Michael Sørensen
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TØI report 985/2008

Institute of Transport Economics
Norwegian Centre for Transport Research

Safety Performance Indicator for Alcohol in the SafetyNet Project

- Data quality in selected countries and comparison with other alcohol indicators

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Summary:
In the European SafetyNet project, safety performance indicators (SPIs) have been developed for 7 areas, including alcohol. The SPIs are used to indicate and compare road safety performance in different countries and years. The alcohol SPI is defined as the percentage of fatalities resulting from accidents involving at least one driver impaired by alcohol. The alcohol SPI for 26 countries varies from 4.4 % to 72.2 %. The question whether extreme values reflect the real situation or if there is a methodological explanation is studied in this report. The results indicate that there is a need to improve the data quality. Until these improvements are made, it is difficult to compare the alcohol SPI results across countries.

Tittel: Trafikksikkerhetsindikatoren for alkohol i Safetynet - Datakvalitet i utvalgte land og sammenligning med andre alkoholindikatorer

Forfatter(e): *Michael Sørensen; Terje Assum*

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Sammendrag:
I EU-prosjektet SafetyNet er trafikksikkerhetsindikatorer blitt utviklet for 7 parametre, herunder alkohol. Indikatorene benyttes til å indikere og sammenligne trafikksikkerhetsnivået i ulike land. Alkohol-indikatoren er definert som andel drepte i ulykker hvor minimum en fører har vært påvirket av alkohol. En beregning av alkohol-indikatoren for 26 land viser at den varierer mellom 4,4 % og 72,2 %. I denne rapporten er det undersøkt om ekstreme verdier er et uttrykk for den virkelige situasjon eller om der er metodemessige forklaringer. Undersøkelsene viser at det er behov for bedre data. Inntil disse forbedringene er gjennomført, er det vanskelig å sammenligne alkohol-indikatorene for ulike land.

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Preface

This report is part of Work Package 3 (Safety Performance Indicators) of the European SafetyNet project, which consists of seven work packages. The objective of the SafetyNet project has been to build the framework of a European Road Safety Observatory (www.erso.eu).

The main objective of work package 3 is to develop and monitor a set of Safety Performance Indicators (SPIs). SPIs have been developed for seven areas. SPIs are used to indicate and compare road safety performance in different countries and to understand the process leading to accidents and helping to decide the measures to reduce them.

This report focuses only on the alcohol SPI. The alcohol SPI is defined as the percentage of fatalities resulting from accidents involving at least one driver impaired by alcohol. A calculation of the alcohol SPI for 26 countries shows that the SPI varies from 4.4 % to 72.2 %. This result gives rise to the question whether extreme values reflect the real situation or if there is a methodological explanation. The report tries to answer this question.

The project has been funded by the European Commission, the Research Council of Norway, the Norwegian Public Roads Administration and the Norwegian Ministry of Transport and Communications.

Research Engineer Michael Sørensen and Senior Research Sociologist Terje Assum have written this report. Terje Assum has been project manager. The report has been externally reviewed by sociologist Heikki Jähi from INRETS (The French National Institute for Transport and Safety Research). Secretary Trude Rømming has prepared the text for printing.

The report has also been published as deliverable 3.10a in the report series of Work Package 3 of the SafetyNet project.

Oslo, October 2008
Institute of Transport Economics

Lasse Fridstrøm
Managing Director

Marika Kolbenstvedt
Head of department

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Summary:

Safety Performance Indicator for Alcohol in the SafetyNet Project

- Data quality in selected countries and comparison with other alcohol indicators

The European SafetyNet project has developed a safety performance indicator (SPI) for fatalities in alcohol related road accidents, in order to facilitate indication and comparison of road safety performance in different countries and for different years. However, the data used for calculation of the SPI are not reliable for all countries. Until the data quality are improved, comparison across countries should be made with caution.

Is the indicator correct?

In the European SafetyNet project, safety performance indicators (SPIs) have been developed for seven areas, including the use of alcohol in road traffic. SPIs are used to indicate and compare road safety performance in different countries, to understand the process leading to accidents, and to help decide on the measures to reduce them. The alcohol SPI is defined as the percentage of fatalities resulting from accidents involving at least one driver impaired by alcohol.

A calculation of the alcohol SPI for 26 countries shows that the SPI varies from 4.4 % in Bulgaria to 72.2 % in Italy. Figure S.1 shows the SPI for all countries included.

The large variation between the very low and very high indicators raises the question if the alcohol SPI results can be trusted for comparison as intended. The following questions are examined:

1. Do the SPI results reflect the real situation in the different countries?
2. Is there a methodological explanation to the differences, such as incomplete and unreliable data or different ways of collecting data or calculating the SPI?

To answer these questions three different studies have been formed:

1. Comparison with other alcohol SPI calculations
2. In-depth studies of data quality in five selected countries
3. Study of correlations between the SPI and possible influencing factors.

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Three systems of SPIs with differing results

Figure S.1 compares the alcohol SPI for SafetyNet 2005 to SPIs from the European Transport Safety Council (ETSC) and the World Health Organization (WHO), which have also developed different sets of SPIs for road accidents.

The ETSC SPI focuses on annual changes. However, it is also possible to calculate an SPI similar to the SafetyNet SPI. The WHO SPI is defined as accidents involving alcohol per accident with injury and cannot be compared directly to the SafetyNet SPI. However, the two rankings should correlate if data for the two rankings are correct.

The comparison between SafetyNet and ETSC reveals some interesting similarities and differences. Italy has an extremely high SafetyNet SPI value, 72.2 % and an extremely low ETSC value, 1.8 %. In other words Italy is ranked as the worst country in SafetyNet and as the best country in ETSC. There are also large differences for Slovenia, Germany, Spain, Sweden, Norway, Denmark, the Netherlands, and Estonia. These differences are between 5 and 26 percentage points. This means that only half the countries have a good accordance between the two systems of safety performance indicators.

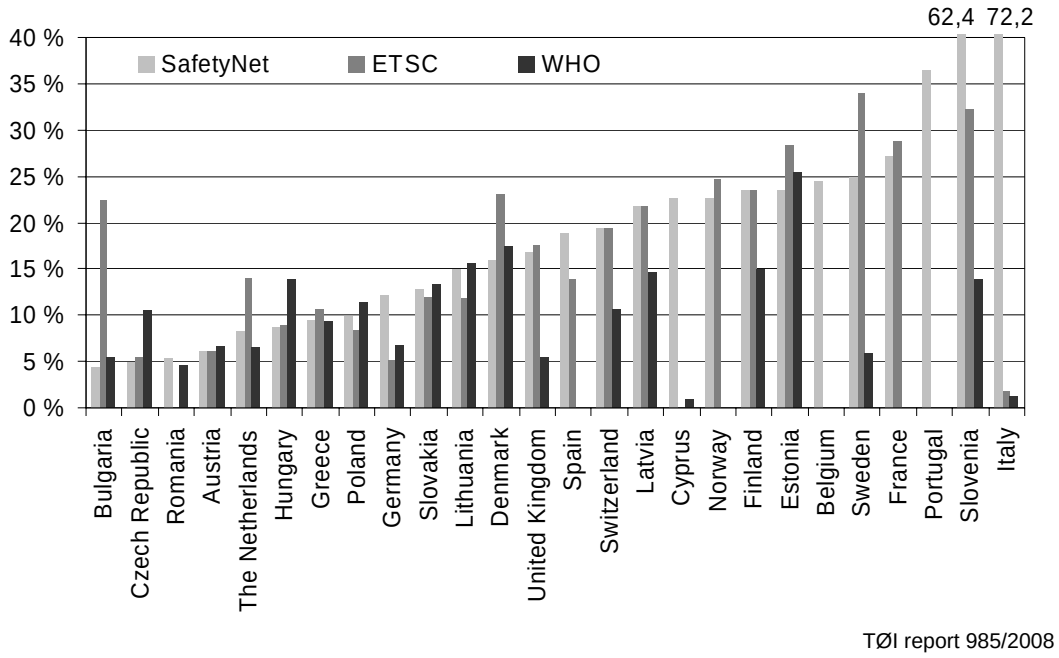

Figure S.1. Alcohol safety performance indicator for SafetyNet 2005, ETSC 2005 and WHO 2005 for 26 European countries. The countries are ranked by SPI for SafetyNet 2005. All countries are not included in all three rankings. Numbers for SafetyNet 2007 are used for Bulgaria, Romania and Slovenia. WHO SPI cannot be compared directly to the other SPIs because it is based on accidents rather than fatalities.

The comparison between SafetyNet and WHO are done by comparing the country ranks. The correlation between the two ranks is calculated to 0.07, i.e. the comparison shows no correlation. The largest negative differences, calculated as the rank for SPI minus the rank for WHO, are found for Hungary, the Czech Republic, Lithuania and Denmark. This means that these countries have a low or medium SafetyNet SPI and a high WHO SPI. The largest positive differences are

found for Italy, Sweden and Cyprus, which also had the largest positive differences in the comparison between SafetyNet and ETSC.

A WHO SPI calculated as accidents involving alcohol per 100,000 persons has also been compared to the SafetyNet alcohol SPI. This correlation is -0.11, an even more unexpected result.

These three comparisons indicate clearly that at least one or two of the data sources are unreliable for several countries.

Unreliable data for four out of five selected countries

Studies of the quality of the data provided for the calculation of the SPI have been carried out for the Czech Republic, Austria, Norway, Sweden and France. The Czech Republic and Austria were chosen because they had the lowest and second lowest SPI in SafetyNet 2005. France was chosen because it had the second highest alcohol SPI in SafetyNet 2005 and because it was impossible to make a reasonable study for Italy. Sweden and Norway also had high SPI results, but not the most extreme. However, they have a high SPI even though they have very low alcohol consumption and are among the safest countries in Europe.

The results of the studies are summarized in table S.1. For France it is concluded that the SPI is likely to have the right level. For Austria and the Czech Republic the conclusions are that the SPIs provided are too low, but it is difficult to make exact estimates of the SPI. For both Austria and the Czech Republic the SPIs are estimated to be about 18-19 %. For Sweden and Norway the new estimates made are considerably lower than the ones provided to SafetyNet.

Table S.1. Alcohol SPI from SafetyNet 2005 and the in-depth studies for five countries.

