

Smoking and Nonfatal Traffic Accidents

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Objective. To investigate the possible associations between smoking and nonfatal traffic accidents, and to evaluate the possible influence of other factors on traffic accidents.

Design. Cross-sectional study of associations.

Setting. Eight health centers in the city of Zaragoza.

Participants. 1214 drivers between 25 and 65 years of age, who visited the health center during the months of July to September 2001, and who drove on at least 2 days of the week.

Main measures. We recorded data on sex, age, marital status, level of education, profession, diseases, use of prescription and nonprescription drugs, drinking, smoking, illegal drug use, accidents and traffic infractions.

Results. We found accidents to be most common among unmarried men between 25 and 29 years of age. There were no significant differences in accident rates between drinkers and nondrinkers. The accident rate was 50% higher in smokers than in nonsmokers (OR, 2.22; 95% CI, 1.49%-3.09%), and there were no significant differences between smokers who smoked while driving and those who refrained from smoking while driving.

Conclusions. The prevalence of accidents is highest in unmarried men younger than 45 years of age. In statistical terms, smokers have twice as many accidents as nonsmokers. The absence of significant differences between smokers who do and do not smoke while driving suggests that smoking increases the risk of being involved in traffic accidents regardless of whether drivers refrain from smoking at the wheel.

Key words: Smoking. Motor vehicle accidents.

CONSUMO DE TABACO Y ACCIDENTES DE TRÁFICO NO FATALES

Objetivo. Estudiar la posible asociación entre consumo de tabaco y accidentes de tráfico no letales, además de valorar la posible influencia de otros factores en los mismos.

Diseño. Estudio transversal de asociación cruzada.

Emplazamiento. Ocho centros de salud de la ciudad de Zaragoza.

Participantes. Un total de 1.214 conductores, entre 25 y 65 años, que acudieron a consulta de alguno de los centros incluidos en el estudio durante los meses de julio a septiembre de 2001, y conducían, al menos, 2 días a la semana.

Mediciones principales. Se recogieron datos sobre sexo, edad, estado civil, nivel de estudios, profesión, presencia de enfermedades, consumo de fármacos, alcohol, tabaco y drogas ilegales, accidentes y denuncias.

Resultados. Se registró una mayor accidentalidad entre conductores varones, solteros, y de edades comprendidas entre 25 y 29 años. No se encontraron diferencias significativas en la accidentalidad según el consumo habitual de alcohol. El porcentaje de accidentados es un 50% mayor en fumadores que en no fumadores (*odds ratio* [OR] = 2,22; IC del 95%, 1,49-3,09), no encontrando diferencias significativas entre los que fuman conduciendo y los que no fuman al volante.

Conclusiones. Aparece una mayor prevalencia de accidentes en conductores de sexo masculino, menores de 45 años y solteros. Por otro lado, los fumadores tienen, estadísticamente, el doble de accidentes de tráfico que los no fumadores. El que no haya diferencias significativas entre los que fuman conduciendo y los que no lo hacen lleva a considerar que el tabaco puede aumentar el riesgo de accidentes de tráfico, aunque no se fume mientras se conduce.

Palabras clave: Tabaquismo. Accidentes por vehículos a motor.

Spanish version available at

www.atencionprimaria.com/52.241

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Manuscript received 26 April 2002.
Manuscript accepted for
publication 25 November 2002.

Introduction

Traffic accidents are a current health problem. The figures for traffic accidents for the entire European Community are alarming:¹ every year 50 000 persons are killed and 1 500 000 are injured. According to Prada, et al (1995),² 1.6% of the Spanish population had a traffic accident in 1993, and of all persons involved, 0.98%, or 5600 persons, were killed as a result.³

