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Driving under the influence of alcohol in the Netherlands by time of day and day of the week

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A B S T R A C T

The purpose of this study is to provide an overview of the variation in the prevalence of alcohol in everyday traffic in the Netherlands during all days of the week and all times of day. Breath tests were taken from randomly selected car drivers and drivers of small vans in six police regions in the Netherlands between January 2007 and August 2009. A total of 28,057 drivers were included in the study. The prevalence of driving under the influence of alcohol was highest during night-time hours of weekend days. Large proportions of sampled drivers under the influence of alcohol were also found during day-time hours on weekend days, especially early in the morning and early in the evening. Furthermore, a small proportion of sampled drivers under the influence of alcohol was found during morning traffic on Monday and Friday mornings. The results of this study indicate that drink driving is not only limited to night-time hours and that prevalence of drink driving is also high during evening hours from Wednesday to Sunday. In addition to these time periods, breath testing activities may also be effective from a police enforcement perspective on Monday, Friday, and Saturday mornings between 06.00 h and 08.00 h and on Sunday mornings until 10.00 h.

1. Introduction

Alcohol use in traffic is one of the most important factors in road safety crashes (Kim et al., 1995; Peden et al., 2004). It is estimated that in Europe 25% of all road fatalities are related to alcohol use (European Communities, 2013). In the United States and in Australia the proportion of alcohol related road fatalities is even higher (Sweedler and Stewart, 2009).

The most commonly used measure against alcohol use in traffic is a combination of legislation that prohibits driving with a blood alcohol concentration (BAC) beyond a certain limit, combined with police enforcement of this legislation. The effective element of police enforcement is deterrence and the effectiveness of deterrence depends on the drivers' impression of the likelihood of being caught when exceeding the limit. A distinction can be made between general deterrence and specific deterrence (Krismann et al., 2011). The aim of general deterrence is to motivate all drivers not to break the rules by creating fear of sanctions and providing the belief that the risk of being caught is high. For general deterrence the severity, speed and certainty of the punishment are important elements (Freeman et al., 2006). The aim of specific deterrence is to improve the attitudes and behavior of drivers once they are caught in order to prevent recidivism.

In most European countries (e.g. France, Norway, Spain, The Netherlands) random roadside breath testing is allowed and in a few countries (e.g. the United Kingdom and Germany) some kind of suspicion, for instance the smell of alcohol, is conditional for a policeman to test a driver (Österberg and Karlsson, 2002). Both systems are effective, but random breath testing was found to be twice as effective as selective testing, i.e. testing only after suspicion (Henstridge et al., 1997).

Doubling the number of random breath tests in the Netherlands was found to decrease the number of drink driving offenders by approximately 25% (Mathijssen, 2005). The effectiveness of random breath testing can be enhanced when it is done near places where alcohol is consumed and at specific times and specific days when the prevalence of drink driving is high, i.e. on weekend nights (Mathijssen, 2001). Effectiveness is further improved when publicity accompanies enforcement campaigns (Erke et al., 2008). Research and experience suggest that highly visible random breath testing (RBT) in order to deter, combined with targeted random breath testing that is not clearly visible and therefore harder to detect, is the most effective approach (ETSC, 1999).

Most random breath testing activities in the Netherlands are conducted during night-time hours, mostly on Friday and Saturday nights (Mathijssen, 2001). These enforcement activities are

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specifically aimed at nightlife activities. Results of several prevalence studies show that the proportion of sampled offenders increases between 22.00 h and 04.00 h (ADV, 2012; DVS, 2011). However, less is known about the prevalence during other days of the week and other hours of the day. The Dutch police presume (Jansen, 2013) that drinkers on Sunday nights are unaware that their BAC may still be over the legal limit when they drive to work the next morning. This is also visible in the log data from the Finnish alcohol program for drink driving offenders (Löytty, 2013) in which fail tests due to too high blood alcohol levels were especially prevalent on Monday mornings. If high BAC levels in drivers also occur during Monday mornings or other time periods, alcohol enforcement activities could also be performed during these other time periods. Depending on the traffic volume and the alcohol related road toll, enforcement activities during these time periods may be cost effective.