	The Czech Rep.	Austria	Norway	Sweden	France
SPI	4.8 % → (18.8 %)	5.9 % → (18.0 %)	22.2 % → 11.1 %	25.0 % → 16.0 %	27.2 %

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Of a total of five countries studied, the data quality is considered good enough for only one. Consequently, there may be reason to believe that more countries have incomplete data as bases for the calculation of their alcohol SPI.

There are several reasons found in the study that could explain why the data sets are incomplete:

- The costs of autopsy of killed drivers are perceived as too high when there is no reason to check for alcohol as the killed drivers cannot be prosecuted.
- Testing people killed in accidents may be legally prohibited unless there is a strong suspicion.
- Privacy. Even if autopsies including alcohol analysis are carried out, the results are not reported back to the police for reasons of privacy.
- Time-consuming routines. The police may have to make formal requests to the hospitals to get the results of the autopsy.
- When the person dies several days after the accident it is too late to check the BAC.
- Data needed are collected, but no statistics are compiled or the statistics are published in a way that makes the SPI calculation impossible.

No correlation with possible influencing factors

Apart from methodological reasons, variation in the alcohol SPI could to some extent be explained by and be expected to correlate with all or some of the factors:

1. Legal BAC limits
2. Drink-driving prevalence
3. Alcohol consumption
4. Motorisation
5. Self-reported behaviour
6. Demographic factors
7. Norms and culture
8. Enforcement
9. Information campaigns
10. Driver training.

In this project the correlations between the SPI and the legal BAC limit, drink-driving prevalence, alcohol consumption, motorisation, and self-reported behaviour are studied. These factors have been chosen because existing relevant data for these factors can be used in an analysis.

Table S.2 summarizes the results. Surprisingly there is no correlation or only a very small correlation between the rank for SPI and the rank for possible influencing factors. The largest correlation is found for self-reported behaviour, where car drivers are asked how many times they have been drinking and driving last week. The second largest correlation is found for motorisation. The correlations for alcohol prevalence and alcohol consumption are only 0.15 and 0.17.

Table S.2. Correlation between country ranking for the SafetyNet Alcohol SPI 2005 and country ranking for possible influencing factors.

					Self-reported behaviour		
	BAC limit	Prevalence	Consumption	Motorisation	Drink and drive last week	Accident cause	Controls
Correlation	0.10 (R^2)	0.15	0.17	0.32	0.36	-0.26	-0.12

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Two overall explanations for the missing correlation are possible. Either 1) some of the data for the SPIs or the possible influencing factors may be incorrect, biased or not representative or 2) the assumed correlation between SPI and the other indicators does not exist because the SPI to a greater extent correlate with factors not included in this study, such as demographic factors, norms and culture, or information campaigns and driver training.

Only further research can decide whether this lack of correlation is due to poor quality of the SPI data or to substantive reasons, but this lack of correlation is an indication that there may be problems with the quality of the SPI data.

Improved data quality

The three studies show clearly that there is a need to improve the quality of the data on the basis of which the alcohol SPI is calculated. The following information should be reported:

- The total number of drivers involved in fatal accidents
- The number tested for alcohol and the number not tested
- The number of alcohol positive and negative drivers among those tested.

When these figures are made available, adjusted SPI results can be estimated. Until these improvements are made, it is advisable to exercise great caution when comparing alcohol SPI results across countries.

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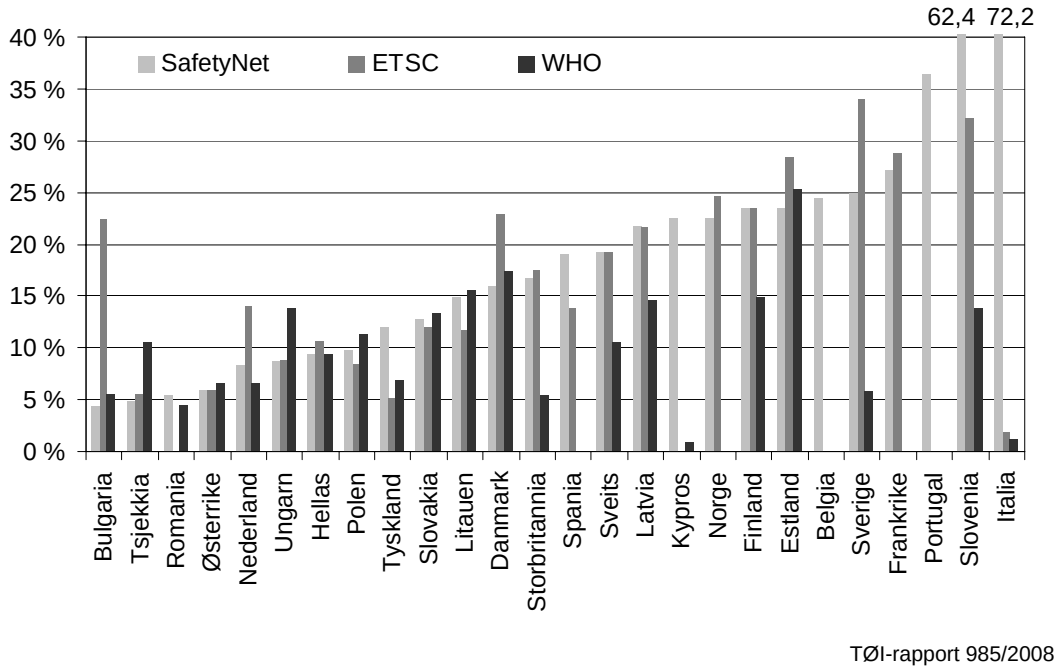
Sammendrag:

Trafikksikkerhetsindikatoren for alkohol i Safetynet

- Datakvalitet i utvalgte land og sammenligning med andre alkoholindikatorer

I EU-prosjektet SafetyNet er trafikksikkerhetsindikatorer utviklet for 7 parametre, herunder alkohol. Indikatorene benyttes til å indikere og sammenligne trafikksikkerhetsnivået i ulike land. Alkohol-indikatoren er definert som andel drepte i ulykker hvor minimum en fører har vært påvirket av alkohol. En beregning av alkohol-indikatoren for 26 land viser at den varierer mellom 4,4 % og 72,2 %. I denne rapporten er det undersøkt om ekstreme verdier er et uttrykk for den virkelige situasjon eller om der er metodemessige forklaringer. Undersøkelsene viser at det er behov for bedre data. Inntil disse forbedringene er gjennomført, er det vanskelig å sammenligne alkohol-indikatorene for ulike land.



Figur S.1. Trafikksikkerhetsindikatoren for alkohol for SafetyNet 2005, ETSC 2005 og WHO 2005 for 26 europeiske land. Landene er rangert etter indikatoren for SafetyNet 2005. Alle land er ikke inkludert I alle tre rangeringer. Tallene for SafetyNet 2007 er brukt for Bulgaria, Romania og Slovenia. WHO indikatoren kan ikke sammenlignes direkte med de andre indikatorene fordi den er basert på ulykker, ikke på drepte.

Rapporten kan bestilles fra:
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1 Introduction

1.1 Background

Road safety research has through the years revealed a number of risk factors, such as high speed, alcohol impairment, lack of protection, poor light conditions etc. A risk factor for accidents is any factor that increases the probability of accident occurrence (Elvik & Vaa, 2004, pp. 48-66). Thus, for road safety authorities it is important to control such factors, to know whether a particular risk factor is becoming more or less important in their country or region, and to know how these risk factors compare with other countries.

Road safety authorities on national and provincial levels need some indications on the state of road safety in the country or other geographical area, and valid time series for road safety. The numbers of road accidents, fatalities and injuries are of course the most important indications of the road safety situation, but these statistics do not show in detail the causes or risk factors producing the road accident problems. Safety Performance Indicators (SPIs) can show in more detail the state of risk factors and the trends in these as well as the potential for reduction of this kind of accidents.

A work package within the European SafetyNet project has developed methods for data collection and estimation of such SPIs and done the collection and estimation for a majority of European countries.

1.2 Safety performance indicators

Work package 3 in the SafetyNet project deals with safety performance indicators (SPIs). According to Vis (Ed., 2005, p. 13) *"Safety Performance Indicators are the measures (indicators), reflecting those operational conditions of the road traffic system, which influence the system's safety performance"*.

That is, SPIs may be described as a measurement of a factor causally related to crashes or injuries. SPIs are used in addition to the accident or casualty statistics to indicate safety performance or understand the process that leads to accidents. They also provide the link between the casualties from road accidents and the measures to reduce them (Assum 2007).

The SafetyNet project has developed SPIs for the following seven areas (Hakkert, Gitelman and Vis (Eds.) 2007):

1. Alcohol and drugs
2. Speeds
3. Protective systems
4. Daytime running lights
5. Vehicle passive safety
6. Roads
7. Trauma management.

Vis (Ed. 2005) describes the state of the art for road safety performance indicators, Hakkert, Gitelman and Vis (Eds. 2007) describes the theory for each of the seven safety performance indicators and Hakkert and Gitelman (Eds. 2007) is a detailed manual that describes how to establish the necessary systems of data collection for producing national SPIs for each one of the seven areas and how to make them comparable on a European level.

1.3 Alcohol use as a safety performance indicator

Alcohol and drug use among motor vehicle drivers are known to be important accident risk factors.

Driving under the influence of alcohol is known to be an important risk factor (Elvik & Vaa, 2004, p. 975).

The risk of driving under the influence of drugs is less documented. The number of drugs is big. There are legal, medical drugs in prescribed doses, medical drugs in abuse doses, and illicit drugs as well as combinations of two or more drugs and combinations of drugs and alcohol. Assum et al. (2005) show that the accident risk of a driver who has taken morphine or heroin is 32 times higher than the risk of drivers with no drugs or alcohol, alcohol alone above 1.3 g/l gives a risk 87 times higher, and the combination of alcohol above 0.8g/l and drugs gives a risk which is 179 times higher than that of drivers with no drugs or alcohol.

Most European countries have provided some data on alcohol use among drivers, whereas only six countries were able to deliver data on drug use for drivers involved in fatal road accidents (Vis and van Gent 2007 (Eds.), p. 14). Consequently, this report focuses on the quality of the alcohol SPI.

