's own disabled vehicle, called for help in one's own or another's medical emergency, called police to warn of dangerous weather or traffic situations). It indicates that a large proportion of the population have purchased and used their phones for some of the above reasons. It is most likely that these benefits are a major reason for the growth in non-business usage.

- **On-Road Studies showed:**

- 1) Talking on a mobile phone decreased the standard deviation of lateral position or "swerving," particularly while driving on a quiet roadway. Talking on the mobile phone delayed adaptation to speed variation of the followed car by 600msec. Steering wheel standard deviation was considerably greater when using a mobile phone during city driving, particularly when placing and receiving calls on the hand-held phones. Drivers' mental workload increased while undertaking the telephone task; no measurable difference was detected for the alternative driving conditions of phone types. ("The Effects of Mobile Telephoning on Driving Performance" , Brookhuis, et al., 1991)
- 2) Speaking while driving exerts a higher mental workload than driving alone and induced increased task effort and frustration. Time taken to complete the route was around 10 percent longer under speaking conditions. Heart rate was significantly higher in the car phone condition than either the passenger or control conditions. This could either have been caused by the inexperience of using a car phone or could indicate that a car phone conversation is fundamentally more demanding than a passenger conversation. Other studies have found that these two types of conversation are different in the complete absence of "social cues" in car phone conversations, and also that the presence of a passenger increases the driver's awareness of their own driving standards. ("Effects of Handsfree Telephone Use on Driving Behavior" , Fairclough, et al., 1991)
- 3) The three tasks involved in mobile phone use - placing calls, simple conversations and complex conversations - all increased the time required to respond to highway traffic conditions, by between 0.3 and 0.85 seconds. Complex conversations induced the largest reaction time increases, which were equivalent to tuning a radio. Placing a call and undertaking a simple conversation were found to be less distracting than tuning a radio. Age was found to have an influential effect on the amount of distraction incurred. ("The Effect of Cellular Phone Use Upon Driver Attention" , McKnight, 1991)
- 4) Drivers reported to be using a phone at the time of collision had a nine-fold risk of a fatality over those without a phone. Drivers reported to have a phone present in their vehicle were at twice the risk for a fatality as drivers without phones. Drivers with phones were more likely to incur a collision due to "wandering" from their lane. Results suggest that phone use is associated with driver inattentiveness to speed and lane position. ("Cellular Phones and Fatal Traffic Collisions" , Violanti, 1998)

- **General Studies showed:**

- 1) Using a mobile phone does increase the risk of a crash but the amount of increased risk was hard to quantify and may depend on other driver-related variables besides mobile phone usage. The national magnitude of the problem was found to be unquantifiable due to the absence of mobile phone use in police crash data reports. The report predicted that the number of crashes due to mobile phone usage would increase in the future as the number of mobile phone users increased. There is a large scope for improving the safety of mobile phone usage, both through driver education to increase awareness of the dangers involved and through technological advances to create ergonomically sound mobile phones. ("An Investigation of the Safety Implications of Wireless Communications in Vehicles", NHTSA, 1997)

Analyzing Accident Rate Data

As one can see from the various researches described above, analyzing the effects of cell phone use on driving and subsequent accident involvement or risk of crash is a very complex task. The accuracy of these predictions/projections of driver behavior, accident involvement depends on the quality of the data. However, due to the limited amount of police crash reports detailing cell phone usage, these above studies are for the most part what is currently available for any crash risk or accident analysis. The studies all find that there is a significant risk, with the swing in accident involvement to be from the Redelmeier study (1997) which states a quadrupling of the risk, to the study by Violanti (1996) which finds a 34 percent increase in risk.

All the studies mentioned above are useful in pointing out how cell phone usage affects general driving behavior. Repeatedly these findings most often include the adverse effects on driver reaction time, mental stress, vehicle lane drifting, etc., all which point to the distracting nature of cell phone use. In comparing cell phone use with other in car activities, Violanti (1996) found that mobile phone use was most distracting if used for more than fifty minutes per month. In contrast, McKnight (1991) found cell phone use to be no more dangerous than tuning a radio. Considering both the physical and mental activity required by cell phones, it appears that this activity may be one of the most distracting in vehicle activities. Even if one considers it to be only as distracting as tuning a radio; the actual exposure to accident risk is significantly higher. This can be attributed to the fact that one spends a considerable more amount of time on the phone as compared to tuning a radio, inserting a cassette or compact disk.