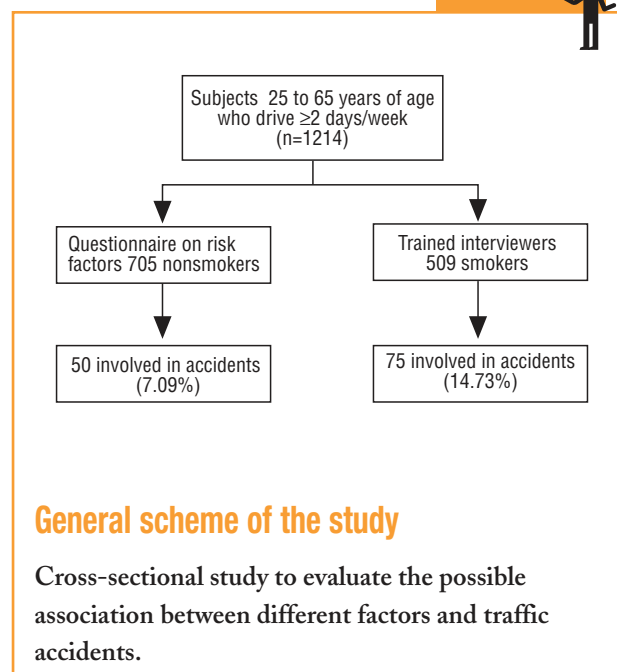
Driving a motor vehicle is a complex activity in which the driver becomes an information processor, receiving, evaluating, deciding and acting. Because these processes take place in very brief time periods, it is important for all psychophysical functions to perform optimally. Factors such as tiredness, fatigue, drinking, and certain drugs can alter the decision-making process, increasing the risk of accidents.

A number of studies have investigated the factors that influence traffic accidents, and human factors have been shown to be responsible for 90% of them.⁴ Although smoking is a recognized risk factor for the three main causes of death (cancer, cerebrovascular disease and heart disease), little attention has been given to smoking as a risk factor for accidents,⁵ another major cause of death. However, smoking has been identified as a cause of fires, explosions, and other fire-related accidents. One study related smoking with an increased risk of being involved in a traffic accident. Sacks and Nelson⁶ reviewed the relationship between smoking and different types of accident, and found that smokers had a 50% higher risk of traffic accidents than nonsmokers.⁷ A study of Montreal drivers involved in traffic accidents found that involvement was more often associated with smoking while driving than with age, sex or distance driven.⁸ Among participants in a safety course, smokers had 50% more accidents than nonsmokers; this difference persisted after adjustment for age, years of driving, and drinking.^{9,10} According to these findings, smoking may be an independent risk factor for being involved in traffic accidents. The aim of the present study, which forms part of a large-scale research project, was to investigate the association between smoking and nonfatal traffic accidents.

Material and methods

This cross-sectional study of associations was designed to evaluate the possible relationship between a number of factors and traffic accidents, by examining the prevalence of accidents according to exposure. On the basis of data obtained from the 1997 National Health Survey we calculated a sample size of 1246 questionnaires. The setting was the population of the city of Zaragoza in northeast Spain, and we selected for participation 8 health centers located in different parts of the city, from among the city's 27 centers. A total of 1250 patients participated; 36

Material and methods



questionnaires were later excluded because of hard-to-understand, incomplete or contradictory data.

Patients

The subjects were men and women aged 25 to 65 years who came to any of the participating health centers and who drove on at least two days of the week.

Survey

We designed a questionnaire that was based on similar, previously standardized instruments, and trained a group of interviewers to ensure concordance between interviewers in implementing the survey. The following variables were recorded: 1) Sex and age: between 25 and 65 years inclusive. 2) Marital status: a) unmarried; b) married (or living with partner); c) separated (or divorced); d) widow or widower, and e) other. 3) Educational level, recorded as the highest level reached: a) primary; b) secondary; c) technical; d) university, or e) no formal education. 4) Profession: recorded as the participant's profession at the time of the survey. 5) Disease: recorded as the most common chronic diseases that might influence motor vehicle driving. 6) Prescription and nonprescription drugs: recorded as habitual prolonged or continued) or occasional (sporadic or short-term) use of medications during the previous 12 months. 7) Drinking: recorded as weekly alcohol intake in standard units. For this study the participants were divided into two groups: those who consumed more than 17 standard units per week and those who consumed ≤17 units. 8) Use of illegal drugs: recorded as consumption during the previous 12 months and driving immediately after consumption. 9) Smoking: smokers were considered those participants who smoked any number of cigarettes daily during the previous year. The number of cigarettes smoked per day was noted, as was whether the participant smoked while driving. 10) Driving habits: recorded as the number of kilometers driven per

week, and as driving on urban or interurban roads. 11) Accidents: recorded as accidents that had occurred during the previous 12 months, according to the definition published in the *Boletín Oficial del Estado* (BOE) no. 47, 24 February 1993. This source defines traffic accidents as unforeseen events that fulfil the following conditions: 1) Occurring or having their origin on any of the roadways subject to legislation regarding traffic, motor vehicle movement and traffic safety. 2) Giving rise to any of the following consequences: a) one or more persons killed or injured, and b) property damage only. 3) Involvement of at least one moving vehicle. Participants who had had an accident were asked whether anyone had been injured or killed, or whether the accident had resulted only in property damage. We assumed that if there were victims, property damage had also occurred. During the interview we asked participants only about injuries or deaths. 12) Reports to the police: recorded as infractions committed during the previous 12 months while the vehicle was in motion.