An SPI should ideally be measured independently of accidents and of the accident countermeasures. In the case of alcohol, drugs and driving the "ideal" safety performance indicator would be the prevalence and concentration of impairing substances among the general road user population, but as described by Assum et al. (2007, 2007a) this ideal may be difficult to achieve in practice. Consequently, three SPIs were proposed for alcohol and drugs. The one finally applied for alcohol is:

> *The percentage of fatalities resulting from accidents involving at least one driver impaired by alcohol.*

Based on this definition the SafetyNet project has collected data for European countries (Vis and Van Cert (Eds.) 2007). Questionnaires were sent in 2005 and 2006 to the 25 member countries at that time plus Norway and Switzerland. Even after two questionnaires to each country, it was difficult to collect exactly the information needed, and a follow-up by e-mail was necessary to several countries.

Of the 27 countries approached, 23 provided data for 2004-2005 that could be used to calculate the safety performance indicator for alcohol. Figure 1 shows the result for 2005. The SPI average is 18.8 % and the SPIs vary from 4.8 % in Czech Republic to 72.2 % in Italy.

The SPIs vary a lot from country to country. The Czech Republic, Austria, Belgium and the Netherlands have very low SPI and the countries in South

Europe; Italy, Spain, France and Portugal have very high SPIs. Especially the SPI for Italy is high, more than twice as high as the second highest and 15 times higher than the lowest SPI. The SPI for Italy is likely not to be correct, but no answer has been received to follow-up questions to Italy.

The question may be asked in general whether very low or very high indicator values reflect the real situation or if there is a methodological explanation to the extreme values.

Thus, it has been decided to compare the alcohol SPI used in the SafetyNet project with other indicators to try to assess its quality. In addition some in-depth studies of the SPI for the countries with the most extreme SPI will be conducted.

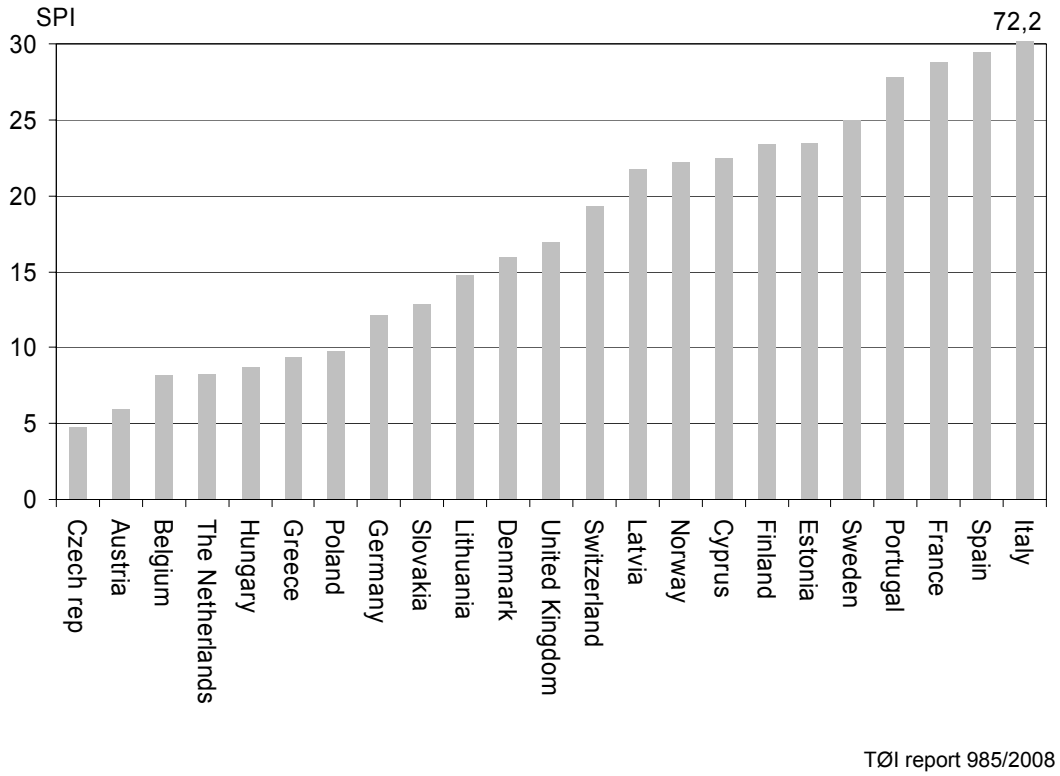

Figure 1. Alcohol safety performance indicator for SafetyNet 2005 that primarily are based on data from 2004 and 2005 (Vis and Van Cert (Eds.) 2007).

1.4 Objective

The objective of this report is to asses the quality of the SafetyNet alcohol SPI described above for the different European counties:

- How is it calculated?
- Is the SPI valid and reliable?
- How can the SPI be explained and does it correlate with other factors?

1.5 Method and delimitation

The study comprises the following thee parts and 10 sub parts:

Part 1: Calculation and comparison

1. Calculating the SPI from 2004-2005 under different assumptions
2. Comparisons of the SPI with new data from 2006-2007
3. Comparisons of the SPI to the SPI calculated by ETSC
4. Comparisons of the SPI to the SPI calculated by WHO

Part 2: In-depth study

5. In-depth study of selected countries with extreme alcohol SPI

Part 3: Influencing factors

6. Correlations of the SPI with the legal blood alcohol concentration limits
7. Correlations of the SPI with drink-driving prevalence
8. Correlation of the SPI with alcohol consumption
9. Correlations of the SPI with motorisation
10. Correlations of the SPI with self-reported attitudes and behaviour of drivers

The objective of this study is not to explain for every country why the SPI is so low or high, but to make a quality control of the numbers and method used for the SPI calculation and to evaluate if there is a methodological explanation for low and high SPI values.

The idea of the SPIs is that they should be updated continuous. The latest update for the alcohol SPI was done in autumn 2008 based on numbers from 2006-2007. The present report was made before and parallel with this update. This means that is was not possible to base the report on the updated numbers. Thus, the report is primarily based on the first collected numbers from 2004-2005. However, this was also preferable considering the fact that most of the information about possible influencing factors used in part 3 is also only available for 2004-2005.

The results from the in-depth studies in part 2 are used in part 3 in stead of the "original" alcohol SPIs described in figure 1, because the reestimated SPIs in the in-depth studies are considered to be more right.

2 Calculation of the alcohol SPI

The alcohol SPI applied in SafetyNet is as mentioned above:

> *The percentage of fatalities resulting from accidents involving at least one driver impaired by alcohol.*

A condition for the validity and reliability of this SPI is that all drivers involved in fatal accidents are tested for alcohol. However, there may be many reasons why only some drivers are tested in practice, e.g. if nobody dies at the actual accident scene, but somebody dies later on (within 30 days after the accident is the limit in most countries) the police will not know at the time of the accident that it is a fatal accident and the involved drivers may not be tested for alcohol.

In many countries the drivers involved in fatal accidents are only tested if the police have some sort of suspicion for alcohol impairment. In other countries dead drivers are not tested because they cannot be considered guilty and convicted.

The important issues regarding this SPI are consequently the *percentage* of drivers involved in fatal accidents who are actually tested for alcohol and how the SPI should be calculated if all drivers are not tested?

Table 1 shows the calculated SPI for 23 European countries. Three of these countries, Belgium, France and Spain have explicitly described the percentage of drivers involved in fatal accident who are tested for alcohol. These percentages vary between 20 % and 88 %.

Note that the United Kingdom also has provided a percentage, which is 59 %. However, the United Kingdom has made separate calculation of SPI which is used in SafetyNet (Dar 2006), so it is not necessary to "worry" about this percentage.

As indicated in table 1 the SPI for Belgium, France and Spain is calculated in two different ways in the country profiles (Vis and van Gent (Eds.) 2007a) and country comparisons reports (Vis and van Gent (Eds.) 2007).

For Belgium it is calculated as alcohol positive drivers involved in fatal accidents divided by *all* drivers involved in fatal accidents. For France and Span it is calculated as alcohol positive drivers involved in fatal accident divided by only the *tested* drivers involved in fatal accidents.

In the Belgian case it is assumed that no drivers among the untested persons are impaired by alcohol. In the France-Spain case it is assumed that the same percentage is impaired by alcohol among the untested persons as the tested persons.

Both assumptions are probably incorrect, and the assumptions should also be the same for all countries:

- The assumption that no drivers among the untested drivers are impaired by alcohol is probably not right because it is unlikely that the police identify all drivers that are impaired without testing them.

- The assumption that the same percentage is impaired by alcohol among the untested persons as the tested persons is probably not right because it is likely that the police are able to identify a considerable part of the drivers impaired by alcohol.

Table 1. Alcohol safety performance indicator (SPI) from SafetyNet for 23 European countries based on data from mostly 2004-2005 (Vis and Van Cert (Eds.) 2007, 2007a). The countries are listed by country code and membership of EU.

Country	Year	BAC limit (g/l)	Fatali-ties	Alcohol fatalities	SPI (%)	Tested (%)	SPI 1 (%)	SPI ½ (%)	SPI 0 (%)	SPI '05 (%)
Belgium (BE)	2002	0.5	1263	103	8.2	20.0	40.7	24.4	8.2	24.4
Czech rep (CZ)	2004	0	1382	67	4.8				4.8	4.8
Denmark (DK)	2005	0.5	331	53	16				16.0	16.0
Germany (DE)	2004	0.3	5842	704	12.1				12.1	12.1
Estonia (EE)	2005	0.2	168	35	23.5				23.5	23.5
Greece (EL)	2004	0.5	1670	157	9.4				9.4	9.4
Spain (ES)	2005	0.5	4741	398	29.5	28.5	29.5	18.9	8.4	18.9
France (FR)	2005	0.5	5318	1355	28.8	88.3	28.8	27.2	25.5	27.2
Italy (IT)	2004	0.5	5780	4172	72.2				72.2	72.2
Cyprus (CY)	2005	0.9	102	23	22.5				22.5	22.5
Latvia (LV)	2005	0.5	442	96	21.7				21.7	21.7
Lithuania (LT)	2005	0.4	760	113	14.8				14.9	14.9
Hungary (0,0)* (HU)	2005	0	1284	112	8.7				8.7	8.7
Hungary (0,5)* (HU)	2005	0.5	1284	108	8.4				8.4	8.4
The Netherlands (NL)	2005	0.5	750	62	8.3				8.3	8.3
Austria (AT)	2005	0.5	768	46	5.9				6.0	6.0
Poland (PL)	2005	0.2	5444	535	9.8				9.8	9.8
Portugal (PT)	2005	0.5	496	181	27.8				36.5	36.5
Slovakia (SK)	2005	0	560	72	12.9				12.9	12.9
Finland (FI)	2005	0.5	379	89	23.4				23.5	23.5
Sweden (SE)	2005	0.2	440	110	25				25.0	25.0
United Kingdom (UK)	2005	0.8	3337	560	17	(59)**			16.8	16.8
Norway (NO)	2002	0.2	243	55	22.2				22.6	22.6
Switzerland (CH)	2005	0.5	409	79	19.3				19.3	19.3
Average					18.8				18.2	19.4

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- **SPI (%):** SPI described in deliverable D3.7a (Vis and van Gent (Eds.) 2007), i.e. the definition used previously in this report.
- **Tested (%):** Percentage of drivers involved in fatal accident that are tested for alcohol. This is only described explicitly for three countries.
- **SPI 1 (%):** SPI calculated as alcohol impaired drivers divided by the tested drivers only.
- **SPI ½ (%):** SPI calculated under the assumption that the percentage of alcohol fatalities among untested drivers is half of the percentage among tested drivers.
- **SPI 0 (%):** SPI calculated as alcohol fatalities divided by all fatalities.
- **SPI '05 (%):** The new recommended SPI for 2005 is based on SPI ½.
- **Grey:** The SPI used in deliverable D3.7a (Vis and Van Gent (Eds.) 2007).
- * BAC limit for Hungary is 0.0 g/l, but data is also provided for BAC over 0.5 g/l.
- ** Percentage for United Kingdom is not used, because United Kingdom has made separate calculation of SPI which is used in SafetyNet (Dar 2006).