Going with the assumption that cell phone use is associated with an increased accident or crash risk, it can be hypothesized some types of behavior appear to be more at risk than other types of behavior. The current research suggests that hands-free use is less dangerous than hand-held use due to the removal of "physical distraction" while placing and receiving calls. However, research comparisons of hand-held and hands-free phones in these studies shows that there is little difference in the actual risk during the act of conversation due to the continued presence of a mental distraction.

Current research purports that the type of conversation is significant in determining crash or accident risk. Violanti (1996) found that cell phone users engaging in intense or business conversations were more likely to have a crash, while McKnight (1991) found that complex conversations were the most dangerous phone-related activity. The general resultant finding in most of the studies seems to be that engaging in a simple conversation is relatively risk-free compared to engaging in an intense conversation. In Alm's study (1990), a possible explanation is given for this, where it is stated that cell phone use and driving are parallel tasks competing for the driver's attention. If the driving task or phone task is simple, the driver can easily accommodate one or the other but not both if they are difficult. Thus the increased accident involvement rate with city driving.

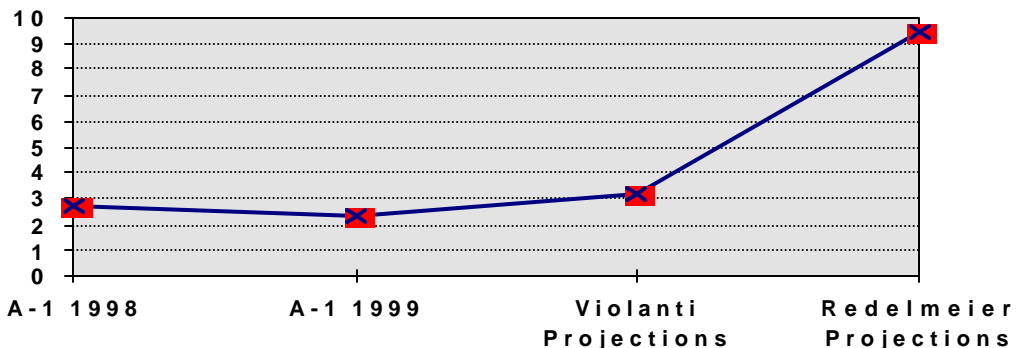
SURVEY RESULTS

A survey by the Insurance Research Council in 1997 found that an overwhelming number of cell phone owners (84%) believe that using a phone while driving is a distraction and increases the likelihood of an accident. This corresponds to the A-1 Limousine survey (88%) responses. Additionally, drivers noted on the survey the physical detractions incurred (one hand driving, inability to signal lane changes, having to reach for a phone, sight migration) to the overall distraction of talking and listening to information being relayed leads to inattention. Many had comments written on the survey form (50%) that illustrated their knowledge of cell phone distraction and detraction while driving with the causal relationship leading to accidents.

The following table exhibits the calculated accident rates comparing year of no cell phone versus year of cell phone use along with projected accident rate expectations from two studies on the probability of accident involvement increase from use of cell phone.

Accident Rates 1998-no cell phone 1999-cell phone	Accident Rate per Million Miles 1998	Accident Rate per Million Miles 1999	Sideswipe 1998	Sideswipe 1999	Hit Other in Rear 1998	Hit Other in Rear 1999
A-1 Limousine	2.73	2.36 (-14%)	.4	.36 (-10%)	.6	.55 (-8%)
Violanti Study (1996) 34% increase in risk		3.16		.54		.8
Redelmeier, Tibshirani Study (1997) (quadruple increase in risk)		9.44		1.6		2.4

Accident Rate Comparison with Cell Phone Usage



BEST PRACTICES

The Cellular Telecommunications Industry Association (CTIA) is using a campaign "Safety: Your Most Important Call" (CTIA, 1998). This campaign's central message is that it is a driver's first responsibility to drive safely and includes 10 points to consider when using a cell phone while driving. These are:

