For Debate . . .

Drinking and driving: choosing the legal limits

JAMES A DUNBAR, ANTTI PENTTILA, JARMO PIKKARAINEN

Abstract

The legal limit for drinking and driving in Britain is 80 mg/dl (17·4 mmol/l) of alcohol in the blood. This was chosen 20 years ago on the basis of studies that have recently been reanalysed. Changes in public opinion, the results of recent research, and the evaluation of other countermeasures, such as random breath testing, show that there are good grounds for revising the legal limit downwards.

It is suggested that the legal limit should be reduced from 80 mg/dl to 50 mg/dl (10·9 mmol/l) and random breath testing introduced as in most Nordic countries. A zero limit is proposed for learner and first year drivers, who are likely to have accidents even with low concentrations of alcohol in their blood.

Introduction

The ideal blood alcohol concentration in a driver would be zero, but legislators chose a compromise between concentrations at which there is a high risk of having an accident and concentrations that are so low that they would generate too great a workload for the police and be unacceptable to the public. The present limit in Britain of 80 mg/dl (17·4 mmol/l) of alcohol in the blood was recommended by the BMA in 1965 to meet these criteria, the research at that time suggesting that above 80 mg/dl the risk of having an accident rose rapidly with increasing alcohol concentrations.[1,2] It was also thought that a lower concentration would place undue strain on the police by increasing the number of arrests.

A Departmental Committee of Enquiry (Blennerhassett) in 1976, the Central Policy Review Staff report of 1979, and the consultative document from the Department of Transport in 1980 all recommended retaining the legal limit at 80 mg/dl and finding ways to stop those drivers who were above that limit rather than reducing the legal limit and arresting more drivers. The Central Policy Review Staff and the Blennerhassett reports noted that a report from the Organisation for Economic Cooperation and Development said that for most drivers there was an increased risk of having an accident when the blood alcohol concentration was between 50 mg/dl (10·9 mmol/l) and 80 mg/dl and they recommended that the government should keep open the option to lower the limit.[3-6]

University Department of Forensic Medicine, Royal Infirmary, Dundee DD1 9ND

JAMES A DUNBAR, MRCGP, DMJ, director, Tayside Safe Driving Project

Department of Forensic Medicine, University of Helsinki, SF 00280 Helsinki, Finland

ANTTI PENTTILA, MD, MSC, associate professor

National Public Health Institute, SF 00280 Helsinki, Finland

JARMO PIKKARAINEN, MD, professor

Correspondence to: Dr Dunbar.

Twenty years have passed since the British legal limit was chosen. Countries such as Australia, Finland, Greece, The Netherlands, Iceland, Japan, Norway, Portugal, Sweden, some states of the United States, and Yugoslavia have introduced a legal limit of 50 mg/dl.[7] New research on the physical effects of alcohol, changes in public opinion, and evaluation in other countries of recent drinking and driving countermeasures question the validity of the 80 mg/dl legal limit.

Experimental research

In a recent extensive review of 200 scientific papers a variety of behavioural aspects were examined[8]: reaction time (40 studies); tracking (28); concentrated attention (seven); divided attention (15); information processing (24); visual function (28); perception (28); psychomotor performance (28); and driver performance (22). The authors of the review concluded that though many of the earlier publications had reported impairment at alcohol concentrations of 100 mg/dl and above publications in the past decade have discussed lower alcohol concentrations, giving evidence of impairment at concentrations below 30 mg/dl. In most of the functions examined the results of most of the studies showed impairment at 70 mg/dl. In 45 studies (roughly 20%) impairment was reported at concentrations of between 10 and 40 mg/dl. For nearly all functions a lower limit could not be placed at which alcohol impairment began. Apart from simple reaction time few studies failed to show some impairment. There was no evidence that alcohol improved any skill at any concentration, and at the lowest concentration examined there was some impairment.