Table 2 summarises the different methods for calculation of SPI when the number of tested drivers is known. It is suggested to calculate the SPI under the assumption that the percentage of alcohol impaired drivers involved in fatal accidents among untested, involved drivers is half that of the tested drivers. Overall, this assumption corresponds to the calculation by the United Kingdom.

Table 2 shows that the SPI result varies quite a lot depending on the assumptions concerning the untested drivers when the share of drivers tested is small, as is the case for Belgium and Spain. For Belgium the SPI result varies between 40.7 % and 8.2 %. When the share of drivers tested is high, as is the case for France, the results vary only slightly.

Table 2. Alcohol safety performance indicators (SPI) for Belgium, France and Spain, countries for which the numbers of tested drivers have been given (Vis and Van Gent (Eds.) 2007a).

Country	SPI (%)	Tested (%)	SPI, 1 (%)	SPI, 2/3 (%)	SPI, ½ (%)	SPI, 1/3 (%)	SPI, 0 (%)	SPI '05 (%)
Belgium (BE)	8.2	20.0	40.7	29.9	24.4	19.0	8.2	24.4
Spain (ES)	29.5	28.5	29.5	22.5	18.9	15.4	8.4	18.9
France (FR)	28.8	88.3	28.8	27.7	27.2	26.6	25.5	27.2

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- **SPI (%):** SPI described in deliverable D3.7a (Vis and Van Cert (Eds.) 2007).
- **Tested (%):** Percentage of drivers involved in fatal accident that are tested for alcohol. This is only described explicitly for three countries.
- **SPI 1 (%):** SPI calculated as alcohol impaired drivers divided by the tested drivers only.
- **SPI 2/3 (%):** SPI calculated under the assumption that the percentage of alcohol fatalities among untested drivers is two-thirds of the percentage among tested drivers.
- **SPI ½ (%):** SPI calculated under the assumption that the percentage of alcohol fatalities among untested drivers is half of the percentage among tested drivers.
- **SPI 2/3 (%):** SPI calculated under the assumption that the percentage of alcohol fatalities among untested drivers is one-third of the percentage among tested drivers.
- **SPI 0 (%):** SPI calculated as alcohol fatalities divided by all fatalities.
- **SPI '05 (%):** The new recommended SPI for 2005 is based on SPI ½.
- **Grey:** The SPI used in deliverable D3.7a (Vis and Van Cert (Eds.) 2007).

3 Data for 2005 and 2007

The idea of the SPIs is that they should be updated regularly, preferably every year. This will give the opportunity to follow the development in each country on a yearly basis, and make annual comparisons between the countries. The procedure for the annual updating has not been decided yet. However, a questionnaire for updating has been developed and sent out to relevant persons from every European country (SafetyNet 2007).

Table 3. Alcohol SPI from SafetyNet for 18 countries based on data from 2006-2007 (SafetyNet 2007). The countries are listed by country code and membership of EU.

Country	Year	Fatalities	Alcohol fatalities	Tested %	SPI 1 (%)	SPI ½ (%)	SPI 0 (%)	SPI '07 (%)
Belgium (BE)	2006	1069	58	33.4	16.2	10.8	5.4	10.8
Czech rep (CZ)	2006	1063	50				4.7	4.7
Germany (DE)	2006	5091	580				11.4	11.4
Greece (EL)	2006	1657	133	85.1	9.4	8.7	8.0	8.7
Spain (ES)	2006	4104	365	52.9	26.8	20.5	14.2	20.5
France (FR)	2006	4709	1400	84.1	29.7	27.3	25.0	27.3
Cyprus (CY)	2006	86	15	78.8	22.1	19.8	17.4	19.8
Latvia (LV)	2007	419	91				21.7	21.7
Lithuania (LT)	2007	739	69				9.3	9.3
Austria (AT)	2006	730	45	(3.6)			6.2	6.2
Poland (PL)	2007	5583	480				8.6	8.6
Portugal (PT)	2007	854	57	48,3	13,8	10.2	6.7	10.2
Slovenia (SI)	2006	263	158	92.8	60.0	57.9	55.7	57.9
Slovakia (SK)	2006	579	42				7.3	7.3
Finland (FI)	2006	336	88				26.2	26.2
United Kingdom (UK)	2006	3172	540				17.0	17.0
Bulgaria (BG)	2007	1006	44				4.4	4.4
Romania (RO)	2007	2791	150				5.4	5.4
Average								**16.0**

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- **Tested (%):** Percentage of drivers involved in fatal accident who are tested for alcohol. This is described explicitly for eight countries including Austria. However, the number for Austria is very small, and it is therefore assumed that it probably is not right.
- **SPI 1 (%):** SPI calculate as alcohol fatalities divided by the tested drivers only.
- **SPI ½ (%):** SPI calculated under the assumption that the percentage of alcohol fatalities among untested drivers is half that of the tested drivers.
- **SPI 0 (%):** SPI calculated as alcohol fatalities divided by all fatalities.
- **SPI '07 (%):** The recommended SPI for 2007 is based on SPI ½.
- **Grey:** The alcohol SPI indicated in the updated questionnaire by the seven countries which also have stated percentage of drivers involved in fatal accident who are tested for alcohol (SafetyNet 2007).

Data from 2006 or 2007 for calculation of the alcohol SPI was received, including data from three new countries, Bulgaria, Romania and Slovenia. On the other hand eight countries which delivered data for 2004 or 2005 did not do so for 2006 or 2007. The eight countries are; Denmark, Estonia, Hungary, Italy, Norway, Sweden, Switzerland and The Netherlands. Consequently, 18 countries have delivered data for 2006-2007.

The new data and the calculated SPIs are summarised in table 3. Among these 18 countries seven countries have explicitly stated the number of the drivers involved in fatal accidents tested for alcohol. This is more than three times as many as in 2005.

The percentage of drivers involved in fatal accident tested for alcohol varies between 18.9 % for Belgium and 92.8 % for Slovenia with an unweighted average on 65.9 %. Four countries; Cyprus, France, Greece and Slovenia have tested between 79 % and 93 % of the drivers.

Belgium, France and Spain have explicitly stated the number of drivers involved in fatal accidents tested for alcohol in both 2005 and 2007. Among these three countries the percentage of tested drivers has increased only for Spain, from 28.5 % to 52.9 %. There is probably a methodological explanation for this increase or some of the increase. In 2005 the calculation was based on all killed road users and in 2006 the calculation is based on killed drivers. If the same calculation method is used for 2006 as for 2005 the percentage of tested road users will be 33.1 % instead of 52.9 %. Thus, if this method is used there will still be an increase, but it is not so large. In Belgium this percentage has decreased from 20.0 % to 18.9 %, and in France it has decreased from 88.3 % to 84.1 %.

Since only three countries have data for percentage of drivers tested for both 2005 and 2007, no general trend in testing can be concluded.

The questions in the updated questionnaire are formulated differently than the questions in the first questionnaire. In the updated questionnaire the percentage of fatalities caused by accident in which one driver involved was impaired by alcohol should be stated. However, it is not stated how this percentage is calculated, because the absolute number is not indicated. This is a problem for the seven countries which have stated the percentage of tested drivers. This means that the percentage may have been calculated in three different ways:

1. As the alcohol fatalities divided by the tested drivers only (SPI 1)
2. As the alcohol fatalities divided by all fatalities (SPI 0)
3. In a different way to take the percentage of tested drivers into consideration.

Moreover, there is also the question of *selection* of the tested drivers. If the drivers tested are selected for testing because of suspicion of alcohol use, the percentage of alcohol positive drivers is likely to be higher than if drivers are selected for testing at random. The method will probably differ from country to country. It is assumed that the countries either will use the first or the second method. For each country an individual assessment of the most likely method has been made. This assessment is indicated in table 3.

For countries with data for both periods (Belgium, France and Spain), an evident interpretation is that the percentage is calculated in the same way for both years.

This has been confirmed for France and is probably also the case for Belgium. Spain is one of the few countries explicitly indicating how the percentage is calculated.

For the last four countries; Cyprus, Greece, Portugal and Slovenia an evident interpretation is that the percentage is calculated as the number of alcohol fatalities divided by all fatalities (SPI 0). The argument for that is that these two numbers are directly stated and can be used without any intermediate calculations.

Based on these assumptions the recommend alcohol SPI (SPI ½) has been calculated for the seven countries. This means that the percentage stated in the questionnaire and summarized in table 3 is not the same.

Figure 2 and table 4 compare the alcohol SPI for 2005 and 2007. 15 countries have stated numbers for both periods, eight countries have only given data for 2005 and three countries have delivered data for 2007 only.