Data collection

After the interviewers had been trained, participants were interviewed during July, August and September 2001. All data were recorded in a database created in Microsoft Access.

Statistical analysis

The dependent variables in the statistical analysis were antecedents of being involved in an accident and reports to the police of infractions with the vehicle in motion during the previous 12 months. Both were recorded as dichotomous variables. The main independent variable was smoking. Bivariate analysis was first done with dependent and independent variables grouped into the following categories: general (sex, age, unmarried or otherwise, primary schooling or other), health problems, habitual or occasional use of medications, and risk habits (use of illegal drugs, smoking and drinking). When the independent variable was qualitative in nature, we used the chi-squared test. For quantitative independent variables we used Student-Fisher's *t* test. Multiple logistic regression analysis was used to estimate the effect of independent variables on the dependent variable. Independent variables found in the bivariate analysis to have an association at a level of significance of <0.20 were considered covariables to control for. Variables were included according to a forward stepwise strategy, with the Wald test as the inclusion criterion. All results were expressed as odds ratios and 95% confidence intervals (95% CI). The statistical analysis was done with a database designed for Microsoft Access, and statistical tests were run with the SPSS package.

Results

In all, 1214 drivers were surveyed, of whom 125 (10.2%) had been involved in at least one accident during the previous 12 months. Injuries or deaths occurred in 22.4% of the accidents. Slightly more than two-thirds of the sample (67.3%) were men, 11.41% of whom had had one or more accidents, versus 8.02% of the women (χ^2 , 3.3; $P=.07$) (Table 1). Of the men who had been involved in accidents, 11.4% had committed a traffic infraction, versus 2.76% of the women (χ^2 , 24.1; $P<.005$). The differences between men and women were significant in both cases.

The greatest percentages of accidents involved younger drivers, with 20% of all accidents involving drivers aged 25 to 29 years. Mean age was significantly younger among drivers who had had accidents (mean, 40.2 years; SD, 11.4 years) than among drivers who had not been involved in accidents (mean, 43.8 years; SD, 12.0 years), with a *t* value of 3.2 ($P=.002$). More than two-thirds of the participants (69.69%) were married. The proportion of participants involved in accidents was larger for unmarried drivers (17.1%) than for all other groups (7.8%; χ^2 , 21.8; $P=.005$).

We found that 13.59% of the drivers drank more than 17 units of alcohol per week. Of these drivers, 9.09% had had an accident during the previous year. In the group of dri-

TABLE 1 Bivariate analysis

Variable	Accidents	χ^2	<i>P</i>
Sex			
Women	32	8.0	3.3
Men	93	11.4	
Marital status			
Unmarried	55	17.1	21.8
Other	70	7.8	<.005
Education			
Primary	33	7.7	5.0
Other	92	11.7	.03
Diabetes mellitus			
Yes	14	20.0	7.6
No	111	9.7	.006
Habitual medication			
Yes	52	10.1	0.05
No	73	10.5	.83
Occasional medication			
Yes	62	11.3	1.1
No	63	9.5	.29
Habitual or occasional medication			
Yes	96	11.3	2.8
No	29	8.0	.09
Drug use			
Yes	8	20.0	4.2
No	117	10.0	.04
Smoker			
Yes	75	14.7	18.7
No	50	7.1	<.005
Alcohol consumption (>17 units)			
Yes	15	9.1	0.3
No	110	10.5	.58

TABLE 2 Percentage of drivers who committed infractions, according to drinking habit

		Subjects		Infractions		χ^2	<i>P</i>
		No.	% of total	No.	%		
Intake >17 units	No	1.049	86.41	78	7.44	7.9	.005
	Yes	165	13.59	23	13.94		

TABLE 3 Percentage of drivers involved in accidents according to smoking habit

		Subjects		Infractions		χ^2	<i>P</i>
		No.	% of total	No.	%		
Smoker	No	705	58.07	50	7.09	18.7	<.005
	Yes	509	41.93	75	14.73		
Smokes while driving	No	198	16.31	23	11.62	2.5	.11
	Yes	311	25.62	52	16.72		

TABLE 4 Percentage of drivers who committed infractions, according to smoking habit

		Subjects		Infractions		χ^2	<i>P</i>
		No.	% of total	No.	%		
Smoker	No	705	58.07	50	7.09	5	.02
	Yes	509	41.93	53	10.41		
Smokes while driving	No	198	16.31	16	8.08	1.9	.17
	Yes	311	25.62	37	11.90		

vers who drank fewer than 17 units per week, 10.49% had had an accident during the previous year; the difference between the two groups was not significant (χ^2 , 3.0; $P=.08$). However, the number of infractions committed differed significantly between the two groups, as shown in Table 2.

