

Summary:

The effect of mobile telephone use on traffic accident risk

Introduction

The use of mobile telephones has increased drastically during the last few years, and Norway is now one of the countries with the highest *per capita* mobile telephone density, with about 1.7 million subscribers out of 4 million inhabitants. Naturally the use of telephones in cars has paralleled the growth in the number of telephones, and much concern has been voiced regarding the possible traffic safety hazard associated with telephoning while driving. After accidents caused by cars that for no obvious reason deviate into the opposite lane, which is a rather common type of accident, it is often speculated whether mobile telephone use may have contributed to the accident.

During the last decade several studies – both in driving simulators and in real traffic - have clearly demonstrated that telephoning during driving affects driver behaviour negatively, in terms of increased reaction time, less awareness of deceleration of a leading car, poorer lane-keeping, and slower detection of potentially critical traffic events. Driving behaviour suffers both during the conversation and during dialling. Research on relationships of mobile telephone use to accidents is, however, rather scarce. Until a couple of years ago there were no published studies addressing this issue directly. Two recent studies have changed this picture somewhat. Both are consistent with the hypothesis that the use of mobile telephones results in elevated risk, but alternative explanations of the results have not been convincingly ruled out. As yet, no studies have assessed the frequency of accidents where mobile telephones have been in use. Estimation of the accident risk of mobile telephone use is limited by lack of both accident and exposure data. It is difficult to get valid information about mobile telephone involvement in accidents, and to get representative exposure data is difficult without carrying out comprehensive and expensive roadside surveys.

In the present study the issue of accident risk by telephone use in cars is addressed by collecting questionnaire data from a large and representative sample of drivers having been involved in an accident, and using the method of “quasi-induced exposure” to estimate the relative risk of mobile telephoning.

Method

From the files of the two largest insurance companies in Norway a sample of the most recently reported accidents was drawn, consisting of 29600 owners of passenger cars, with accidents having occurred during the last few months. These car owners received a postal questionnaire, to be filled in by the person who had been driving the car during the accident. Irrelevant damages, i.e., cars damaged when parked or stolen, etc., were supposed to be filtered out before the sample was drawn. It turned out, however, that due to limitations in the coding of accidents by the insurance companies several irrelevant cases were included in the sample, so the real sample was considerably smaller than originally planned. It was not possible in retrospect to estimate the number of relevant accidents in the sample.

The questionnaire contained questions about the last accident (time, place, type and severity, etc.), and whether or not the telephone had been used in the accident (and in that case, if the accident happened during the conversation or during other phases of telephone use). Further, there were questions about the use of mobile telephones while driving in general (telephone type, frequency of usage, etc.). It was also asked about other distracting events possibly contributing to the accident. In addition, there were questions about background factors of the driver. The questionnaire was anonymous, and it contained no reference number or other information enabling anyone to identify the respondent. The insurance companies distributed the questionnaires, together with pre-paid postage return envelopes addressed to the Institute of Transport Economics.

Before the questionnaires were distributed, the accidents were classified according to whether the driver in question was responsible or innocent party in the accident. The questionnaires for these two categories of drivers were printed in different background colours, making it possible to identify the appropriate category of the completed and returned forms. In addition, to make allowance for the possibility that a different accident was reported than the one that was the basis of the selection, the questionnaire contained a question about the responsible party (as judged by the insurance company). The purpose of the classifications of drivers as innocent or guilty was to estimate the relative risk using the method of "quasi-induced exposure". This is a method that is used when real exposure data are missing. A basic assumption underlying its use is that the proportion of multiple-vehicle accidents in the presence of a given risk factor (in this case, mobile telephone use) among innocent drivers, is a direct function of the exposure (i.e., the distance of driving in the presence of that factor). The *relative risk* of the factor in question is its proportion among guilty drivers divided by its proportion among the innocent drivers. A relative risk significantly larger than one means that the factor leads to a risk increase, whereas a relative risk smaller than one means lowered risk.

The significance of the relative risk was tested by chi-square. In addition, logistic regression analysis was performed to control for effects of various background variables on the relationship between mobile telephone use and accident responsibility.

Questionnaires were returned from about 9150 drivers. The response rate in relation to the number of relevant accidents in the total sample could not be computed, since the number of irrelevant damages included, as pointed out above, is not known.

Telephone use during driving

Very close to 50 per cent of the drivers are using a mobile telephone some time during driving. Among these, about 20 per cent use hands-free and 80 per cent handheld telephones. Among the latter, one-fourth have dashboard-mounted telephones (with which dialling can be done without holding the telephone, while it must be held during the conversation). About two out of three mobile telephone users make less than one call per day from the car, on the average. The users of hands-free telephones have the highest frequency of calls; about 25 per cent of them receive more than three incoming calls on an average day, against 8 per cent among the users of handheld phones.