Between 2006 and 2011 the European research project DRUID (Driving under the Influence of Drugs, Alcohol and Medicines) was conducted to provide a scientific base for European road safety policy to combat driving under the influence of psychoactive substances (DRUID, 2012). Within the DRUID-project 13 national roadside surveys were held to determine the prevalence of psychoactive substances in traffic. These roadside surveys were designed according to a common study design (Assum et al., 2007) in which the hours of the day were classified into four six-hour time periods (04.00–10.00 h, 10.00–16.00 h, 16.00–22.00 h, and 22.00–04.00 h) and the days of the week were classified into weekdays and weekend days; this resulted in eight time periods. These eight time periods were chosen because each period was believed to represent more or less the same pattern in substance use. In the analysis that was presented in the official publication of the prevalence studies (Houwing et al., 2011), the eight time periods were clustered into four time periods to increase the statistical power of the study. This resulted in the following clusters: weekdays (04.00–22.00 h), weeknights (22.00–04.00 h), weekend days (04.00–22.00 h), and weekend nights (22.00–04.00 h). However, the clustering made the DRUID results less useful for national enforcement strategies. Other studies have reported on the prevalence of alcohol during different time periods as well, but they either used clustered time periods or time periods that only represented a limited proportion of the times of the day and the days of the week (Assum et al., 2005; Beirness and Beasley, 2010; Belgisch Instituut voor de Verkeersveiligheid, 2010; Gjerde et al., 2008; Ingsathit et al., 2009; Lacey et al., 2009; Li et al., 2013).

This study provides detailed insight on the variation of the prevalence of alcohol in traffic during all days of the week and all times of the day, as 84 time periods of two hours were used. The increased insight on the prevalence of alcohol in traffic can provide an improved basis for an expansion of alcohol enforcement activities to other time periods to the customary periods during weekend nights.

2. Method

2.1. General design

A roadside survey was conducted to determine the prevalence of alcohol among the general driving population in the Netherlands. A stratified multistage sampling design was used. In the first stage, four study regions were defined in the Netherlands: North, East, South, and West. These regions were considered to be representative for the entire country with regard to alcohol use and traffic based on the results of annually conducted national prevalence studies on alcohol use in weekend nights (DVS, 2008). Within these

Fig. 1. Geographical distribution of the six police regions: Groningen, Twente, Amsterdam-Amstelland, Hollands Midden, Gelderland-Zuid, and Tilburg.

regions, smaller research areas (i.e. six Dutch police regions) were selected in the second stage (Fig. 1).

Within these six police regions, survey locations were selected in which 28,057 car drivers and van drivers were randomly selected from actual traffic between January 2007 and August 2009. Survey locations were situated on main municipal and provincial roads, mainly within built up areas of both small and large municipalities. During the period 2006–2008, these road types together accounted for approximately 80% of police reported serious injury crashes in the Netherlands. For each police region, data was collected during 12 roadside survey sessions distributed over eight 6-hour periods covering all hours of the day on both weekdays and weekend days. The periods were distributed into type of day (work day/weekend day) and time of day (04.00–10.00 h, 10.00–16.00 h, 16.00–22.00 h, and 22.00–04.00 h). Four survey locations were selected for each roadside survey session. The main selection criteria were: traffic flow, (lack of) possibilities for drivers to avoid the survey location, enough room for the research and police teams and their vehicles, and safe working conditions. The availability of the police officers determined the number of car drivers who were stopped and breath tested by the police. In the first hours of a test session, traffic was sometimes too dense to test all passing drivers. In that case, drivers were randomly selected from moving traffic, according to the availability of police officers to perform a breath test. During later hours, when traffic had become less dense, a breath sample was taken from every passing driver. Eventually, all observations were combined according to time of day and day of the week, and divided into 7×12 groups G_{dh} of two-hour periods h and for every day of the week d.

The breath test was compulsory for all drivers who were stopped. The estimated blood alcohol concentration (BAC) was measured with a handheld breath alcohol analyzer using a Dräger Alcotest 7410 Plus screening device (Dräger Safety AG & Co. KGaA, Lubeck). Under Dutch legislation the resulting breath alcohol concentrations (BrAC) are converted into BAC using a conversion factor of 1:2300: 1 μg alcohol/ℓ breath air corresponds to 2300 μg alcohol/ℓ blood (Mathijssen and Twisk, 2001).

2.2. Statistical analysis

Prevalence p_{dh} for every two hour period p on a specific day of the week was calculated as the maximum likelihood estimate $p = n/N$, where n equals the number of positives (BAC ≥ 0.5 g/ℓ) and N equals the total number of observations (tested participants). As an indication of the accuracy of the measurement, 90% confidence intervals were calculated. Because of the nonsymmetrical and bounded binomial distribution function of n given p and N, the upper limit p_u and the lower limit p_l of the confidence interval were calculated separately. To calculate confidence intervals, exact values were determined. This was done by deriving a numerical calculation of the value $p_{dh,l}$ for which the probability that the number of positives would be *at most* n, equals 0.05 (in the cases where $p_{dh} > 0$). Similarly, $p_{dh,u}$ was derived by a numerical calculation of the value for which the probability that the number of positives would be *at least* n, equals 0.95. The calculations were carried out in Excel by means of the Clopper–Pearson method (Clopper and Pearson, 1934).