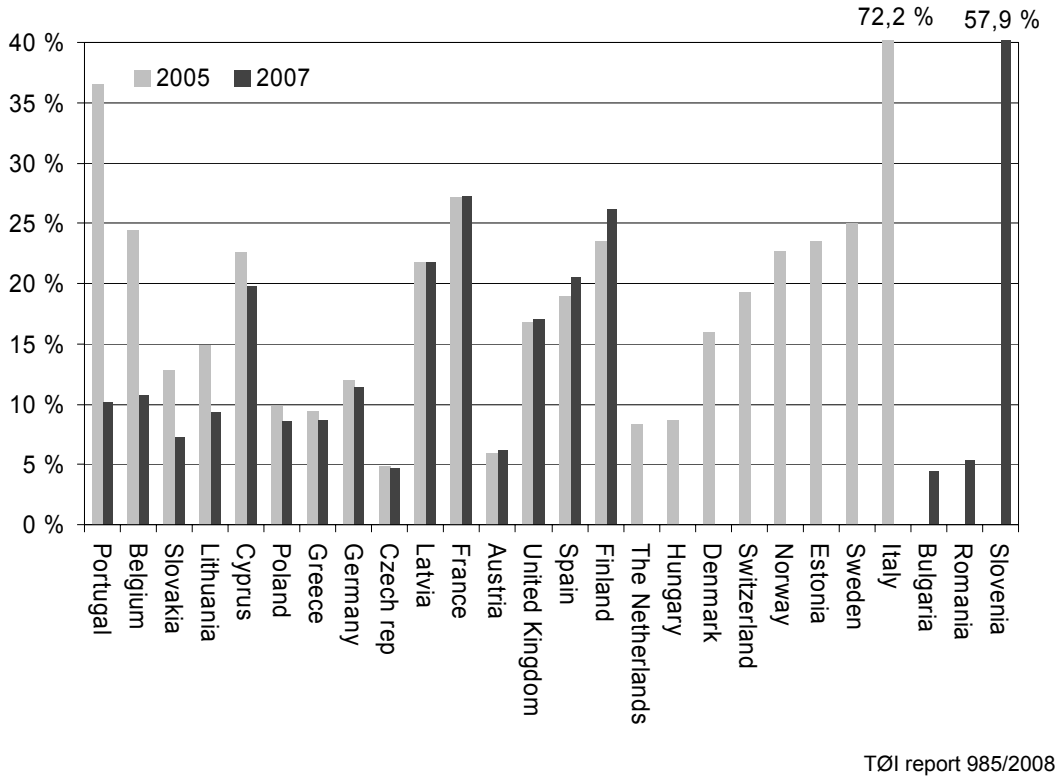

Figure 2. Comparison of alcohol safety performance indicators for 2004-2005 (SPI '05) and for 2006-2007 (SPI '07). The countries are listed from the largest decrease to the largest increase. Countries with figures for only 2005 or 2007 are listed on the right side of the diagram.

Nine countries have had an improvement. If the data are correct, it seems that Portugal has had a very large improvement. Belgium, Slovakia and Lithuania have had a large improvement. Cyprus and Poland have had a medium improvement and Greece, Germany and Czech Republic have had a small improvement.

Five countries have had an increase in SPI. Finland and Spain have had a medium increase in the alcohol SPI from 2005 to 2007 and France, Austria and United Kingdom have had a small increase.

Table 4. Countries by large, medium, small and no decrease or increase in SPI from 2005 to 2007.

Changes	2007 < 2005	2007 > 2005
Very large (> 15 % point)	- Portugal	
Large (5-15 % point)	- Belgium - Slovakia - Lithuania	
Medium (1-5 % point)	- Cyprus - Poland	- Finland - Spain
Small (<1 % point)	- Greece - Germany - Czech rep	- France - Austria - United Kingdom
None		- Latvia

Only 2005 data	Only 2007 data
- Denmark	- Bulgaria
- Estonia	- Romania
- Hungary	- Slovenia
- Italy	
- Norway	
- Sweden	
- Switzerland	
- The Netherlands	

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4 ETSC and SafetyNet alcohol SPIs

The European Transport Safety Council (ETSC) has also developed a set of safety performance indicators for road accidents, the Road Safety Performance Index – PIN (ETSC 2007).

The SPI used for alcohol is the percentage change in the annual number of deaths in accidents related to drink-driving relative to the percentage change in all road fatalities. This indicator is a more dynamic, emphasizing the change in alcohol-related fatalities compared to change in all fatalities (Assum 2007). Based on the data from ETSC it is however also possible calculate an SPI similar to the SafetyNet SPI.

The SafetyNet SPI and the SPI based on the ETSC data are compared in figure 3 and table 5. These reveal some interesting similarities and differences.

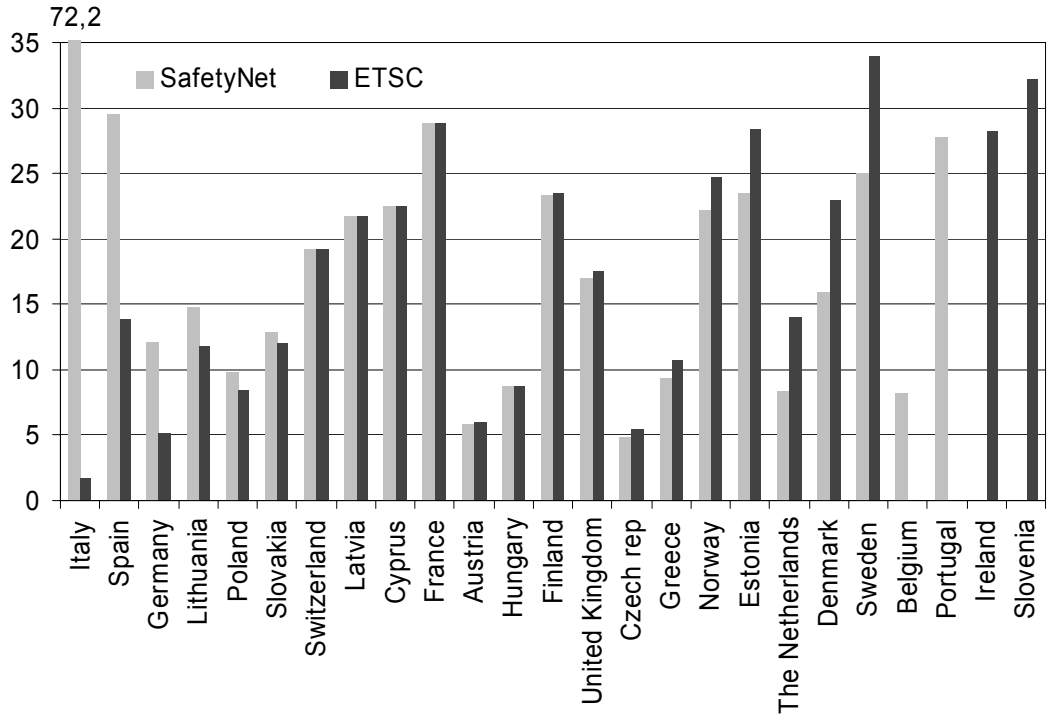

Figure 3. Alcohol safety performance indicators for SafetyNet 2005 and ETSC (European Transport Safety Council) (ETSC 2007, 2007a). The countries are ranked from the largest positive difference (SafetyNet – ETSC) to the largest negative difference. Finally countries with number for only SafetyNet or ETSC are listed.

Four countries, Cyprus, France, Latvia and Switzerland have exactly the same percentage, and three have almost the same percentage. These are Austria, Finland and Hungary. This means that the calculations are based on the same numbers or that ETSC and SafetyNet have got the numbers from each other.

Five countries, Greece, Czech Republic, United Kingdom, Poland and Slovakia have a difference between 0.1 % point and 2 % points. Thus, for 13 countries the two SPIs show very good accordance.

Italy has an extremely high SafetyNet SPI value, 72.2 % and an extremely low value 1.8 % for the ETSC SPI. In other words Italy is ranked as the worst country in SafetyNet and as the best country in ETSC. Both of the two numbers are extreme and neither of the two numbers is likely to be reliable. The quality of the Italian data needs to be checked further.

There is also a large (but not extreme) difference for Sweden, Denmark, the Netherlands, Spain and Germany. These differences are between 5 and 16 % points. For the first three countries SafetyNet SPI is smaller than ETSC SPI, and for the two last countries it is reverse.

Table 5. Countries by very large, large, medium, small, very small and no difference in SafetyNet and ETSC-based SPI results for alcohol.

Difference	SafetyNet < ETSC	SafetyNet > ETSC	Only SafetyNet	Only ETSC
Very large (> 20 % point)		- Italy	- Belgium - Portugal	- Slovenia - Ireland
Large (5-20 % point)	- Sweden - Denmark - The Netherlands	- Spain* - Germany		
Medium (2-5 % point)	- Estonia - Norway	- Lithuania		
Small (0.1-2 % point)	- Greece - Czech rep - United Kingdom	- Poland - Slovakia		
No / very small (0-0.1 % point	- France - Cyprus - Latvia	- Switzerland - Austria - Finland - Hungary		

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* Calculation for Spain is based on SafetyNet SPI equal 29.5 %. It is suggested to change this to 18.9 %. This will reduce the difference from 15.6 to 5.5 % points.

According to figure 3 Spain has a large difference of 15.6 % point. However, this calculation is based on a SafetyNet SPI on 29.5 %. However, table 1 suggests that the SafetyNet SPI'05 for Spain should be 18.9 %. If that is the case, the difference is "only" 5 % points. This may indicate that the suggested method for calculation of SafetyNet SPI is better than the "old" method.

The differences between SafetyNet and ETSC indicators cannot be explained within this project, but the fact that six of 22 countries have differences of more than 5 % points between the two SPIs, indicates clearly that at least one of the two data sources are unreliable.

Four countries have supplied data to the one, but not to the other SPI system. Note that Slovenia has provided 2006 data to SafetyNet. The SafetyNet SPI is about 60 %. In comparison the ETSC SPI for Slovenia is only half about 30 %. This means that there is a very big difference that needs further investigation. At the moment the SPIs for Italy and Slovenia should be considered unreliable.

5 WHO accident data and the SPI

World Health Organization (WHO), Regional Office for Europe, has developed a European health for all database (HFA-DB) online available on http://data.euro.who.int/hfadb/. HFA-DB is a central database of independent, comparable and up-to-date basic health statistics for 53 European WHO Member States that allows different country analyses. The data comes from country experts and partner organizations and the database is updated biannually. HFA-DB contains about 600 health indicators including information about alcohol and road traffic accidents (WHO 2008, 2008a).