Accident risk during telephone use

Among the guilty drivers who responded to the questionnaire, 0.62 per cent answered that they had used a mobile telephone at the moment when the accident occurred, compared to 0.31 per cent among the innocent drivers. In terms of the proportion of accidents rather than drivers involved, this was estimated to correspond to 0.82 per cent of all accidents. This is a considerably lower proportion than we had expected on the basis of preliminary counts of mobile telephone use on one randomly selected site in Oslo, which had indicated that about 4 per cent of the drivers used a telephone. The explanation of the lower-than-expected number of accidents is probably that the countrywide frequency of telephone use is lower than in Oslo, and that most users avoid using the telephone under conditions where the risk is considered to be especially high; e.g. during fast and heavy traffic. Thus, the proportion of mobile telephone use in accidents is probably lower than the proportion of vehicle kilometres driven during mobile telephone use.

The relative risk ratio for mobile telephones generally - hands-free and handheld combined - was found to be 2.0; which means that the risk of causing an accident is twice as high when the telephone is used, compared with driving without using the telephone. Considering all accidents during mobile telephone use - including those where an innocent driver uses the telephone - the relative risk of 2.0 corresponds to about 60 per cent increase in the probability of accidents where one of the drivers uses a mobile telephone. For handheld telephones the relative risk was 3.6; due to a smaller number of accidents this figure is, however, less certain than the estimate for all telephones. Logistic regression analyses showed that this relationship could not be explained by driver characteristics or by other background factors. There were no differences between users and non-users of mobile telephones regarding the relative risk of accidents *not* involving telephone use; i.e., accident risk in general.

Due to the low number of accidents with mobile telephones involved - 39 in all - the data were not sufficient for investigating differences in risk between hands-free and handheld telephones.

In the absence of additional evidence we cannot conclude that all accidents occurring during telephone use were actually *caused by* the mobile telephone. Some accidents with quite different causes will necessarily happen even among

drivers who are occasionally using their mobile telephone; the number of such accidents is directly related to the exposure. As mentioned above, mobile telephone use occurs in about 0.8 per cent of the accidents. If we assume that this percentage is representative for police-reported accidents, on the average some 50 personal injury accidents involving passenger cars are expected to occur annually during mobile telephone use in Norway. The proportion of accidents that can be assumed to be caused by mobile telephone use equals the difference between the proportions of telephone use among guilty and innocent drivers, respectively; i.e., 0.31 per cent. In terms of police-reported accidents this amounts to about 20 accidents per year.

About two-thirds of the “guilty” drivers in mobile telephone accidents answered that the accident “probably” or “quite certainly” would have been avoided if the telephone had not been in use. This is fairly consistent with the estimated percentage of accidents caused by the mobile telephone.

A large majority of accidents occurred during the conversation phase of the telephone use, which reflects that generally more time is used on speaking than on dialling etc. The relative risks during speaking were 1.15 for handheld and hands-free combined, and 2.30 for handheld only; none of these risk ratios were, however, significant. All accidents during the dialling and handling phase occurred to guilty drivers. The number of such accidents among guilty drivers was sufficient for the effect to reach statistical significance, but since there were zero accidents among the innocent drivers, a risk ratio could not be computed. Neither did data permit statistical testing of the difference in risk between conversation and dialling/handling.

Rear-end collision is the most frequent accident type during mobile telephoning. One in three accidents during telephone use involved a telephone-using driver hitting the lead car in the rear, whereas this type of collision make up only 17 % of accidents in general.

Our estimates of relative risk must be considered *minimum estimates*, which means that the real risk may be somewhat higher. This is related primarily to uncertainty associated with the classification of drivers as innocent or guilty, which is the basis of the relative risk computations. Conceivably, the use of a mobile telephone by an innocent driver may in some cases have reduced his/her possibility to avoid an accident that in the first place was caused by the other driver. In that case the proportion of mobile telephone use in the accident among innocent drivers will be higher than expected on the basis of exposure alone, resulting in underestimation of the relative risk ratio.

Characteristics of mobile telephone users and mobile telephoning accidents

Comparisons were made between the following three categories of drivers:

- a) Drivers who do not use a telephone while driving,
- b) those who use a telephone while driving, but whose latest accident did not occur during telephone use, and
- c) drivers whose latest accident occurred during telephone use.