The percentage of smokers in the sample was 41.93%. Of this group, 61.1% ($n=311$) admitted to smoking while they drove (Table 3). The percentage of drivers involved in accidents was 50% higher among smokers than among nonsmokers, and was even greater among smokers who smoked while driving, with a significant difference between smokers and nonsmokers. Although the percentage of accidents was higher among those who smoked while driving than among smokers who refrained from doing so, this difference was not significant (Table 3). With regard to the number of infractions, we also found that significantly more police reports had been filed against smokers than against nonsmokers. When we compared drivers who smoked with drivers who refrained from smoking at the wheel, we found that the difference between these two groups did not reach statistical significance (Table 4).

Discussion

Because of the nature of this study, we cannot claim that any of these variables is a direct cause of traffic accidents, although we can speak of significant or nonsignificant associations between variables. When an association denoting causality is strong, the variable in question is likely to be a causal factor. As in most known studies, we also found that mean age of drivers involved in accidents was lower than among drivers who had not had an accident. Antecedents of involvement in an accident were more frequent among men, drivers younger than 45 years, unmarried persons, and persons with secondary or university level education, as earlier research has also noted.² Habitual drinking did not appear to be influential as a risk factor for traffic accidents. Driving under the effects of alcohol was related less clearly with accident rates, but more clearly with the seriousness (fatal outcome) of accidents. In Spain, high blood levels of alcohol have been found in 50%-55% of the persons who died in traffic accidents, and in 35.4% of the victims the concentration was greater than 0.8 g/L.¹¹ At least 40% of all deaths from traffic accidents were caused directly by drinking, and the annual number of deaths from this cause has been placed at 2500.¹² Habitual drinking unconnected with driving did not appear in the present study to be related with less serious, nonfatal accidents; however, this finding does not contradict the fact that drinking may be related with fatal accidents or accidents that result in severe disability. In fact, a weekly intake of more than 17 units of alcohol was related with a higher risk of being reported by the police for committing an infraction.

We found that in smokers the risk of having a traffic accident (odds ratio) was 2.22 (95% CI, 1.49%-3.09%) after adjustment for confounding variables such as age, marital status and level of education (Table 5). In other words, on average the risk of having a nonfatal traffic accident was twice as high among smokers as among nonsmokers. The proportion of drivers who were involved in accidents was

TABLE 5 Results of the multivariate (logistic regression) analysis

Variables	Coefficient	SE	Wald test	<i>P</i>	OR	95% CI
Unmarried	0.941	0.202	21.601	.000	2.562	1.723 3.810
Diabetes	1.134	0.336	11.403	.001	3.108	1.609 6.002
Smoker	0.801	0.202	15.702	.000	2.227	1.499 3.309
Medication ^a	0.492	0.233	4.463	.035	1.636	1.036 2.582
Urban roads ^b	0.020	0.009	5.422	.020	1.021	1.003 1.038
Constant	-3.490	0.269	167.967	.000	0.030	

^aUse of medication during the previous year.

^bDrives only on urban roads.

SE indicates standard error of the coefficient.

Discussion
Key points



What is known about the subject

- Human factors are responsible for 90% of all traffic accidents.
- Smoking has been recognized as a risk factor in three of the main causes of death: cancer, cerebrovascular disease and heart disease.

What this study contributes

- The risk of being involved in a traffic accident is 50% greater in smokers than in nonsmokers.
- This risk is independent of whether the driver smokes or refrains from doing so while driving.

