

Age and Gender-Related Differences in Blood and Breath-alcohol Concentration among Drinking Drivers in Sweden

Berglund, K.¹ and Jones, A.W.²

¹ National Laboratory of Forensic Science, Linköping, Sweden.

² Laboratory of Forensic Medicine, University Hospital, Linköping, Sweden.

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Abstract

Age and gender-related differences in blood- and breath-alcohol concentrations were investigated among drinking drivers apprehended in Sweden between 1994 and 1998. During this 5-year period the number of suspects decreased appreciably from 21000 to 14600. The concentration of alcohol was below the statutory limits (0.2 mg/g blood or 0.1 mg/L breath) in about 20% of suspects after making an allowance for uncertainty. About 11% of all drunk drivers were women. The mean concentration of alcohol was about 50% higher for those who gave blood samples compared with evidential breath tests regardless of gender. The median age of drunk drivers tended to be higher for women than for men but the average alcohol concentration was higher for men than for women. The average alcohol concentration for all groups regardless of gender increased between 1995 and 1998. The age distribution changed over the period studied with the proportion of drivers between 20-29 years decreasing and those aged 50 and over increasing. This trend was consistent in all subgroups so the average and median ages of drunk drivers in Sweden increased. This survey shows that drinking drivers in Sweden are getting fewer, older and drunker.

Introduction

Breath-alcohol testing evidential purposes started to be used by the Swedish police on 1st July 1989. The Intoxilyzer 5000, a quantitative infrared analyzer, with software modified according to the special requirements for Sweden has been the only approved instrument. Both blood- and breath-alcohol concentration are accepted as evidence for prosecuting drunk drivers and the statutory *per se* limits are 0.10 mg/L for breath and 0.20 mg/g for blood. Higher alcohol limits, which carry more serious penalties, are set at 1.00 mg/g blood and 0.50 mg/L breath called aggravated drunk driving. The mean of duplicate determinations of the alcohol concentration in blood or breath is used for prosecution after making a deduction to guarantee that the final result is not less than the value reported with 99.9% confidence. For the breath-alcohol tests made with Intoxilyzer 5000S, a constant amount of 0.07 mg/L is subtracted whereas for blood-alcohol analysis, 0.06 mg/g is deducted at a threshold concentration of 0.20 mg/g and 0.08 mg/g at 1.0 mg/g.

During an evidential breath-alcohol test, the suspect is allowed two attempts at providing a sufficient volume of breath sample. If this is unsuccessful a specimen of venous blood is taken instead. About 7% of those tested with Intoxilyzer 5000S failed to produce an approved sample, which means that about 700 or 16% (for 1998) of the blood samples are derived from disallowed breath tests.

The organisation and procedures for evidential blood- and breath-alcohol testing in Sweden have been described elsewhere and will not be treated here (1, 2). Presently, there are 160 Intoxilyzer 5000S instruments used throughout a country the size of California but with a population of 8.8 million. In some rural areas it is often more practical to take blood samples than breath samples for legal purposes.

Material and Methods

Results from blood- and breath tests from suspected drinking drivers in Sweden are stored in two databases, which also contain the date of birth and gender of the subject. Information collected during the period 1994 to 1998 was retrieved and divided into four groups: blood-tests men, blood-tests women, breath-tests men and breath-tests women. The age distributions, the concentrations of alcohol, and the average and median ages for each group were calculated.

Results

Trends in number of blood and breath-tests

After 1990, which was the first full year of evidential breath testing, the number of blood tests decreased and the breath tests increased. The total number of suspected drunk drivers reached its highest level in 1991. From 1993 both breath- and blood tests have decreased. From 1994 to 1998 the number of tests have decreased by 30%, in the same proportion for men and women. For the blood tests, the reduction is less than for breath tests, 24% and 33% respectively. Among women there seems to be a redistribution from breath to blood tests; blood tests have decreased only by 18%, compared with 37% for breath tests.