The following differences were found:

- Accidents in general among mobile telephone users, as compared to non-users, tend to occur during work-related driving.
- Relatively more accidents during telephoning, compared to accidents in general, happen to drivers who are alone in the car.
- Relatively more mobile telephone users have experienced sleeping at the wheel.
- More mobile telephone users are men, and the proportion of men is even higher among those who have incurred an accident during telephoning.
- Among telephone users, and particularly among those who have had accidents, there is a higher proportion with education at college level or higher.
- More drivers with telephoning accidents live in cities.
- The proportion using hands-free telephones is higher among drivers who have had telephone-related accidents.
- Fewer drivers having had telephone-related accidents tend to stop the car when making a telephone call.
- Fewer drivers having had telephone-related accidents answer that they drive “much slower” or “very much slower” when using the telephone.
- More of the drivers having had telephone-related accidents tend to drive with shorter headway when using the telephone.
- The mobile telephone users, and particularly those who have had telephone-related accidents, are on the average younger than the non-users, and have held a licence for a shorter time.
- The mobile telephone users drive considerably longer distances than the non-users, and there is no difference in average annual driving distance between those with and without telephone-related accidents.

Proportion of accidents caused by distraction: Comparison between mobile telephone and other sources of distraction

The questionnaire contained a list of possible sources of distraction, and the drivers were asked to tick off any factor that had contributed to the accident. The results showed that most of the other factors cause more accidents than does mobile telephoning. Since the exposure of each factor is unknown, it is not possible to compare the *risk* of the various factors. Factors occurring with a high frequency, such as e.g. conversation with passengers, may cause more accidents than a low-frequency factor such as reading a map, although the latter may entail a considerably higher risk during its occurrence. The relatively low proportion of accidents caused by mobile telephone use is most likely explained by a low frequency of use.

Proportion of accidents caused by various sources of driver distraction according to drivers' self-report. Per cent of accidents reported by "guilty" drivers.

Source of distraction	Percentage of accidents (n = 6461)
Conversation with passenger(s)	7.8 %
Sleep/fatigue	3.9 %
Children in backseat	2.6 %
Searching for street name or house number	2.3 %
Use of in-car equipment	1.8 %
Changing cassette/CD	1.1 %
Tuning/adjusting of radio	1.0 %
Advertising signs or boards	0.8 %
Object falling down inside car	0.8 %
Smoking	0.6 %
Eating/drinking	0.4 %
Mobile telephone *	0.3 %
Insect in car	0.3 %
Reading a map	0.2 %

* Percentage estimated on the basis of relative risk

Other risk factors

The logistic regression analysis revealed the following factors which in addition to mobile telephone use tend to increase the likelihood of a driver being considered guilty party after becoming involved in an accident - irrespective of its occurring or not occurring during telephone use.

- The driver does not own the car.
- The driver does not drive daily on the accident site.
- The driver is male.
- The driver does not drive the car daily.
- The driver has a shorter-than-average annual driving distance.
- The driver is below 30 or above 70 years old.
- The driver is driving alone.

Can telephone-related traffic accidents be prevented?

With the present level of mobile telephone use in Norway, the proportion of accidents caused by telephoning in cars is so low that usage restrictions probably will have a very small effect on the total number of traffic accidents. On the other hand, mobile telephone is a risk factor on the increase, and it will therefore cause an increasing number of accidents and thereby advance on the list of distraction factors causing the highest number of accidents.

Laws prohibiting the use of handheld telephones during driving have been passed in some countries. Such legislation is currently being considered in Norway as well. Since the total number of accidents caused by telephoning while driving was estimated to 20 per year, the number of accidents caused by handheld telephones - which is the upper limit to the number of accidents possibly prevented by such a measure - is somewhat lower than that. And the expected effect of the measure is probably considerably less than the upper limit. Firstly, the compliance cannot be expected to be one hundred per cent. Secondly, some of those who are now using handheld phones will install hands-free equipment in their cars. This means an increase in the number of accidents with the use of hands-free telephones, partly offsetting the effect of reduced use of handheld telephones. And, thirdly, there may possibly be an increased risk of rear-end collisions caused by drivers suddenly stopping on the verge to receive or place telephone calls.

A law against the use of handheld telephones, while permitting hands-free equipment, may be interpreted to the effect that hands-free telephoning while driving is safe. Since it has still not been convincingly documented that hands-free telephones are safer than handheld telephones during driving, this may be a misleading signal to the drivers, possibly resulting in underestimation of the risks associated with hands-free telephoning.

Despite these objections, a law against handheld telephone use in cars may possibly result in a lower number of accidents, not because of lowered risk, but primarily because of *reduced exposure*. The law, if complied with, will probably reduce the total amount of telephone use during driving, because many of those who presently are using handheld telephones, will give up telephoning rather than investing in a hands-free set. Supposedly, a considerable number of telephone calls presently being made during driving are not considered important enough to defend either the cost of stopping or of violating the law.