Thus recent reports of impaired performance at low alcohol concentrations testify to the increasingly refined research techniques and support setting legal limits at the lowest concentration that society will accept.[8] Linnoila and Mattila quoted epidemiological case-control studies showing that in drivers with blood alcohol concentrations greater than 60 mg/dl the risk of having an accident is appreciably increased.[9] For example, recent data from Canada show that young men under 20 years of age and drivers over 55 have an increased risk of having an accident at low alcohol concentrations. Driving experiments on closed courses have shown impaired responses to braking and steering in accident avoidance manoeuvres at concentrations around 30 mg/dl. In the laboratory sensitive performance tests that stimulate driving have shown impairment after very small doses of alcohol.[9] Linnoila stated that for drivers aged 18-24 there is a 30-fold risk of having an accident at 80 mg/dl.[10]

At the National Swedish Road and Traffic Research Institute Laurell studied the effects of small doses of alcohol on the performance of drivers in emergency traffic situations and the effects of hangovers on driving performance.[11,12] Twelve drivers were tested in emergency braking and manoeuvring, and their reaction to a surprise situation where an object shaped like a man suddenly appeared in front of the car was included. The alcohol concentrations of the drivers were in the range 27-53 mg/dl. The results showed that an average concentration of 42 mg/dl significantly impaired braking and manoeuvring. In the surprise

test five of 10 drivers affected by alcohol hit the figure, but only one of 10 drivers with a zero alcohol concentration hit it.

Traditionally laboratory studies have taken second place to epidemiological studies, and have used the concept of the relative risk of a crash to show the effect of rising concentrations of alcohol. The Grand Rapids and the Adelaide studies are best known.[13,14] The results from Grand Rapids were reanalysed by the Transport Road Research Laboratory of the Department of Transport,[2] but this has been criticised on statistical grounds and the conclusion drawn that the Grand Rapids and Adelaide studies showed that alcohol concentrations above 50 mg/dl and below 80 mg/dl appreciably increased the risk of having a crash.[15] It is perhaps not surprising that Professor Milan Valverius, who conducted one of the earliest epidemiological studies, wrote recently that the limit of 80 mg/dl was too high and could not be supported on scientific grounds.[16]

Public opinion in Britain

In 1986 the Health Education Council and Gallup each carried out surveys of public opinion in Britain,[17,18] and the results were remarkably similar. They both suggested what legal limit would be acceptable to the public. Drinking and driving was selected by most respondents to be the least justified, most avoidable cause of premature death and the greatest killer: just under three quarters wanted stricter penalties. Nearly two thirds of respondents stated that they did not drink and drive, and only one tenth admitted to drinking more than three units of alcohol before driving. Roughly half believed that the legal limit was greater than three units. One third thought the limit should be lowered and a very few believed it should be raised. Interestingly, drivers aged under 24 or over 55 were least likely to drive when over the legal limit.

Three units of alcohol would be unlikely to raise a driver's blood alcohol concentration to even a legal limit of 50 mg/dl. The results of the surveys suggest that the large majority of the British population would support lowering the legal limit to 50 mg/dl and that they would not exceed this limit themselves. If the results of these surveys can be accepted the danger of overloading police resources —thought to be so important a decade ago—appear not to be valid now.

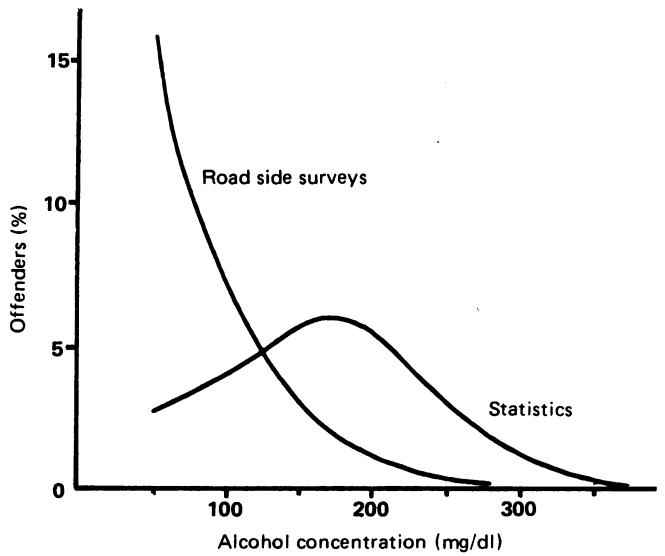
Consequences of recent countermeasures

RANDOM BREATH TESTING

In Britain the police are not yet empowered to set up static checkpoints at the roadside where all passing drivers are stopped and tested for breath alcohol concentrations. It is only a matter of time before this is introduced. The results of introducing random breath testing in Finland and in New South Wales and Victoria, Australia, suggest that it would be even more effective in Britain if linked with a legal limit of 50 mg/dl.[19-27]