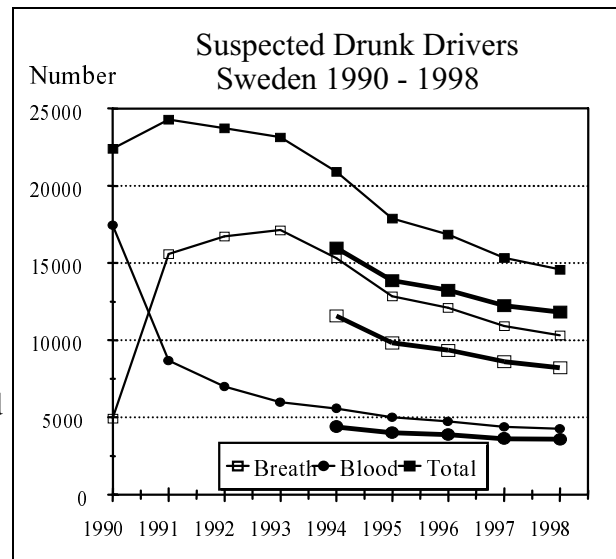


Fig. 1

Fig 1. The number of tests performed with suspected drinking drivers (thin lines) and the number of suspects with alcohol concentrations over the lower legal limit (thick lines).

Relationship blood and breath-alcohol for men and women

The proportions of blood- and breath tests were rather constant from 1994-1998 with about 72% breath tests and 28% blood tests, even though the total numbers of apprehended drivers dropped dramatically.

The relative proportion of men and women has remained remarkably constant during the past five years at about 89% men and 11% women. During the same period the proportion of blood tests increased slightly. The men/women relationship among drunk drivers depends on whether blood or breath was taken for alcohol analysis. One explanation appears to be that women in general, and especially those who smoke, have small stature, are elderly and have consumed a lot of alcohol have more difficulty providing a sufficient breath sample. The fact that women are “over-represented” among those who provide blood leads to means gender-

related differences in the proportions of blood and breath tests conducted being 40 to 60 for women compared with 25 to 75 for men (see Table 1).

Table 1. Blood/breath men/women relationship

		1994	1995	1996	1997	1998
All subjects	Blood Tests, %	26.8	28.1	28.2	28.7	29.2
	Breath Tests, %	73.2	71.9	71.8	71.3	70.8
	Men, %	89.1	88.4	88.7	88.4	89.0
	Women, %	10.9	11.6	11.3	11.6	11.0
Blood Tests	Men, %	85.4	82.3	83.6	83.6	84.5
	Women, %	14.6	17.7	16.4	16.4	15.5
Breath Tests	Men, %	90.4	90.8	90.7	90.3	90.9
	Women, %	9.6	9.2	9.3	9.7	9.1
Men	Blood Tests, %	25.7	26.2	26.6	27.1	27.7
	Breath Tests, %	74.3	73.8	73.4	72.9	72.3
Women	Blood Tests, %	35.6	42.8	40.9	40.5	41.4
	Breath Tests, %	64.4	57.2	59.1	59.5	58.6

Age distributions

In all groups, men and women, blood and breath tests, there is the same tendency towards older ages. The proportion of young drivers, 16 - 19 years old, has changed very little, while the 20 - 29 years group decreased from about 26 to 21% and in the 50 - 59 y group increased from 14 to 18%.

The average age of drunk drivers has increased from 37.7 to 39.3 years during the period 1994 to 1998. The increase is greater for women than for men. The average age is highest for the blood-tested women and lowest for the blood-tested men and the breath tested women.

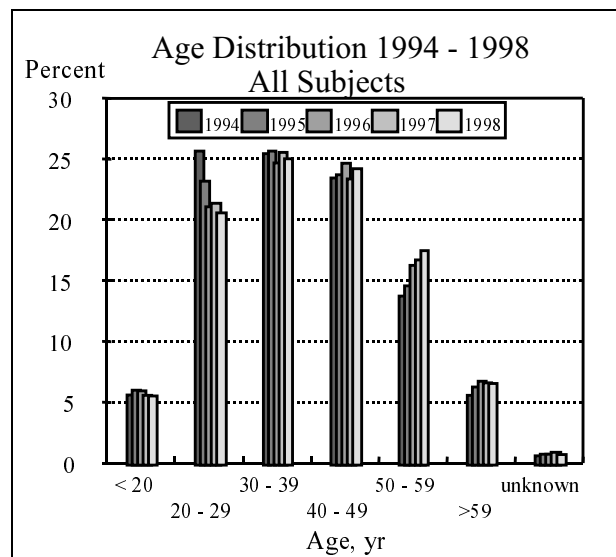


Fig. 2

Fig. 2 shows the age distribution for all subjects during the period 1994 - 1998.