The average prevalence for any of the days of the week p_d (regardless of the time of day) and the average prevalence for any of the two hour periods p_h, (regardless of the day) were also calculated. This was done by averaging the corresponding values of p_{dh}:

$$p_d = \sum_h \frac{p_{hd}}{12} \quad \text{and} \quad p_h = \sum_d \frac{p_{hd}}{7}.$$

The lower and upper confidence intervals for p_d and p_h were based on the confidence intervals for each p_{dh}, using $\sigma_{dh,l} = p_{dh} - p_{dh,l}$, and $\sigma_{dh,u} = p_{dh,u} - p_{dh}$. Here, the observations for the different groups G_{dh} were considered to be independent observations:

$$\sigma_{d,l}^2 = \sum_h \left(\frac{\sigma_{dh,l}}{12}\right)^2; \ \sigma_{d,u}^2 = \sum_h \left(\frac{\sigma_{dh,u}}{12}\right)^2 \quad \text{and,}$$

$$\text{likewise,} \quad \sigma_{h,l}^2 = \sum_d \left(\frac{\sigma_{dh,u}}{7}\right)^2; \ \sigma_{h,u}^2 = \sum_d \left(\frac{\sigma_{dh,u}}{7}\right)^2$$

Similarly, the average p for all periods, regardless of day or hour, was calculated as

$$p = \sum_d \frac{P_d}{7} = \sum_h \frac{P_h}{12}$$

and the confidence interval $\sigma_l^2 = \sum_d (\sigma_{d,l}/7)^2; \sigma_u^2 = \sum_d (\sigma_{d,u}/7)^2$.

Table 1
Distribution of the breath tested drivers by BAC-class, in g/ℓ.

BAC [g/ℓ]	Number	Proportion
0 ≤ BAC < 0.2	27,222	97.0%
0.2 ≤ BAC < 0.5	500	1.8%
0.5 ≤ BAC < 0.8	190	0.7%
0.8 ≤ BAC < 1.3	83	0.3%
BAC ≥ 1.3	62	0.2%

3. Results

3.1. Study population

A total of 28,057 drivers were breath tested. None of these drivers refused, since refusing to cooperate with a breath test may result in a high penalty in the Netherlands. Breath test based BAC values varied between 0.00 g/ℓ and 2.74 g/ℓ. Table 1 shows the distribution over the different BAC classes.

Of all breath tested drivers, 1.2% were tested positive and were driving with a BAC ≥ 0.5 g/ℓ. The results for the estimated marginal averages (both time of day and day of the week) are both presented in Fig. 2.

Fig. 2 shows that for days of the week, the prevalence of alcohol use was highest on Sunday, followed by Thursday, Saturday and Friday. The prevalence was relatively low on Monday to Wednesday.

For the two-hour periods of all days of the week, prevalence of alcohol among drivers tested was above 2% between 00.00 h and 06.00 h with a peak of more than 4% between 02.00 h and 04.00 h. The prevalence was above average also during evenings between 20.00 h and midnight. In the DRUID study that was used as a basis for this study, no police activities were planned on Mondays between 10.00 h and 16.00 h. Therefore, the three two-hour periods in this time span were not included in the study.

Appendix 1 shows the number of positive drivers n, the total number of tested drivers N, the maximum likelihood estimation of the fraction of positive drivers $p = n/N$ and the 90% confidence interval for each group of test periods G_{dh}. The corresponding marginal values are also given.

The results of the prevalence $n/(n+N)$ of BAC ≥ 0.5 g/ℓ by time of day and day of the week are graphically represented in Fig. 3.

The distribution of samples over the time periods varies between $N = 85$ and $N = 1231$, except for the three periods with 0 or 1 breath tests during the two-hour period. For practical reasons, these periods are assumed to have $p = 0$.