1. Get to know your phone and its features such as speed dial and redial.
2. When available, use a hands-free device.
3. Position your phone within easy reach.
4. Let the person you are speaking with know you are driving; if necessary, suspend the call in heavy traffic or hazardous weather conditions.
5. Do not take notes or look up phone numbers while driving.
6. Dial sensibly and assess the traffic situation; if possible, place calls when you are not moving or before pulling into traffic.
7. Do not engage in stressful or emotional conversations that may divert your attention from the road.
8. Use your phone to call for help.
9. Use your phone to help others in emergencies.
10. Call roadside assistance or a special non-emergency wireless number when necessary.

A number of the above practices are incorporated into the policies and procedures in A-1 Limousines Operations and thus correlated with their positive results in this study.

Some of these practices are:

- 1) Human Resources, includes training on use of cell phone and its features with the chauffeurs
- 2) Dispatch is required to ask chauffeur if they are ready to copy information, i.e. is the vehicle pulled over.
- 3) Company procedures are to pull over and not be driving when calling Dispatch for information or if chauffeur has to write down information from Dispatch.
- 4) General Practice as evidenced by the Chauffeur's Survey is the practice of limiting time and number of calls while client is in vehicle. This leads to contact with Dispatch when the chauffeurs have reached their destination and are pulled over rather than while they are driving.
- 5) Company has sent memos out outlining procedures and the effect of emotional and lengthy conversations can have on the chauffeurs' overall attentiveness while driving.
- 6) A-1 Limousine is constantly analyzing and trending the types of accidents and disseminating this information and prevention techniques to their chauffeurs.

BEST PRACTICES

	<i>CTIA</i>	<i>A-1 Limousine</i>
<i>Get to know your phone and its features such as speed dial and redial.</i>	0	Yes
<i>Do not take notes or look up phone numbers while driving.</i>	0	Yes
<i>Dial sensibly and assess the traffic situation; if possible, place calls when you are not moving or before pulling into traffic.</i>	0	Yes
<i>Do not engage in stressful or emotional conversations that may divert your attention from the road.</i>	0	Yes
<i>Use your phone to call for help.</i>	0	Yes
<i>Use your phone to help others in emergencies.</i>	0	No
<i>Call roadside assistance or a special non-emergency wireless number when necessary.</i>	0	Yes
<i>When available, use a hands-free device.</i>	0	No
<i>Position your phone within easy reach.</i>	0	Yes

Best Practice Summary

The above items are incorporated into the overall safety program of A-1 Limousine as summarized on previous page. They typically also have a significant number of other safety activities in addressing auto accidents. During the compilation of the information for this report A-1 Limousine began adopting and

moving towards formalizing these Best Practices as part of their overall strategy to improve the accident experience in their operations.

SPECIFIC DISTRACTION/DETRACTION AREAS

Following Distances

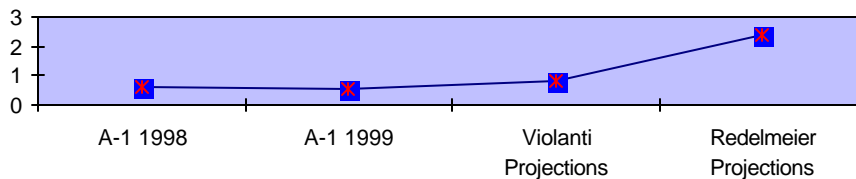
Since the studies related to increased reaction times, loss of headway or following distances, analysis of Hit Other in Rear type accidents was benchmarked to gauge the effect cell phone usage would have on this type of accident.

The following table portrays the projected accident rate increases purported by Violanti and Redelmeier against the accident rate of the year without cell phone usage. The following table and graph illustrate the effect the Best Practices A-1 Limousine incorporates into their fleet program and its overall positive impact on the frequency of these type accidents. It should also be noted that A-1 noticed a trending in these type of accidents last summer and contacted Liberty Mutual for information to disseminate to its drivers. A-1 Limousine also utilizes the concept of a Timed Interval in its Driver Training Program to ensure adequate following distances

<i>Number of Hit Other in Rear Accidents Per Million Miles</i>	
Studies Projections	Mean
<i>A-1 Limousine 1998 Hit Other in Rear Rate</i>	<i>.6</i>
<i>Redelmeier</i>	<i>2.4</i>
<i>Violanti</i>	<i>.8</i>
<i>A-1 Limousine 1999 Hit Other in Rear Rate</i>	<i>.55</i>

As can be seen from the above exhibit, the studies expected an increase in the accident rate and A-1 decreased their accident rate.