The standard deviation of the age in the whole population of drunk drivers was 13 years and this figure has changed very little over the period studied. It is about one year lower for women than for men. The greatest change was among blood tested women with an increase of 0.8 years. The median age was in general a bit lower than the average age. The difference between average and median was greater for males than for females and was smallest among breath-tested women.

Alcohol concentration distributions

To compare the concentrations of alcohol in blood and breath, we expressed the breath alcohol test results as mg/2 L breath, which brings the values much closer to the measured blood-alcohol concentration expressed as promille or mg/g blood.

Table 2. Changes in Average Age, Standard deviation and Median Age for Suspected Drunk Drivers in Sweden 1994 - 1998.

	Average age 1994 and change, yr.	S.D. for age 1994 and change, yr.	Median age 1994 and change, yr.	Numbers of suspects and change, %
All Suspects	37.7 + 1.6	12.9 + 0.3	36.8 + 2.1	20914 - 30.3
All Women	37.3 + 2.4	11.6 + 0.3	37.3 + 2.4	2288 - 30.2
All Men	37.7 + 1.6	13.1 + 0.2	36.8 + 2.0	18626 - 30.3
All Blood Tests	37.6 + 1.6	13.0 + 0.4	36.2 + 2.2	5596 - 23.2
All Breath Tests	37.7 + 1.7	12.9 + 0.2	37.1 + 2.0	15318 - 32.7
Women Blood Tests	37.8 + 2.6	11.7 + 0.8	37.7 + 2.2	815 - 18.5
Women Breath Tests	37.0 + 2.2	11.6 - 0.1	37.1 + 2.4	1473 - 36.7
Men Blood Tests	37.5 + 1.5	13.2 + 0.4	36.0 + 2.2	4781 - 24.7
Men Breath Tests	37.8 + 1.6	13.0 + 0.2	37.1 + 2.0	13845 - 32.3

There is an interesting difference between the alcohol concentration patterns for blood and breath tests, which is about the same for men and women over the 5 year period. Disregarding alcohol concentration below the legal limits, a greater proportion of individuals with higher concentrations of alcohol were evident among those who gave blood samples. For breath tests the situation was quite the opposite; the greater proportion of suspects was seen at the lower alcohol concentrations. The blood-tested men and the breath-tested women illustrate this pattern best (see figs 3 and 4).