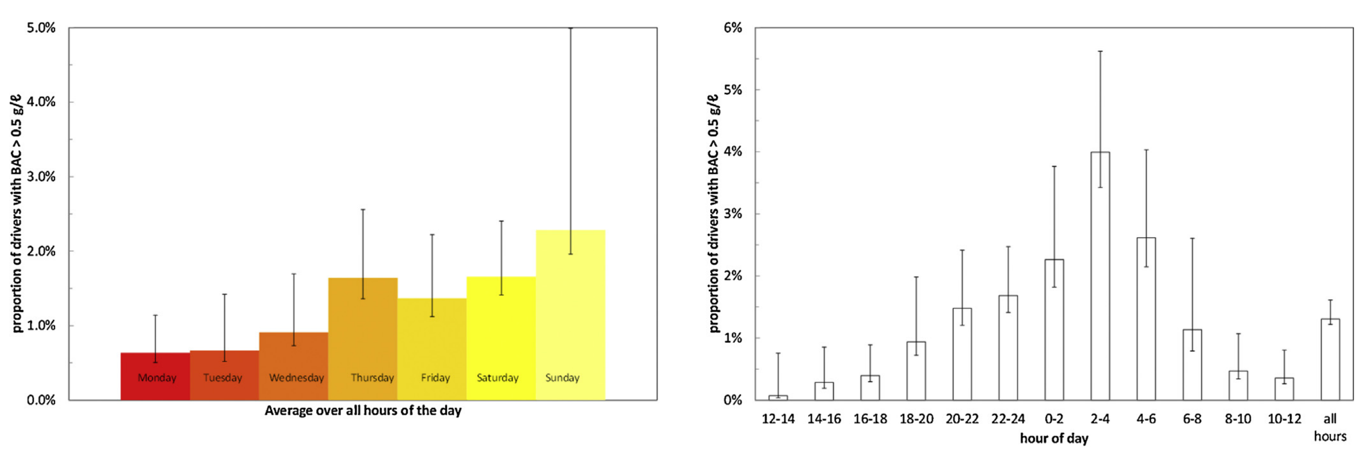

Fig. 2. Average prevalence of BAC ≥ 0.5 g/ℓ in Dutch drivers, stratified by day of the week (left panel) and time of day (right panel), with error bars indicating 90% confidence intervals.

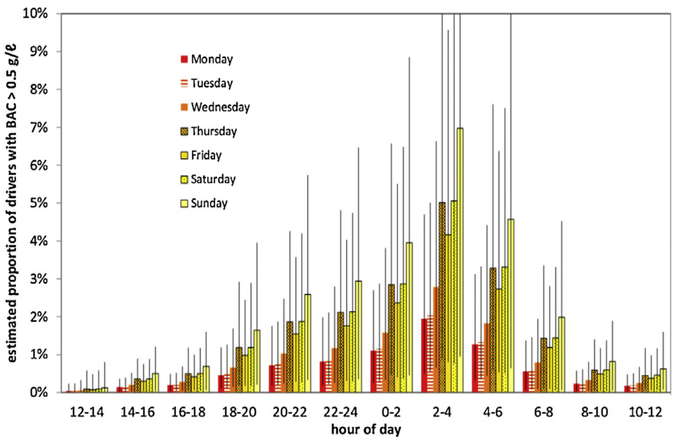

Fig. 3. Maximum likelihood estimations of the prevalence of BAC > 0.5 g/ℓ in Dutch drivers, stratified by day of the week and time of day (two-hour periods).

The results in Appendix 1 and Fig. 3 show that the highest proportions of sampled drivers under the influence of alcohol (i.e. with BAC ≥ 0.5 g/ℓ) were measured on Thursday, Friday, and Saturday mornings between 02.00 h and 04.00 h and on Sunday mornings between 04.00 h and 06.00 h.

On Monday the proportion remains between 1% and 2% (moderate) from midnight to 08.00 h. This is interesting as it confirms the presumption of the Dutch police (Jansen, 2013) that some drinkers on Sunday nights do not realize that their BAC may still be over the legal limit when they drive in traffic the next morning. The relatively high prevalence during rush hour on Monday morning is also in line with the log data from the Finnish alcohol program for drink driving offenders (Löytty, 2013).

Similarly, the prevalence of drink driving was relatively high during the morning rush hour on Friday, which may indicate that some people who have been drinking on the Thursday night step into their vehicles on Friday morning to drive to work. Although the proportions of drink-driving are lower on the Monday and Friday morning than on the Saturday and Sunday morning, the negative road safety effect may be relatively large due to the larger amount of traffic on weekday mornings. During the morning rush hour on Tuesdays, Wednesdays and Thursdays, none of the breath tested drivers had a BAC ≥ 0.5 g/ℓ.

From Monday to Wednesday a low proportion of alcohol offenders was measured outside the peak period between 02.00 h and 06.00 h. On Thursday morning high proportions of sampled drivers under the influence of alcohol were found from midnight to 04.00 h and from 20.00 h until Friday morning 06.00 h, ending with a moderate level of 1.1% during rush hour from 06.00 h to 08.00 h.