The distribution of alcohol concentrations among drivers arrested by random breath testing (roadside surveys) differs from that in drivers arrested when the police suspected that they were driving under the influence of alcohol (normal police statistics).[19,25,26] The last group has much higher alcohol concentrations (figure). Lowering the legal limit to 50 mg/dl maximises the value of random breath testing for detecting problem drinkers throughout 24 hours, even in the morning traffic when they are likely to have lower alcohol concentrations.[19] This group is much more likely to have road accidents, albeit at other times and with higher alcohol concentrations. Random breath testing changes the behaviour of those who drink and drive. At present in Britain many social drinkers drink and drive, and tens of thousands are arrested each year. They would be largely deterred from drinking and driving by random breath testing, and far fewer proportionally would face arrest. On the other hand, the proportion of problem drinkers, who are the most dangerous offenders, would increase. If the limit was not lowered to 50 mg/dl many would escape prosecution.

It has been suggested that a lower limit would increase the number of "hit and run" accidents. There is no published evidence



Blood alcohol concentrations among offenders who were arrested after random breath testing compared with the concentrations in drivers who were arrested by police during normal supervision of traffic. 100 mg/dl≈21·7 mmol/l.

of this in Finland. It is not impossible that having lower limits and random breath testing reduces the likelihood of "hit and run" accidents. The results of our studies, based on γ-glutamyltransferase values, suggest that the proportion of problem drinkers is the same in the ranges of 50-80 mg/dl and 80-150 mg/dl. This is independent of whether the drivers were arrested in normal police supervision of traffic or at checkpoints for random testing (table). As problem drinkers have been shown to be at a high risk of having accidents[28-30] the Finnish results argue for a legal limit of 50 mg/dl.

Serum γ-glutamyltransferase at different blood (or breath) alcohol concentrations

γ-Glutamyltransferase (U/l)	Alcohol concentrations (mg/dl) <50*		50-79		80*-149		≥150	
	No	%	No	%	No	%	No	%
Arrested by police on suspicion of drinking and driving								
<50	57	88	44	71	97	73	146	64
≥50	14	22	18	29	35	27	82	36
≥75	9	14	7	11	19	14	57	25
Total	65	100	62	100	132	100	228	100
Arrested at checkpoint for random breath testing								
<50	31	67	25	58	30	57	20	67
≥50	15	33	18	42	23	43	10	33
≥75	8	17	11	26	14	26	9	30
Total	46	100	43	100	53	100	30	100

*50 mg/dl≈10·85 mmol/l; 80 mg/dl≈17·36 mmol/l.

EVIDENCE FROM BREATH ANALYSIS

From May 1983 breath replaced blood as the evidential sample in most drinking and driving cases. A year after its introduction public controversy led to an independent inquiry into the performance of the measuring instruments for breath alcohol. Sir William Paton, who conducted the inquiry, concluded that both the allowance made for blood-breath ratios and taking the lower of the two breath test results meant that the reading used in evidence erred very much in favour of the driver. In his words: introduction of evidential breath testing led to "underprosecution" of drivers and some drivers were therefore learning the wrong lesson—that is, that they could drink and drive. He suggested that lowering the legal limit would be one way round the problem.[31] For this reason Sweden is

considering introducing evidential breath testing and lowering its present legal limit from 50 mg. Britain might reasonably lower the legal limit from 80 mg to 50 mg/dl merely to compensate for the introduction of evidential breath testing.

LOWER LIMIT FOR YOUNG DRIVERS

The ideal legal limit for drinking and driving would be zero, which is the limit for pilots in many countries, though in practice drivers with a concentration below 20 mg/dl in the blood would not be prosecuted. Several states in Australia have now introduced a zero limit for learners and first year drivers as these drivers are more likely to be over the legal limit, five times more likely to have an accident, and more likely to be hospitalised after such an accident.[32-36] Recent results from Finland showed that compared with older drivers young drivers were clearly more impaired at the same alcohol concentrations.[37] Inexperience of both drinking and driving is an adverse combination. An evaluation of the zero limit has shown that this has reduced the number of deaths and injuries in young drivers, though the law is backed by random breath testing,[38] and the cars of first year drivers carry special plates. Many young Australians have now grown up with the idea that they must separate drinking and driving.[39] In Finland 92% of young drivers have been shown to share this view.[40] Public opinion surveys in Britain show that drivers under the age of 24 are already less likely to drink and drive than their elders. It seems likely, therefore, that there would be some popular support for a zero limit law for learner and first year drivers in Britain.