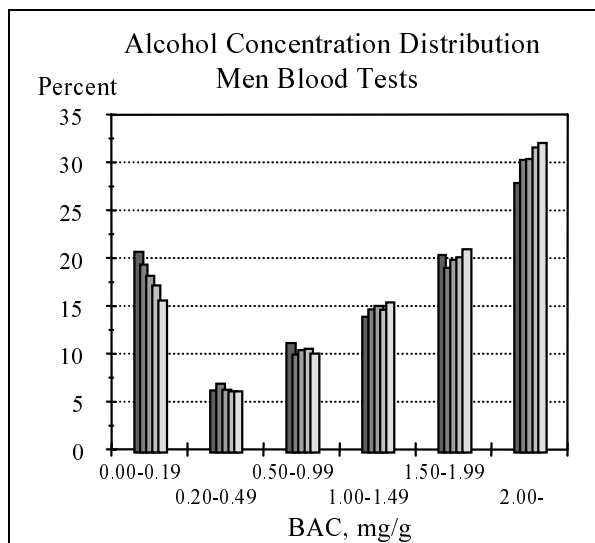


Fig. 3

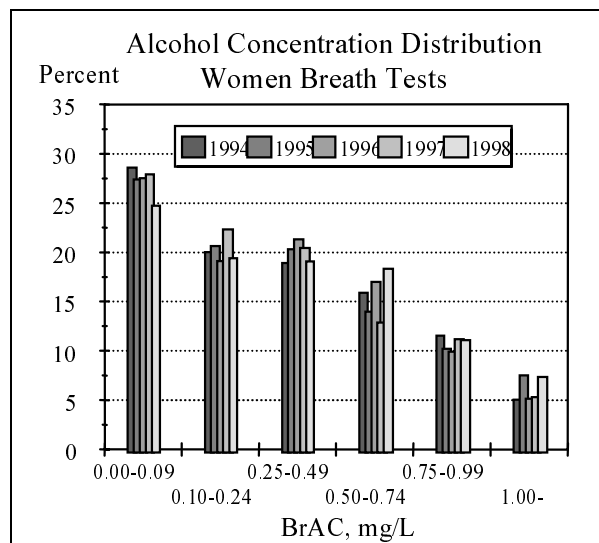


Fig. 4

The proportion of suspects with alcohol concentration below the legal limit has decreased from approximately 24 to 19% whereas the proportion with the highest concentrations (more than 1 mg/g) has increased from 44 to 49%.

Average alcohol concentrations

The average alcohol concentration has increased by about 9% between 1995 to 1998. The increase is greater for women than for men, 11% compared to 9%. The blood tests have increased less than the breath tests, 8% and 9% respectively, but the blood-tested women have increased their average alcohol concentration by 15%, while the increase for the breath-tested women was only 7.5%. The average alcohol concentration is 4-7% higher for men than for women.

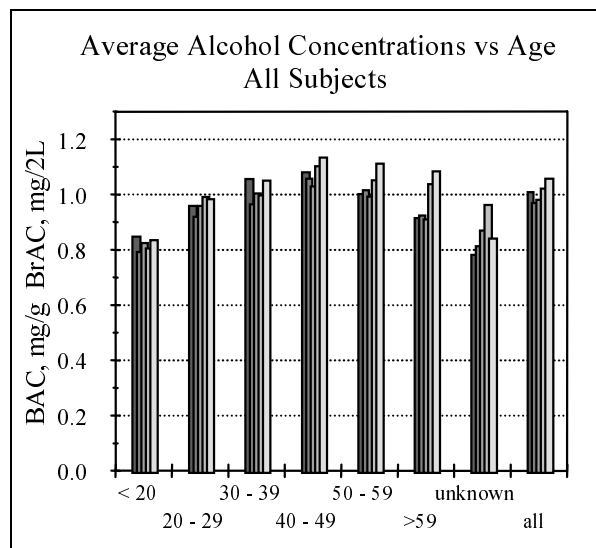
Table 3. Average alcohol concentrations (after deduction for uncertainty)

		1994	1995	1996	1997	1998
All suspects	BAC, mg/g or BrAC,mg/2L	1.01 n=20914	0.97 n=17878	0.98 n=16858	1.02 n=15325	1.06 n=14583
All Women	BAC, mg/g or BrAC,mg/2L	0.95 n=2288	0.92 n=2076	0.94 n=1911	0.96 n=1776	1.02 n=1600
All Men	BAC, mg/g or BrAC,mg/2L	1.02 n=18626	0.98 n=15802	0.99 n=14947	1.03 n=13549	1.06 n=12983
All Blood	BAC, mg/g	1.53 n=5596	1.34 n=5024	1.37 n=4750	1.41 n=4397	1.44 n=4260
All Breath	BrAC,mg/2L	0.82 n=15318	0.83 n=12854	0.83 n=12108	0.86 n=10928	0.90 n=10323
Women Blood	BAC, mg/g	1.35 n=815	1.14 n=889	1.24 n=781	1.33 n=719	1.32 n=662
Women Breath	BrAC,mg/2L	0.73 n=1473	0.75 n=1187	0.74 n=1130	0.72 n=1057	0.81 n=938
Men Blood	BAC, mg/g	1.56 n=4781	1.38 n=4135	1.40 n=3969	1.43 n=3678	1.46 n=3598
Men Breath	BrAC,mg/2L	0.83 n=13845	0.83 n=11667	0.84 n=10978	0.88 n=9871	0.91 n=9385

Alcohol concentrations vs age

The average alcohol concentration was lowest for those under 20 and highest for those 40 to 49 years. The difference was 0.2 – 0.3 mg/g as shown in **Fig. 5**.