Contrary to the Wednesday and Thursday, a low proportion of offenders was detected on Friday between 18.00 and 22.00. Hence, drink driving seems to start later on Friday evening.

On Saturday morning high BAC levels were detected between 02.00 h and 06.00 h with a peak of 7% between 02.00 h and 04.00 h. In the evening moderate BAC levels in traffic were observed between 18.00 h on Saturday and 10.00 h on Sunday morning, with high levels between 22.00 h and 24.00 h on Saturday and between 02.00 h and 08.00 h on Sunday morning. The largest proportion of the entire week was found on Sunday morning between 04.00 h and 06.00 h.

4. Discussion and conclusion

The results of this study indicate differences between the days of the week concerning the hours in which the largest proportions of sampled drink drivers are detected. In general, a relatively high prevalence of drink driving was detected between 02.00 h and 04.00 h. However, on Thursday nights, frequent alcohol use among drivers was already detected from 20.00 h continuing until 06.00 h on Friday morning. In the night from Saturday to Sunday, high prevalence was detected up until 08.00 h in the morning. Furthermore, on Monday and Friday morning during the morning rush hour 1% of the breath tested drivers had a BAC over 0.5 g/ℓ. During the other rush hours of the other days of the week no alcohol use was found.

During the weekend days, the share of drivers with a BAC > 0.5 g/ℓ was lower than 1% only between 10.00 h and 18.00 h. During all other time periods on weekend days at least 1% of the breath tested drivers were driving under the influence of alcohol.

To our knowledge, this is the first study to report on alcohol use in traffic during virtually all times of the day and all days of the week in relatively small two-hour periods (84 different two-hour periods, with data available for 81 time periods). In comparison: the overall results of the European DRUID-project covered eight different time periods (four six-hour periods for both weekdays and weekend days).

The use of small two-hour periods in the present study could be useful for targeting drink driving enforcement activities and other measures to prevent drink driving at specific days of the week and times of the day.

Another strength of this study is that the results were based on random breath testing and not on selective breath testing. In addition, locations were spread over different regions in the Netherlands and breath tests were performed in both urban and rural areas. Furthermore, enforcement activities in this study avoided large scale festivals and other activities which are likely to result in more cases of BAC ≥ 0.5 g/ℓ than in general traffic. The results may therefore be considered as representative for the Netherlands in general.

A limitation of this study is that the results have not been weighted for the distribution of traffic over the different time periods. These analyses may be made in future; the results could be used to assess a potential effect of enhanced drink driving enforcement in the Netherlands. The findings of the present study can be combined with data on the distribution of traffic volume over the time periods concerned.

Whereas the total number of samples is large (28,057), the number of positive samples per two-hour period is relatively small, which increases the confidence intervals. Differences in the prevalence of alcohol in traffic between time periods should therefore be considered with care. The use of larger time periods however, would have limited the level of detail of this study and have prevented obtaining insight in the patterns of alcohol use in traffic in the different days of the week and times of the day.

The results indicate that the use of large time periods leads to loss of information on patterns of the prevalence of driving under the influence of alcohol. An additional disadvantage of large time intervals is that the results from hours with high traffic volumes may be relatively underrepresented due to the fact that police officers are not able to stop all drivers during peak hours. However, depending on the research question, clustering time periods may be more practical.

A study by Li et al. (2013) on prevalence of driving under the influence of alcohol in Hong Kong used results from police enforcement activities during all times of the day and all days of the week as well. Data were clustered in two large time periods: weekend overnight hours (11 p.m.–7 a.m.) and all other hours. Hence, their conclusions were based on these two time intervals and not comparable with the results of the study under scrutiny.

The findings of this study can be used to better design drink driving enforcement activities in the Netherlands. The results indicate that drink driving is not only limited to night-time hours and that considerable differences exist between the different days of the week. Although the weekdays Wednesday and Thursday are generally considered to be work days, drinking patterns in the evening and night from Wednesday to Thursday and from Thursday to Friday seem to resemble weekend evenings and nights more closely than they resemble Monday and Tuesday nights.

Additional breath testing activities may therefore also be useful from a police enforcement perspective on Monday, Friday, and Saturday mornings between 06.00 h and 08.00 h and on Sunday mornings until 10.00 h. However, the consideration for the police whether or not to expand their alcohol breath testing activities to other time periods should not only be based on the prevalence of drivers with a BAC above the legal limit. To create an optimal schedule for police enforcement activities, additional factors such as the costs and the availability of police enforcement, but also external factors such as the traffic volume and the number of alcohol related crashes should be taken into account. Furthermore, it seems that drivers under the influence of alcohol on Monday, Friday, Saturday and Sunday mornings (but also on Saturday and Sunday mornings) are not fully aware of the residual alcohol levels in their blood. It may therefore be helpful to raise awareness on this issue with mass media campaigns.