Conclusion

The scientific evidence indicates that there is a clear risk of having an accident while driving when the blood alcohol concentration is above 50 mg/dl and even lower in young drivers. Recent public opinion surveys strongly suggest that lowering the legal limit would be acceptable to most drivers and that most drivers now do not drink more than 50 mg/dl.

Lowering the legal limit to 50 mg/dl alone is unlikely to have any effect on drinking and driving since at present most drivers realise that they are unlikely to get caught. The benefit would come if random testing was introduced at the same time. For drivers who cannot control their drinking the probability of arrest would be greater. A highly visible deterrent would also ensure that most social drinkers stop drinking and driving. This would more than balance the increased number of arrests related to lowering the legal limit for alcohol.

This study was undertaken while JAD held a Council of Europe Medical Fellowship at the National Public Health Institute, Helsinki, Finland. Additional funding came from the Association of Police Surgeons of Great Britain and the Ministry of the Interior, Finland.

References

1 Drew GC, Colquhoun WP, Long HA. *Effects of small doses of alcohol on a skill resembling driving.* London: Medical Research Council, 1959.
2 Allsop RE. *Alcohol and road accidents.* Harmondsworth: Road Research Laboratory, 1966. (Report No 6.)
3 Department Committee, Department of the Environment. *Drinking and driving.* London: HMSO, 1976.
4 Anonymous. *Alcohol policies in the United Kingdom. Central Policy Review Staff.* Stockholm: Sociologiska Institution, 1979:45-53.
5 Department of Transport. *Consultation document on drinking and driving.* London: DOT, 1980:3-4.
6 Organisation for Economic Cooperation and Development. *New research programme on alcohol and drugs. Final report.* Paris: OECD, 1977:1-174. (Road Research Programme, Research Group S14.)
7 Denny RC. *Alcohol and accidents.* Wilmslow: Sigma Books, 1986:59-66.
8 Moskowitz H, Robinson C. Driving related skills: impairment at low blood alcohol levels. In: Noordzij P, Roszbach R, eds. *Proceedings of the tenth international conference on alcohol, drugs and traffic safety.* Amsterdam: Elsevier, 1987:79-87.
9 Linnoila M, Mattila MJ. Drug interaction on driving skills as evaluated by laboratory tests and by a driving simulator. *Pharmakopsychiatrie Neuropsychopharmakologie* 1973;6:127-32.
10 Guthrie S, Linnoila M. Epidemiology and laboratory studies on alcohol, drugs and traffic safety. In: Noordzij PC, Roszbach R, eds. *Proceedings of the tenth international conference on alcohol, drugs and traffic safety.* Amsterdam: Elsevier, 1987:63-71.
11 Laurell H. *Effects of small doses of alcohol on driver performance in emergency traffic situations.* Linkoping: National Swedish Road and Traffic Research Institute, 1975.
12 Laurell H, Tornos J. *Hang-over effects of alcohol on driver performance.* Linkoping: National Swedish Road and Traffic Research Institute, 1982.
13 Borkenstein RF, Crowther RF, Shumate RP, Ziel WB, Zylman R. *The role of the drinking driver in traffic accidents.* Bloomington: Indiana University Department of Police Administration: February 1964.
14 McLean AJ, Holubowicz DT, Sandow BL. *Alcohol and crashes: identification of relevant factors in this association.* Adelaide: Department of Transport Office of Road Safety, 1980. (Report CR11.)
15 Arthurson RM. *Blood alcohol concentration in drivers: 0·05 or 0·08?* Rosebery, NSW: Traffic Authority, New South Wales, Traffic Accident Research Unit, 1986.
16 Valverius MR. *Drinking and driving in Nordic countries: an overview.* Stockholm: Karolinska Institute, 1985:8-13.
17 Wood D. *Beliefs about alcohol.* London: Health Education Council, 1986:63-71. (Research Report No 5.)
18 Anonymous. *Attitudes to drink/driving. Social surveys (Gallup poll).* London: Gallup, 1986:2-12.