Hit Other in Rear Accident Rate Projected Comparisons



Establishing the Timed Interval Rule and creating an expectation appeared to produce results. Even though the expectation is communicated during orientation, it still is necessary to relate and refresh chauffeurs' memory to increase awareness and attentiveness to address this type of accident.

SPECIFIC DISTRACTION/DETRACTION AREAS

Lane Drifting, Swerving: Distraction and Driver Deviation

Physical distraction and/or movement as well as mental distraction has a resultant effect in a greater lateral deviation from path of travel which has been observed in on road studies of cell phone use while driving.

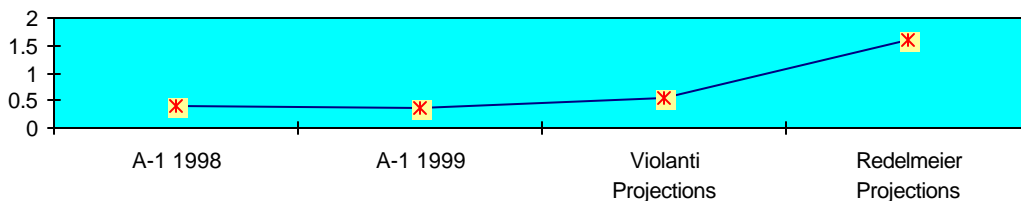
Since the studies related this increased lateral deviation from path of travel, analysis of Sideswipe type accidents was benchmarked to gauge the effect cell phone usage would have on this type of accident.

The following table portrays the projected accident rate increases purported by Violanti and Redelmeier against the accident rate of the year without cell phone usage. The following table and graph illustrate the effect the Best Practices A-1 Limousine incorporates into their fleet program and its overall positive impact on the frequency of these type accidents. It should be noted that A-1 maintains a practice of pulling over and not driving during cell phone usage and this practice may have the greatest impact on this type of accident.

<i>Number of Sideswipe Accidents Per Million Miles</i>	
Studies Projections	Mean
<i>A-1 Limousine 1998 Sideswipe Rate</i>	<i>.4</i>
<i>Redelmeier</i>	<i>1.6</i>
<i>Violanti</i>	<i>.54</i>
<i>A-1 Limousine 1999 Sideswipe Rate</i>	<i>.36</i>

As can be seen from the above exhibit, the studies expected an increase in the accident rate and A-1 decreased their accident rate.

Projected Sideswipe Accident Rate Comparisons



Establishing a set practice of pulling over when using cell phone to gather or relate information and creating an expectation appeared to produce results.

SUMMARY

The essential elements outlined in this report were to help A-1 Limousine manage and address fleet accidents and overall driver and highway safety. In general, one can draw the following conclusions from this report:

Cell Phone Users Should -

- ◆ Know reaction time will increase and thus there will be a need for increased following distances.
- ◆ Know there will be lateral deviation from their path of travel if using phone while driving and should pull over to a safe area when there is a need for any extended phone conversation.
- ◆ Be included in Driver Awareness Programs through their businesses, cell phone industry literature and insurance companies. Education about the safety hazards need to be disseminated.

FUTURE PLANS

Specific programs and practices may be used by different companies and individuals and also may vary slightly. Some companies and individuals may have good results with different program and practices, so the exact mix of safety program elements, and training is likely to vary from one company or one individual to the next. It is essential though that a company establishes an overall plan to educate their drivers on the exposures and hazards on driving while using a cell phone.

It is easier in the business environment to enforce practices and procedures as a condition of one's employment. To enforce safe habits and practices on an individual may encounter the same resistance we have seen with seat belt legislation. There is no easy solution but I think all will agree there is a great exposure and hazard and any pro-active approach is better than waiting on mandates from the political sector.

APPENDICES

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