Table 6. Road traffic accidents involving alcohol per 100,000 persons and accident involving alcohol pr. accident with injury in 22 European countries in primarily 2004 (WHO 2008, 2008a). The countries are listed by accidents involving alcohol per 100,000 persons.

	Year	Accidents with injury per 100,000 persons	Accidents involving alcohol per 100,000 persons (WHO 1)	Accidents involving alcohol per accident with injury (WHO 2)
Romania	2003	30.6	1.4	4.5 %
Cyprus	2004	267.3	2.4	0.9 %
Italy	2002	416.1	5.1	1.2 %
Bulgaria	2004	97.8	5.4	5.5 %
Sweden	2004	200.5	11.7	5.9 %
The Netherlands	2003	195.0	12.8	6.5 %
Greece	2004	140.5	13.1	9.3 %
Poland	2004	133.8	15.1	11.3 %
United Kingdom	2004	346.6	18.8	5.4 %
Finland	2004	129.4	19.3	14.9 %
Denmark	2004	115.0	20.1	17.5 %
Slovakia	2004	156.8	20.9	13.3 %
Czech Rep.	2004	259.8	27.3	10.5 %
Hungary	2004	207.4	28.8	13.9 %
Lithuania	2004	185.0	28.8	15.6 %
Germany	2003	429.6	29.4	6.8 %
Luxembourg	2003	160.0	31.3	19.6 %
Latvia	2004	219.7	32.3	14.7 %
Switzerland	2002	324.6	34.4	10.6 %
Austria	2004	521.8	34.7	6.6 %
Estonia	2004	166.3	42.2	25.4 %
Slovenia	2004	637.0	88.3	13.9 %
EU25	2004	268.9	19.2	7.1 %
EU15*	2003	315.4	19.3	6.1 %
EU10**	2004	145.2	17.0	11.7 %

* EU members before May 2004.
** EU members since 2004 or 2007.

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The database contains the following relevant data (WHO 2008a):

- Road traffic accidents involving alcohol per 100,000 persons
- Road traffic accidents with injury per 100,000 persons.

Road traffic accidents involving alcohol is defined as road traffic accidents involving one or more persons under the influence of alcohol. Accidents involving personal injury are included, while accidents with only material damage are not included. The parameter can be used as an alcohol safety performance indicator.

If the two parameters of the database are combined it is possible to calculate road traffic accidents involving alcohol pr. road traffic accident with injury. This can also be used as an alcohol safety performance indicator.

Table 6 summarizes the three described parameters for 22 European countries in primarily 2004. No data exist for Belgium, France, Norway, Portugal and Spain.

The numbers of accidents involving alcohol per 100,000 persons vary between 1.4 and 88.3 with an average for EU on 19.2. Romania, Cyprus, Italy and Bulgaria have very few accidents involving alcohol. The numbers for these countries are between 1.4 and 5.4. Slovenia has a very high number of 88.3.

The share of accidents involving alcohol per road traffic accident with injury varies between 0.9 % and 25.4 %. You find the lowest percentage in Cyprus, Italy and United Kingdom, while Estonia, Denmark and Lithuania have the highest percentage.

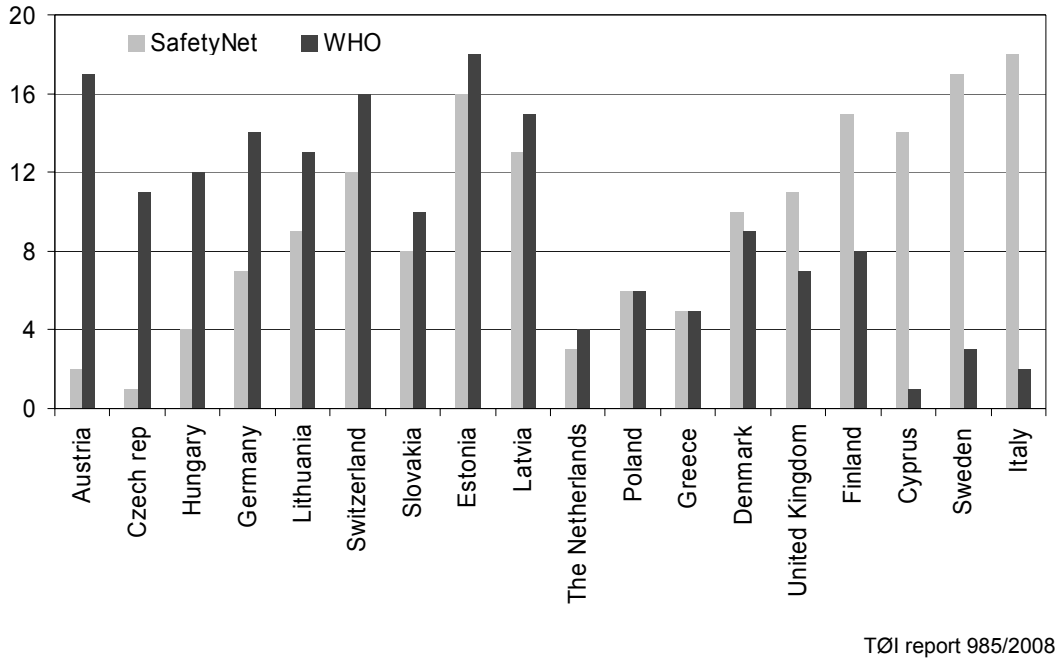

Figure 4. Ranks for the SafetyNet 2005 alcohol SPI and WHO SPI calculated as accidents involving alcohol per 100,000 persons (WHO 2008, 2008a). The countries are ranked from the largest negative difference (SafetyNet – WHO) to the largest positive difference.

Figure 4 compares the ranks for the SafetyNet 2005 alcohol SPI and WHO SPI calculated as accidents involving alcohol pr. 100,000 persons. It is necessary to

compare ranks instead of numbers because the two indicators are based on different data. The SafetyNet alcohol SPI is based on fatalities and the WHO alcohol SPI is based on accidents.

Figure 4 shows surprisingly that there is no correlation between the SafetyNet SPI and the WHO SPI calculated as accidents involving alcohol per 100,000 persons and drink-driving prevalence. The correlation is calculated to -0.21.

The largest negative difference calculated as the rank for SPI minus the rank for WHO is found for Austria, Czech Republic and Hungary, i.e. differences of -15, -10 and -8 respectively. This means that these countries have a low SafetyNet SPI and a high WHO SPI.

The largest positive difference is found for Italy, Sweden and Cyprus. Italy has the largest positive difference of 16 (18 minus 2). This calculation is based on the SafetyNet SPI for Italy, which is very different compared to the ETSC SPI for Italy. If the ETSC SPI is used, the difference is only -1.

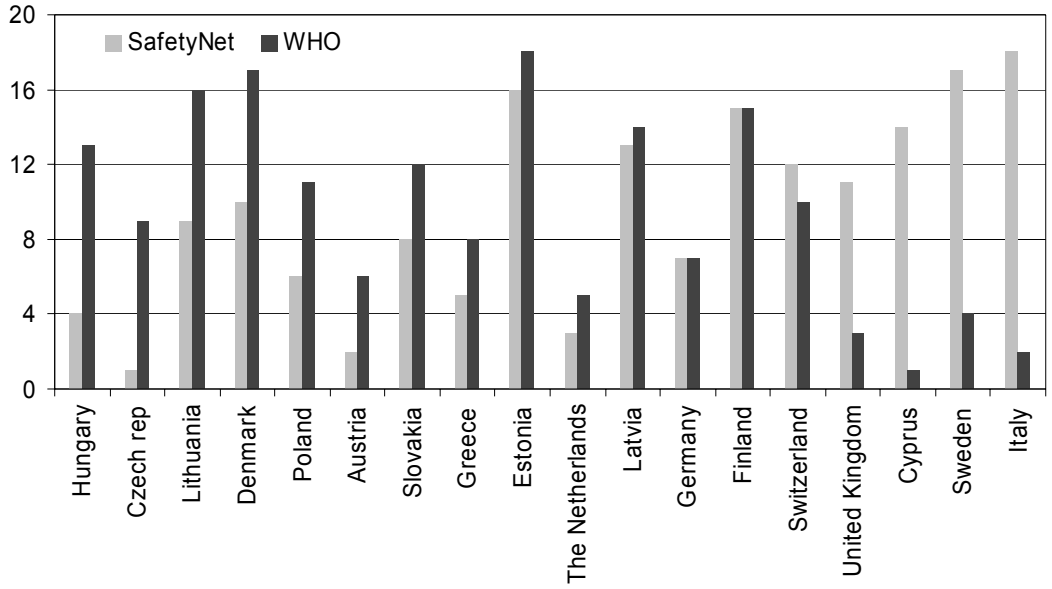

Figure 5. Ranks for the SafetyNet 2005 alcohol SPI and WHO calculated as accidents involving alcohol pr. accident with injury (WHO 2008, 2008a). The countries are ranked from the largest positive difference (SafetyNet – WHO) to the largest negative difference.

Figure 5 compares the ranks for the SafetyNet 2005 alcohol SPI and the other WHO SPI calculated as accidents involving alcohol pr. accident with injury. These ranks show neither correlation. The correlation is calculated to -0.01.

The largest negative difference calculated as the rank for SPI minus the rank for WHO is found for Hungary, Czech Republic, Lithuania and Denmark. This means that these countries have a low or medium SafetyNet SPI and a high WHO SPI.

The largest positive difference is found for Italy, Sweden and Cyprus, which also had the largest positive different in the previous comparison.

6 Data quality study of five countries

As described in the previous chapters the alcohol SPIs vary a lot from country to country. Thus, the question may be asked whether very low or very high indicator values really reflect the real situation or if there is a methodological explanation for such a value. To try to answer this question some in depth studies of the SPI for the countries with the most extreme SPI will be conducted in the following.

The objective of these studies is not to explain why the SPI is so low or high, but to make a quality control of the numbers and method used for the SPI calculation and evaluate if there is a methodological explanation for a particularly low or high SPI.

The in depth studies are conducted in different ways for the selected countries depending of what relevant materials (accident data, publications, reports and information from key persons) is was possible to find and include in the analysis.

6.1 Selection of countries

It was chosen to make an in depth study for the countries listen in table 7. This table describe also why the countries have been chosen.

Czech Republic and Austria have primarily been chosen because they have the lowest and second lowest alcohol SPI. At the same time they have high alcohol consumption. This is clarified in chapter 10. In addition Austria has also few alcohol controls. This is clarified in chapter 12.