19 Pikkarainen J, Penttila A. Drinks, drugs and driving in Finland. Past, present and future. In: Murayama N, Kiyono S, eds. *Proceedings of the 22nd annual meeting of the Japanese Council of Traffic Sciences.* Matsumoto: Shinsu University, 1986:16-57.
20 Arthurson RM. *Evaluation of random testing.* Rosebery, NSW: Traffic Authority of New South Wales, 1985:24-31.
21 Trinca GW, ed. *Road trauma—the national epidemic.* Melbourne: Royal Australian College of Surgeons, 1983:15-7.
22 Paciullo G. Random breath testing in New South Wales. *Med J Aust* 1983;i:620-1.
23 Homel R. The impact of random breath testing in New South Wales, December 1982 to February 1983. *Med J Aust* 1983;i:616-9.
24 Johnston IR. The integration and interdependence of countermeasures. *Proceedings of the Royal Society of Medicine* (in press).
25 Kearns IB, Goldsmith HJ. The impact on traffic crashes of the introduction of random breath testing in New South Wales. *ARRB Proceedings* 1984;12(7):81-95.
26 Frank L. *Characteristics of drivers with blood alcohol content over ·05/100 ml detected at preliminary breath test stations in Melbourne: 1983-1985.* Melbourne: Road Traffic Authority, 1986:3-7.
27 Peberdy JR. *Drinking patterns and demographic characteristics of drivers breathalysed in Victoria.* Melbourne: Road Traffic Authority, 1986:1-7.
28 Valverius MR, Moberg J, Linden CH. Roadside survey in northern Sweden. In: Valverius MR, ed. *Roadside surveys: proceedings of satellite conference of the eighth international conference on alcohol, drugs, and traffic safety.* Stockholm: Swedish Council for Information on Alcohol and Other Drugs, 1982:7-32.
29 Dunbar JA, Ogston SA, Ritchie A, Devgun MS, Hagart J, Martin BT. Are problem drinkers dangerous drivers? An investigation of arrest for drinking and driving, serum gammaglutamyl transpeptidase activities, blood alcohol concentrations, and road traffic accidents: the Tayside Safe Driving Project. *Br Med J* 1985;290:827-30.
30 Papoz L, Weill J, L'Hoste J, Chich Y, Got C, Goehrs Y. Biological markers of alcohol intake among 4796 subjects injured in accidents. *Br Med J* 1986;292:1234-7.
31 Cobb PGW, Dabbs MDG. *Report on the performance of the Lion Intoximeter 3000 and the Camic Breath Analyser evidential breath alcohol measuring instruments during the period 16 April 1984 to 15 October 1985.* London: HMSO, 1985:14-5.
32 Drummond AE, Cave TC, Healy DJ. The risk of accident involvement by time of week, an assessment of the effect of zero BAC legislation and the potential of driving curfews. *J R Soc Med* (in press).
33 Drummond AE. Driver licensing and legal drinking ages and accident involvement rates of young drivers in Australia. *J R Soc Med* (in press).
34 South D. *Age and drink driving.* Melbourne: Road Safety and Traffic Authority, 1983:1-7.
35 Hendtlass J, Block I, Ryan M. Differences between drivers injured and not injured in collisions in Victoria, Australia. In: Goldberg L, ed. *Proceedings of eighth international conference on alcohol, drugs and traffic safety.* Stockholm: Almqvist and Wiksel, 1980:124-36.
36 Mayhew DR. Alcohol, age and the risk of accident involvement. In: Kay S, Meyer G, eds. *Proceedings of the ninth international conference on alcohol, drugs and traffic safety.* Washington DC: National Highway Traffic Safety Administration, 1985:937-49.
37 Pikkarainen J, Penttila A, Karhunen PJ, Kauppila R, Liesto K, Tiainen E. Young drunken drivers in Helsinki. II. Drinking habits. *J R Soc Med* (in press).
38 Havard J. Drunken driving among the young. *Br Med J* 1986;293:774.
39 Monk K, South D. *Public awareness of the zero BAC legislation in Victoria.* Melbourne: Road Traffic Authority, 1985:3-20.
40 Elio K, Koivisto V, Lasonen K. *Research Report No 5.* Jyvaskyla: Department of Education, University of Jyvaskyla, 1978:1-170.

(Accepted 11 November 1987)