Appendix 1.

n / N p_{dh} 90% conf int	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	All days	weighted average
	0 / 0	1 / 439	0 / 90	0 / 156	0 / 137	0 / 221	1 / 364	2 / 1407	
12-14		0.23%	0.00%	0.00%	0.00%	0.00%	0.27%	0.07%	0.07%
		0.08% - 1.08%	0.00% - 3.27%	0.00% - 1.90%	0.00% - 2.16%	0.00% - 1.35%	0.10% - 1.30%	0.06% - 0.45%	0.04% - 0.76%
	0 / 0	2 / 706	1 / 121	3 / 532	0 / 234	0 / 592	3 / 922	9 / 3107	
14-16		0.28%	0.83%	0.56%	0.00%	0.00%	0.33%	0.29%	0.29%
		0.12% - 0.89%	0.29% - 3.86%	0.26% - 1.45%	0.00% - 1.27%	0.00% - 0.50%	0.15% - 0.84%	0.17% - 0.50%	0.19% - 0.85%
	1 / 437	1 / 198	2 / 255	1 / 416	0 / 390	6 / 1231	5 / 974	16 / 3901	
16-18	0.23%	0.51%	0.78%	0.24%	0.00%	0.49%	0.51%	0.39%	0.39%
	0.08% - 1.08%	0.18% - 2.37%	0.32% - 2.45%	0.09% - 1.14%	0.00% - 0.77%	0.27% - 0.96%	0.27% - 1.08%	0.28% - 0.62%	0.30% - 0.89%
	1 / 169	0 / 85	2 / 158	2 / 149	1 / 199	5 / 431	6 / 349	17 / 1540	
18-20	0.59%	0.00%	1.27%	1.34%	0.50%	1.16%	1.72%	0.94%	0.94%
	0.21% - 2.78%	0.00% - 3.46%	0.52% - 3.93%	0.55% - 4.16%	0.18% - 2.36%	0.61% - 2.42%	0.95% - 3.36%	0.76% - 1.65%	0.72% - 1.98%
	0 / 295	1 / 109	6 / 338	10 / 276	4 / 471	13 / 982	14 / 748	48 / 3219	
20-22	0.00%	0.92%	1.78%	3.62%	0.85%	1.32%	1.87%	1.48%	1.48%
	0.00% - 1.01%	0.33% - 4.28%	0.98% - 3.47%	2.25% - 6.07%	0.42% - 1.93%	0.86% - 2.10%	1.24% - 2.91%	1.18% - 1.89%	1.21% - 2.42%
	8 / 472	5 / 313	7 / 539	9 / 445	11 / 690	8 / 327	9 / 799	57 / 3585	
22-24	1.69%	1.60%	1.30%	2.02%	1.59%	2.45%	1.13%	1.68%	1.68%
	1.00% - 3.04%	0.84% - 3.33%	0.74% - 2.43%	1.22% - 3.50%	1.01% - 2.62%	1.44% - 4.37%	0.68% - 1.96%	1.29% - 1.98%	1.41% - 2.47%
	4 / 264	2 / 125	1 / 115	7 / 156	7 / 189	5 / 279	3 / 159	29 / 1287	
0-2	1.52%	1.60%	0.87%	4.49%	3.70%	1.79%	1.89%	2.26%	2.26%
	0.75% - 3.43%	0.66% - 4.95%	0.31% - 4.06%	2.58% - 8.26%	2.12% - 6.84%	0.94% - 3.73%	0.86% - 4.80%	1.68% - 3.06%	1.82% - 3.76%
	4 / 404	5 / 250	4 / 140	11 / 203	16 / 282	25 / 359	12 / 296	77 / 1934	
2-4	0.99%	2.00%	2.86%	5.42%	5.67%	6.96%	4.05%	3.99%	3.99%
	0.49% - 2.25%	1.05% - 4.16%	1.42% - 6.42%	3.45% - 8.81%	3.88% - 8.49%	5.12% - 9.59%	2.62% - 6.49%	3.32% - 4.79%	3.43% - 5.62%
	3 / 225	0 / 247	4 / 365	0 / 139	4 / 161	8 / 219	27 / 277	46 / 1633	
4-6	1.33%	0.00%	1.10%	0.00%	2.48%	3.65%	9.75%	2.62%	2.62%
	0.61% - 3.41%	0.00% - 1.21%	0.54% - 2.49%	0.00% - 2.13%	1.23% - 5.59%	2.16% - 6.49%	7.28% - 13.19%	2.23% - 3.59%	2.15% - 4.03%
	2 / 191	0 / 88	0 / 294	0 / 94	1 / 87	2 / 145	5 / 114	10 / 1013	
6-8	1.05%	0.00%	0.00%	0.00%	1.15%	1.38%	4.39%	1.14%	1.14%
	0.43% - 3.26%	0.00% - 3.35%	0.00% - 1.01%	0.00% - 3.14%	0.41% - 5.34%	0.57% - 4.28%	2.32% - 9.00%	0.61% - 1.67%	0.79% - 2.61%
	1 / 438	1 / 179	1 / 629	2 / 206	0 / 253	1 / 505	6 / 512	12 / 2722	
8-10	0.23%	0.56%	0.16%	0.97%	0.00%	0.20%	1.17%	0.47%	0.47%
	0.08% - 1.08%	0.20% - 2.62%	0.06% - 0.75%	0.40% - 3.02%	0.00% - 1.18%	0.07% - 0.94%	0.64% - 2.30%	0.28% - 0.71%	0.34% - 1.07%
	0 / 1	2 / 702	0 / 215	5 / 490	1 / 239	2 / 438	2 / 624	12 / 2709	
10-12		0.28%	0.00%	1.02%	0.42%	0.46%	0.32%	0.36%	0.36%
		0.12% - 0.89%	0.00% - 1.38%	0.53% - 2.13%	0.15% - 1.97%	0.19% - 1.43%	0.13% - 1.01%	0.28% - 0.72%	0.26% - 0.81%
	24 / 2896	20 / 3441	28 / 3259	50 / 3262	45 / 3332	75 / 5729	93 / 6138	335 / 28057	
All hours	0.83%	0.58%	0.86%	1.53%	1.35%	1.31%	1.52%	1.31%	1.31%
	0.60% - 1.16%	0.41% - 0.84%	0.64% - 1.18%	1.22% - 1.94%	1.07% - 1.73%	1.09% - 1.58%	1.28% - 1.80%	1.09% - 1.31%	1.22% - 1.61%
weighted average	0.64%	0.66%	0.91%	1.64%	1.36%	1.66%	2.28%	1.31%	
	0.51% - 1.14%	0.52% - 1.42%	0.73% - 1.69%	1.36% - 2.56%	1.12% - 2.22%	1.41% - 2.40%	1.96% - 3.24%	1.22% - 1.61%	