Table 7. Countries selected for in depth study and why they have been chosen.

Country	SPI	Other criteria
Czech rep	lowest	- Highest alcohol consumption
Austria	2nd lowest	- 4th Highest alcohol consumption - 4th fewest alcohol controls
France	2nd highest	- Large country
Sweden	5th highest	- 3rd lowest alcohol consumption - Fewest people who drink and drive - 4th most alcohol controls - Safe country - Different method for calculation of SPI
Norway	9th highest	- Lowest alcohol consumption - Safe country - Different method for calculation of SPI

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France has been chosen because it has the second highest alcohol SPI. In addition France is a large country, and it is important not only to have small countries in the study.

Sweden and Norway also have high alcohol SPI, but "only" the fifth and ninth highest. Thus, the main reasons to select these countries are that they have a high SPI even though they have very low alcohol consumption. Sweden also has few people who drink and drive and many alcohol controls. This is clarified in chapter 10 and chapter 12. In addition Sweden and Norway are among the countries in Europe having fewest road fatalities per million vehicles or million inhabitants (EU 2008, OECD 2008). Moreover, Sweden and Norway have used other methods for calculation of the SPI than asked for in this project.

The selection of the five countries also means that other possibly relevant countries with extreme low or high SPI have not been selected. Especially Italy stands out as the country with the highest alcohol SPI. Italy has an extremely high SPI which is over trice as high as the second highest SPI. At the same time ETSC indicate an extremely low value for SPI of 1.8 %. Obviously both numbers cannot be right at the same time and both numbers are also so extreme that none of the number probably is right. Thus, Italy is an obvious choice for an in depth study. Further confirmation of the Italian figures was requested, but no reply was received. Consequently, Italy was considered too difficult for a follow-up study.

According to figure 1 Spain could also be relevant for an in depth study. However, in chapter 2 it is described that the SPI for Spain probably should be calculated in another way which handles the untested drivers in another way. This calculation gives that the SPI for Spain "only" is 18.9 %. This is about the average for the European countries.

The selection of countries was based on data from 2004-2005 received in the first questionnaire. In the second questionnaire data was received from three new countries; Bulgaria, Romania and Slovenia. All these three countries have extreme value for the alcohol SPI. Bulgaria and Romania have extreme low alcohol SPI on 4.4 % and 5.4 %, while Slovenia has an extreme high alcohol SPI on about 60 %. Thus, these three countries are very relevant for further investigations.

6.2 The Czech Republic

Even with a legal limit of 0.0 BAC the Czech Republic has only 4.8 % of the fatalities resulting from alcohol-related accidents, according to the data provided. This is the lowest SPI result of the 24 countries having delivered data for the alcohol SPI. If this result is valid, the Czech Republic has almost solved one of the most severe and difficult problems within road safety, drinking and driving, and the extremely high accident risk that goes with it. Consequently, the rest of the world would have a lot to learn from the Czech Republic in this field. Before declaring the Czech Republic a world leader in this field, the question has to be asked whether the SPI shows the real situation or if there is a methodological explanation to this favourable result?

In-depth study of data quality

An in-depth study of the quality of the Czech SPI data was carried out by the Czech Road Safety Institute CDV (Eksler, Tecl and Assum 2008) within the SafetyNet project. The method was to compare police data with hospital data

within the district of Kromeriz in 2003 – 2007, including 54 fatal accidents with 61 fatalities.

This study found that 38 % of the fatalities registered by the police occurred in accidents where the drivers were not tested for alcohol (Eksler, Tecl and Assum 2008, p. 19).

The report concludes: "It appeared impossible to determine an exact level of under-reporting of alcohol-related crashes in the Kromeriz region… The detailed look at the crash statistics, however, allowed identifying cases which were not reported correctly at the central crash database. The analysis of crash reports uncovered several additional cases of alcohol intoxication." Some 11 % of the fatalities studied in the hospital resulted from crashes in which at least one driver was found intoxicated by alcohol (Eksler, Tecl and Assum 2008, p. 21). "If we consider only fatalities which occurred in crashes in which the intoxication by active participants was either proved or refused, it would be 32 % (12 out of 38)" (Eksler, Tecl and Assum 2008, p.2).

The non-reporting of alcohol is mostly due to administrative and legal shortcomings (Eksler, Tecl and Assum 2008, p. 2). Either the post-mortem examination of driver culprit is not done in order to keep costs down, or the BAC results of this examination are not claimed by the police. When an involved driver is unconscious, the police cannot carry out a breath test, or breath tests are not carried out because of lack of time or urgent medical treatment (Eksler, Tecl and Assum 2008, p.2).

"The results suggest that the extent of alcohol involvement in fatal road crashes in the Czech Republic is close to the EU average level" (Eksler, Tecl and Assum 2008, p.2).

Conclusion

The in-depth study of the quality of the data indicates clearly that the low SPI result is due to methodological shortcomings rather than an especially favourable situation in this field in the Czech Republic. However, it is not possible to make an exact estimate of the right SPI.

6.3 Austria

The alcohol SPI for Austria is 5.9 %, the second lowest of the countries having provided data. Does the SPI show the real situation or is there a methodological explanation?

Other studies and references

Machata and Wannenmacher (1998) wrote in their article "*Wie hoch liegt die Alkoholquote wirklich?*" (*How high is the alcohol rate in reality?*) that testing dead or unconscious drivers for alcohol is only allowed when there is a well substantiated suspicion. This means that unconscious or dead drivers are tested only when they are obviously intoxicated.

In their data from the province of Niederösterreich they find that 9 - 17 % of all active road users (N=789) involved in road accidents were under the influence of

alcohol, whereas in the official road accident statistics only 5 % were under the influence. The authors state that "the real figures for alcohol fatalities … are at least three times as high as the official figures" (Machata and Wannenmacher 1998, p. 65).

In single accidents 29 % are under the influence of alcohol, whereas the official statistics said 21 %. The data set is from 1989 - 1991. If the situation still is as described by Machata and Wannenmacher (1998), the explanation of the low alcohol SPI for Austria is rather obvious.

In Austria "if a person is killed or heavily injured by an accident it is legally not allowed to test this person for alcohol or drugs." (Braun and Schausberger 2007, p. 30). The situation is still the same in 2008, and newer data do not exist concerning underreporting of alcohol in fatal accidents in Austria (Machata 2008).

Conclusion

The 1998 article shows clearly that there are methodological reasons for the low alcohol SPI in Austria, and the situation is confirmed to be the same in 2008. Consequently, the conclusion is that the low SPI for Austria is due to the lack of testing of dead or unconscious drivers. If the correct figure still is three times as high as the official figures, the SPI would be about 18 %. It is, however, difficult to estimate the SPI precisely.

6.4 France

France is among the countries having the highest SPI. The alcohol SPI for France is depending of method for calculation about 27-29 %. This is the second highest SPI. Only the SPI for Italy is perhaps higher.

SafetyNet 2005 and 2006

In France 88.3 % of drivers involved in fatal accident are testes for alcohol. This high rate of testing means that the SPI only varies between 27.2 % and 28.8 %, depending whether only the tested drivers or all drivers involved are taken in account. Thus, this correction does not change the fact that the SPI for France is very high.

Updated questionnaires with data for 2006 have been received for France. Obviously, the SPI can and will change from year to year, but unless something "dramatic" has happened in the country, for example new laws, new BAC limits or significantly more or less police control, the SPI should be at about the same level from year to year with a maximal change of some percentage points, hopefully to a lower SPI. Thus, the new numbers can also be used in this quality control.

Based on the new data it is calculated that the SPI for France in 2006 was 27.3 %. This is the same as for year 2005. Unless both the data for 2005 and 2006 is wrong this comparison verify that the SPI for France is very high and that it is about 27 %.

ETSC

In chapter 4 the SafetyNet SPI is compared with the ETSC SPI for 2005. The ETSC SPI is 28.8 %. This means that the two SPIs are exactly the same.

If the raw data for calculation of SPI in the SafetyNet and the ETSC are compared it can be concluded that these also are the same. At the same time ETSC describes that they have the data from national source. This means that the ETSC has the same raw data as SafetyNet and that the ETSC finds these data reliable.

Note that the ETSC have estimated the number of deaths in drink-driving accident in 2005 to 1,532 among the 5,318 fatalities (28.8 %), where the raw data says 1,355 among the tested 4697 (also 28.8 %). This means that ETSC assumed that the percentage is the same among untested drivers as among tested drivers. As clarified earlier this is probably not right.

Other studies and references

The numbers for the calculation of the SPI for 2005 is confirmed in the report "Alcool et accidents de la route" (PSR 2008), which is a yearly description of road accidents and alcohol.

The report has also been made for 2006 (PSR 2008a) and there the numbers are a little different from the numbers used for calculation of the SPI for 2006. The report describes that 29.4 % (not 29.7 %) of the fatalities were killed in accidents which at least one driver was impaired by alcohol, and that the percentage of fatalities for which the blood alcohol concentration is known is 75.4 %. If the same assumption about alcohol fatalities among untested drivers like the other situations are made the SPI for 2006 can be calculated to 25.8 %. This is only 1.5 % points less than the SafetyNet SPI for 2006.

In the report "Drinking and Driving: a Road Safety Manual for Decision-makers and Practitioners" by the Global Road Safety Partnership (GRSP 2007, p. 4) the percentage of fatal accidents with alcohol as a factor is specified for a number of countries including France. These percentages are based on data from 2002-2004. The report describes that alcohol is a factor in about 33 % of the fatal accidents for that period.

According to a press release (Web in France 2008) 4,615 people were killed on the roads in France in 2007. Alcohol-related accidents were stated as the number one cause of road fatalities. 1,241 killed were associated with alcohol-related accidents. This means that the percentage is 26.9 %.

The conclusion of the comparison with these references (PSR 2008, 2008a, GRSP 2007, Web in France 2008) is that the SafetyNet alcohol SPI has the right level.

Finally it should be noted that France is the only country with a high SPI that also has a high alcohol consumption, high motorisation, many people who answer that they drink and drive and many people who do not think that drinking and driving is an important accident cause (see chapter 10-12). Even though the SPI and these indicators do not correlate in general (see chapter 10-12) the fact that these indicators are high for France means that the high SPI for France does not seem wrong.

Conclusion

Based on the different assessments in the in-depth study for France it is concluded that the SPI for France probably has the right level. There are some small differences in the different references, but it seems that this can be explained by different methods of handling the share of untested drivers.