The difference between the average for men and women was only about 0.05 mg/g. There is a greater difference for the younger than the middle-aged and older groups. For all ages there is a significant difference in alcohol concentrations between breath and blood tests. The average alcohol concentration is about 50% higher for the blood tests, and the difference is greatest for those aged over 40 years.

**Fig. 5**

Women

About 11% of all drunk drivers were women and about 40% for those who were blood-tested. One reason why more women than men provide a blood sample is that women have greater difficulties than men to provide an approved evidential breath test. The women that take blood tests are in average about one year older than those who take breath tests. Moreover, their alcohol concentrations are also 1.5 to 1.9 times higher than those breath-tested, but that does not differ from the situation among men. The average alcohol concentration among blood-tested women in average has increased by 15% from 1995 to 1998, while the increase among breath-tested women is 7%. The increase among both blood- and breath-tested individuals has occurred in the age groups over 20 years, while there has been a decrease in the youngest age group.

Teenagers

About 6% of all apprehended drivers were younger than 20 years and this figure has not changed very much over the period studied from 1994 to 1998. Those below 20 years, like the situation as a whole, has decreased by 31 %. Women have decreased significantly more than the men; 56 % compared to 28 %. Thus, the teenage girls have diminished their part from 9.8 to 6.3 % in the whole group.

The proportion of teenagers providing blood vs breath was similar for the subjects as a whole with about 26 % blood tests and 74 % breath tests.

Table 4. Average Alcohol Concentrations (after deduction) in teenagers.

		1994	1995	1996	1997	1998
All suspects	BAC, mg/g or BrAC,mg/2L	0.85 n=1168	0.79 n=1067	0.82 n=1000	0.80 n=854	0.84 n=806
All Women	BAC, mg/g or BrAC,mg/2L	0.72 n=115	0.70 n=95	0.71 n=87	0.72 n=70	0.62 n=51
All Men	BAC, mg/g or BrAC,mg/2L	0.86 n=1053	0.80 n=972	0.84 n=913	0.81 n=784	0.85 n=755
All Blood	BAC, mg/g	1.14 n=305	1.06 n=256	1.01 n=296	0.99 n=251	1.05 n=211
All Breath	BrAC,mg/2L	0.74 n=863	0.71 n=811	0.75 n=704	0.73 n=603	0.76 n=595
Women Blood	BAC, mg/g	0.96 n=37	0.89 n=28	0.86 n=28	0.88 n=31	0.81 n=18
Women Breath	BrAC,mg/2L	0.60 n=78	0.63 n=67	0.64 n=59	0.58 n=39	0.52 n=33
Men Blood	BAC, mg/g	1.16 n=268	1.08 n=228	1.02 n=268	1.00 n=220	1.07 n=193
Men Breath	BrAC,mg/2L	0.76 n=785	0.71 n=744	0.76 n=645	0.74 n=564	0.77 n=562

Conclusion

The number of suspected drinking drivers in Sweden has decreased dramatically by about 30% from 1994 to 1998. Over the same period, the average and median age of the suspects has increased by about 2 years. The relative proportion of men and women providing blood- and breath-tests has been remarkably constant over the period studied, although there was a tendency towards an increase in the proportion providing blood specimens especially among the women.

The average concentration of alcohol when drunk drivers were apprehended has increased since 1995 and this finding holds for all age groups of men and women and for blood- and breath tests. The change observed is greater for women than for men and especially among women who provided blood samples. In a survey from 1967 (3), 1.5% of all drunk drivers were women, which compares with 6.2% in 1986 (4) and 11% in 1998. The change in average alcohol concentrations cannot be compared so easily over time because the legal limits for driving were lowered from 0.50 to 0.20 mg/g in 1990 and the limit for aggravated drunk driving was lowered from 1.50 mg/g to 1.00 mg/g in 1994.

To sum up our findings, it seems that drunk drivers in Sweden are getting fewer, older and drunker.

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