7.09% among nonsmokers, 11.62% among smokers who refrained from smoking at the wheel, and 16.72% among smokers who smoked while driving. The risk was therefore higher among smokers who smoked at the wheel than among smokers who did not smoke while driving (although the difference between these two subgroups was not statistically significant). Our findings are basically similar to those of other authors who reported an odds ratio of 1.51 after confounding variables such as sex, age, use of safety measures, occupation and cardiovascular risk had been controlled for.^{6,13} Other studies found an odds ratio of 1.5 for smokers in general and 2 for those who smoked while driving.¹⁰

Several reasons can be suggested for the higher risk of accidents in the latter subgroup, which may appear surprising: 1) Greater number of distractions during driving: smoking creates many potential sources of distraction, e.g., lighting a cigarette, not being able to use both hands for driving, eye irritation by smoke, etc. 2) Different behavior of drivers (probable tendency to take more risks). 3) Direct toxic effects of carbon monoxide (CO), which reduces alertness and attentiveness. One study has related increased levels of carboxyhemoglobin with reduced night vision, which may lead to driving errors.⁶ 4) Medical problems associated particularly with acute cardiovascular disease. In England, insurance companies consider at least 5% of all traffic accidents to be directly or indirectly attributable to smoking inside the vehicle.

There is thus sufficient evidence that habitual smoking may imply a greater risk of traffic accidents. It is probably associated more closely with nonfatal than with fatal accidents, in contrast to the situation with regard to drinking. The risk associated with smoking probably results from the effects of chronic CO intoxication rather than the indirect effect of smoking-related distractions during driving. The problem thus will not be solved by legislative measures (such as making smoking while driving illegal), but instead will require educational measures and aids for smokers who wish to quit. This should be considered one reason more among the hundreds of good reasons for smokers to quit, and for health professionals to help them to do so.

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COMMENTARY

Smoking and Traffic Accidents: Possible Relationships

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Traffic accidents are an important health problem because of their associated morbidity and mortality, and because of the disabilities they cause. In 2001,¹ traffic accidents accounted for 4145 deaths in Spain. Some authors have found that close to 9% of the over-15 population in Spain has been involved in traffic accidents.

This is a problem that particularly affects young people: it is the most frequent cause of death among children and adults of both sexes aged 5 to 24 years, the second most frequent cause in men and women aged 25 to 34 years and in men aged 35 to 44 years, and the third most frequent cause of death among women aged 35 to 44 years.² Recent guidelines^{3,4} identify three main risk groups: the 15-to-24-year-old population of users of two-wheeled vehicles, the 18-to-34-year-old population of occupants of cars on the road, and pedestrians aged more than 65 years in urban areas.

The following risk factors (among others) have been identified in relation with the frequency and seriousness of traffic accidents:

1. Improper use or nonuse of safety measures (seat belts, helmets, car seats).
2. Drinking.
3. Use of medications that alter driving capacity (anxiolytics, antidepressants, antiepileptics, cardiovascular therapy, etc.).
4. Certain diseases that also alter driving capacity (sleep apnea, visual or auditory defects, diabetes, epilepsy, etc.).

The authors of the article «Smoking and nonfatal traffic accidents» emphasize the relationship between smoking and higher accident rates. They conclude, appropriately, that because of the nature of their study, they cannot claim a direct relationship between smoking and accidents.

Research on this relationship has given rise to different and at times contradictory results. For example, Guibert et al,⁵ in a case-control study that compared a group of 2504 drivers involved in accidents and 2520 drivers with no his-

Key points

- More studies are needed to determine the relationship between smoking, whether as a contributing distraction or as a causal factor, and traffic accidents.
- To prevent injuries caused by traffic accidents, counseling is needed on alcohol consumption, the use of protective measures, medications, and diseases that alter driving behavior.

tory of accidents, found no relationship between smoking and involvement in traffic accidents. However, Brison,⁶ in a similar study, found that smokers were 1.5 times as likely as nonsmokers to have accidents. According to this author, the basis for this association may be distraction of the driver by smoking, differences in behavior between smokers and nonsmokers, and carbon monoxide toxicity. Different reviews of the subject⁷ have noted factors that affect driver attentiveness, and indicate that the most important distractions are use of cell phones, electronic aids (navigation systems) and information and entertainment systems (radios, etc.).

Two lines of research that are therefore likely to be of interest are smoking as a distraction, and as a risk factor for having an accident or worsening the prognosis of accidents. Further studies like the one in this issue of ATENCIÓN PRIMARIA will undoubtedly be needed to confirm the findings in our setting, and advances are most likely to come from studies based on prospective cohort and experimental designs.

On a final note, the need for better preventive interventions aimed at alcohol consumption, undoubtedly the most important and best-studied factor to date, must be emphasized.

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