For every combination of *d* and *h* this table shows a cell with three rows. Each cell shows the numbers of positives *n* and observations *N* on the first row, the estimated fraction of positive drivers p_{dh} on the second row, and its 90% confidence interval on the third row. The last two rows correspond to all hours and the average of all hours; the last two colums correspond to all days and the average for all days respectively. Cells with values of p_{dh} are colored in white and four shades of gray, corresponding to values below 0.5% (white), between 0.5% and 1%, between 1% and 2%, between 2% and 5%, and above 5% (darkest gray).

References

ADV, 2012. Alcoholgebruik van automobilisten in Zeeland. Ontwikkelingen tussen 2004 en 2011. ADV Advies en onderzoek Alcohol, Drugs & Verkeer, Leiden.

Assum, T., Frison, G., Hels, T., Houwing, S., Mathijssen, R., 2007. Uniform Design and Protocols for Carrying out Case–Control Studies. DRUID DRiving Under the Influence of Drugs, Alcohol and Medicines. D2.1.2, Available from http://www.druid-project.eu/

Assum, T., Mathijssen, M.P.M., Houwing, S., 2005. The Prevalence of Drug Driving and Relative Risk Estimations. A Study Conducted in the Netherlands, Norway and United Kingdom. Australian Road Safety Board, Vienna.

Beirness, D.J., Beasley, E.E., 2010. A roadside survey of alcohol and drug use among drivers in British Columbia. Traffic Injury Prev. 11 (3), 215–221.

Belgisch Instituut voor de Verkeersveiligheid, 2010. Rijden onder invloed van alcohol: resultaten van de gedragsmeting 2009. BIVV Belgisch Instituut voor de Verkeersveiligheid, Brussel.

Clopper, C.J., Pearson, E.S., 1934. The use of confidence or fiducial limits illustrated in the case of the binomial. Biometrika 26 (4), 04–413.

DRUID, 2012. Final Report. DRUID Driving Under the Influence of Drugs, Alcohol and Medicines, Available from http://www.druid-project.eu/

DVS, 2008. Rijden onder invloed in weekendnachten 1999–2007. DVS Dienst Verkeer en Scheepvaart, Rotterdam.

DVS, 2011. Rijden onder invloed in Nederland in 2002–2010; Ontwikkeling van het alcoholgebruik van automobilisten in weekendnachten. Dienst Verkeer en Scheepvaart, Rotterdam.

Erke, A., Goldenbeld, C., Vaa, T., 2008. Good Practice in the Selected Key Areas: Speeding, Drink Driving and Seat Belt Wearing: Results from Meta-Analysis. European Commission, Brussels.

ETSC, 1999. Police Enforcement Strategies to Reduce Traffic Casualties in Europe, Brussels.

European Communities, 2013. Prevalence and Rate of Alcohol Consumption, Retrieved August 13th, 2013.

Freeman, J., Liossis, P., Schonfeld, C., Sheehan, M., Siskind, V., Watson, B., 2006. The self-reported impact of legal and non-legal sanctions on a group of recidivist drink drivers. Transport. Res., Part F 9 (1), 53–64.

Gjerde, H., Normann, P.T., Pettersen, B.S., Assum, T., Aldrin, M., Johansen, U., et al., 2008. Prevalence of alcohol and drugs among Norwegian motor vehicle drivers: a roadside survey. Accid. Anal. Prev. 40 (5), 1765–1772.

Henstridge, J., Homely, R., Mackay, P., 1997. The Long-Term Effects of Random Breath Testing in Four Australian States: A Time Series Analysis. Federal Office of Road Safety Canberra, Australia.

Houwing, S., Hagenzieker, M., Mathijssen, R., Bernhoft, I.M., Hels, T., Janstrup, K., et al., 2011. Prevalence of Alcohol and Other Psychoactive Substances in Drivers in General Traffic. Part 1: General results and Part 2: Country Reports. DRUID Driving Under the Influence of Drugs, Alcohol and Medicines, D2.2.3, Available from http://www.druid-project.eu/

Ingsathit, A., Woratanarat, P., Anukarahanonta, T., Rattanasiri, S., Chatchaipun, P., Wattayakorn, K., et al., 2009. Prevalence of psychoactive drug use among drivers in Thailand: a roadside survey. Accid. Anal. Prev. 41 (3), 474–478.

Jansen, R., 2013. Dutch Police Academy, Personal communication.

Kim, K., Nitz, L., Richardson, J., Li, L., 1995. Personal and behavioral predictors of automobile crash and injury severity. Accid. Anal. Prev. 27 (4), 469–481.

Krismann, M., Schoech, H., Knoche, A., Hargutt, V., Klipp, S., 2011. Evaluation of Legal Measures to Combat DUI/DUID DRUID Driving Under the Influence of Drugs, Alcohol and Medicines. Deliverable 1.4.1, www.druid-project

Lacey, J.H., Kelley-Baker, T., Furr-Holden, D., Voas, R.B., Romano, E., Ramirez, A., et al., 2009. 2007 National Roadside Survey of Alcohol and Drug Use by Drivers. National Highway Traffic Safety Administration, Washington, DC.

Li, Y.C., Sze, N.N., Wong, S.C., 2013. Spatial–temporal analysis of drink-driving patterns in Hong Kong. Accid. Anal. Prev. 59, 415–424.

Löytty, M., 2013. Evaluation of the interlock programme for DUI offenders in Finland. In: ICADTS T2013, Brisbane.

Mathijssen, M.P.M., 2001. Rijden onder invloed en het politietoezicht daarop. Voormeting uitgevoerd in 1999/2000 ter bepaling van de effecten van toekomstig verhoogd toezicht, vergezeld van aanbevelingen voor de inrichting van het toezicht. SWOV Institute for Road Safety Research, Leidschendam.

Mathijssen, M.P.M., 2005. Drink driving policy and road safety in the Netherlands: a retrospective analysis. Transport. Res., Part E 41 (5), 395–408.

Mathijssen, M.P.M., Twisk, D.A.M., 2001. Opname en afbraak van alcohol in het menselijk lichaam. Stichting Wetenschappelijk Onderzoek Verkeersveiligheid, R-2001-19, Leidschendam.

Österberg, E., Karlsson, T., 2002. Alcohol Policies in EU Member States and Norway: A Collection of Country Reports. Stakes, Helsinki.

Peden, M., Scurfield, R., Sleet, D., Mohan, D., Hyder, A.A., Jarawan, E., et al., 2004. World Report on Road Traffic Injury Prevention. WHO, World Health Organization, Geneva.

Sweedler, B.M., Stewart, K., 2009. Worldwide Trends in Alcohol and Drug Impaired Driving. Drugs, Driving and Traffic Safety, Birkhäuser, Basel, pp. 23–41.