6.5 Sweden

Sweden has provided an estimate for the alcohol SPI, 25 % of all killed road users were killed in accidents where at least one driver was under the influence of alcohol. This estimate is based upon autopsies of killed drivers.

Other studies and information

In chapter 4 the SafetyNet SPI is compared with the ETSC SPI for 2005. The ETSC SPI for Sweden is even higher than the SafetyNet SPI, some 31 %, and second highest in Europe. We do not know from where the ETSC has received the data for Sweden, but the data must be different than the data made available for SafetyNet.

SUPREME Thematic Report Enforcement (2007, p. 40), concerning Random Breath Testing in Sweden writes: "*…RBT is also compulsory for drivers involved in injury accidents*." There must be some confusion of concepts here. Breath testing of drivers involved in injury accidents will not be random. More importantly, however, we must ask to what extent involved drivers actually are breath-tested for alcohol and what about unconscious and dead drivers – are they tested, and if so, in what way? And if they are tested in hospital, are test results available for statistical purposes?

Chief research officer Ulf Brüde, VTI, says: "Changes in the prevalence of alcohol in road traffic over the years are not known. The total number of alcohol-related fatalities has nevertheless been about the same every year" (VTI 2008).

A press release from the Swedish Road Administration (Vägverket 2007) stated that two persons die every week in alcohol-related road accidents, and further: "*Every year approximately 125 persons die in alcohol-related accidents on Swedish roads and streets."* In 2007 there were 471 road fatalities in Sweden (VTI 2008a), i.e. some 26.5 % of all fatalities result from alcohol-related accidents. This is very much in accordance with the previous estimate, but they may be based on the same data. However, the press release does not define "alcohol-related accidents". These may include impaired pedestrians and bicycle riders, but the press release discusses impaired drivers only, rather than impaired road users in general. If impaired pedestrians and bicycle riders are included, the percentage would be somewhat higher than if motor vehicle drivers only are included.

Lindholm (2004) has studied 63 fatal accidents with impaired motor vehicle drivers (11 fatal accidents involving impaired motor cycle or moped drivers are not included), which killed 75 people. Those are all 2002 fatal accidents where an alcohol impaired driver was detected. A total of 532 people were killed in road accidents in Sweden in 2002, i.e. 14.1 % of fatalities were killed in accidents involving a driver impaired by alcohol. In this study the limit for alcohol

impairment is 0.1 g/l (0/00), whereas the legal limit in Sweden is 0.2 g/l (0/00). If the people killed in the accidents involving alcohol-impaired drivers of MCs and mopeds were included, the percentage would be slightly higher. The number of fatalities in these accidents is, however, not stated, and this percentage can consequently not be calculated exactly. Given that, in average, the number of fatalities per fatal accidents is the same in MC and moped accidents as in other accidents, the percentage would be 16.5 %. Whether 14 % or 16 %, this percentage is considerably smaller than the estimate provided by Sweden, 25 %.

Lindholm (2004) states explicitly that his method, i.e. statistics based on in-depth studies of fatal accidents, does not give a complete picture of alcohol-related accidents. "In the cases where the drivers survive there is a risk that the driver has been taken to hospital before the police arrive at the scene, the driver may have escaped and may be tested for alcohol much later, or the police may have forgotten to report "suspicion of impairment…." Other reasons are people who die later on, within 30 days after the accident. Then it is too late to test both the person who dies and other involved drivers".

In 52 % of these 63 fatal accidents the police had not suspected alcohol impairment of the impaired drivers, even though the average BAC of these drivers was 1.6 g/l (0/00). This is a clear indication that police suspicion is not a reliable measure of alcohol impairment.

A recent document from the Swedish Road Administration (Lindholm 2008, p. 3) shows that about 20 % of the fatal accidents in Sweden are alcohol-related, i.e. including impaired drivers, bicycle rider and pedestrians. Impaired here means above the legal limit of 0.2 g/l (0/00). Some 15 % of the fatal accidents have an alcohol-impaired driver involved. Moreover, these percentages have been constant since 1997. Of all killed drivers 2006, 33 % were alcohol-impaired. Some 125 people die every year in alcohol-related road accidents. However, it is not possible to distinguish between accidents involving alcohol-impaired drivers and accidents involving impaired bicycle riders and pedestrians. Thus, it is not possible to calculate accurately the percentage of fatalities in accidents involving impaired drivers.

Alternative calculation of SPI

If the number of killed people per accident involving an alcohol-related driver was the same in 2007 as for the 63 fatal accidents with impaired drivers in 2002, i.e. 75/63 = 1.19, an estimate can be made. In 2007 there were 426 fatal accidents and 471 fatalities on Swedish roads (SIKA 2008). 15 % of the fatal accidents had alcohol-impaired drivers, i.e. 426 x 0.15 = 63.9 accidents with 1.19 fatalities on average, makes 76 fatalities in accidents with alcohol impaired driver. (76/471) x 100 = ***16.1 %***, which is considerably less than the SPI of 25 % provided by the Swedish Road Administration in 2006.

Conclusion

An estimate of the SPI, 25 %, is made available by the Swedish Road Administration, based upon autopsies of dead drivers, but the specific calculation of the estimate is not known. An estimate made above, based on data from the Swedish Road Administration gives a lower SPI, 16.1 %. Even if these two estimates may be based on statistics from different years, they are so different that

there is reason to ask whether this difference can be explained by different years only. If not, which one is more correct?

Sweden makes systematic in-depth studies of all fatal road accidents, including the blood alcohol concentration of drivers involved in these accidents. Consequently, it should be possible to produce the data needed for the SafetyNet alcohol SPI. Several similar figures, such as the percentage of fatal accidents that are alcohol-related, percentage of fatal accidents involving alcohol-impaired drivers or the number of fatalities resulting from alcohol-related accidents are available. Thus there is reason to ask why the exact data needed for the alcohol SPI cannot be made available, and more importantly, will it be possible to produce the correct alcohol SPI for Sweden in the future.

6.6 Norway

Norway has not been able to provide the data needed for the alcohol SPI, but has provided proxy data, i.e. percentage of killed drivers under the influence of alcohol, 22.2 % in 2002, much the same as Sweden, and Spain have done. Why is Norway not able to deliver the adequate data for the SPI? What can be done to provide these data for Norway? What data exist that can be used to show the situation in Norway? The proxy data provided indicate that drink-driving is an important risk factor in Norway, even if this country has a long tradition for strict enforcement of drink-driving regulations.

Other studies and references

In chapter 4 the SafetyNet SPI is compared with the ETSC SPI for 2005. The ETSC SPI for Norway is some 24 %, i.e. quite similar to the SafetyNet SPI.

Of 403 fatal accidents in Norway 2004 and 2005, 280 were selected for a closer study. Among guilty drivers in these accidents 32 or 11.3 % were under the influence of alcohol alone and 3.9 % were under the influence of both alcohol and other substances, i.e. a total of 15.2 % under the influence of alcohol (Humlegård 2008). These figures are preliminary, and results from all 403 fatal accidents in 2004 and 2005 will be published later (Humlegård 2008a).

The Norwegian Road Traffic Act is strict concerning drinking and driving, and drivers having alcohol in their blood will almost always be found guilty when involved in accidents. Consequently, drivers who are not found guilty are not likely to have been under the influence of alcohol. As all drivers involved in fatal accidents are not tested for alcohol, it is at least theoretically possible that some of the drivers not found guilty have also been under the influence, and all drivers involved in fatal accidents are not tested for alcohol and drugs. Moreover, only about 70 % of killed drivers are tested for alcohol. Thus, it is possible that some of the killed drivers not tested also have been under the influence.

Since 2005 all fatal road accidents in Norway are analyzed in depth to find causal factors within road user behaviour, vehicle safety and road conditions. In 25 % of the fatal accidents in 2005 intoxication is likely to have been a contributing cause of the accident. (Vegdirektoratet 2006), but the report does not distinguish between alcohol and other psychoactive substances. In 2006 intoxication is found to be a contributing factor in 18 % of the fatal accidents, including alcohol in 11

% and other substances in 8 % of these accidents. Although it is not said explicitly, it appears that only intoxicated drivers rather than also intoxicated pedestrians, bicycle riders and passengers, are included in the "contributing cause". All drivers involved in fatal accidents are not tested for alcohol and drugs, and it is recommended that routines be introduced to ensure that all drivers involved in fatal accidents are tested. The percentage of drivers tested is not stated (Statens vegvesen Region Øst, 2007).

Alternative calculation of SPIs

A total of 242 people were killed in the 228 fatal accidents in 2006, i.e. 1.06 fatalities per accident (Vegdirektoratet 2008). If the average number of fatalities per accident is the same in accidents where intoxication is a contributory cause as in other accidents, and the percentages of alcohol and drugs positive are the same among the untested drivers as among the tested drivers, it is possible to make estimates of the SPIs, i.e. *11 % of all fatalities occurred in alcohol-related accidents, and the drugs SPI would be 8 %.* These results are well in line with the preliminary results of the study of the 2004 – 2005 fatal accidents described above.

These new SPI estimates are considerably lower than the estimates of 22.2 % for alcohol and 30.1 per for drugs provided to SafetyNet by Norway. If only the average number of fatalities in alcohol-related accidents and in drugs related accidents had been included in the accident analyses reports, more accurate SPIs for alcohol and drugs could have calculated. Supposedly this information is available for each accident studied, and consequently, Norway should quite easily be able to deliver the right SPIs for both alcohol and drugs.

Conclusion

Norway has the basic data needed for the calculation of the alcohol and drugs SPIs in SafetyNet in in-depth analyses of fatal road accidents. However, the results of these analyses are reported in a way that makes this calculation impossible. However, estimates are 11 % for the alcohol SPI and 8 % for the drugs SPI for 2006, on the condition that the number of fatalities per fatal accident is the same, whether the accidents are alcohol-related, drugs-related or not, and that the untested drivers involved in the fatal accidents have the same percentages of alcohol and drug positive results as the tested drivers. The alcohol and drug SPIs estimated here are considerably lower than those included in the SafetyNet Country Profiles and Country Comparisons reports.

6.7 Other countries

Originally, the plan was to include the United Kingdom in the data quality study to have two large European countries included. However, the data and information delivered by United Kingdom in the second questionnaire and later on, explained in detail the data quality and the method of calculations (Vis and Van Gent, (Eds.) 2008). Consequently, the UK has not been included in this study.

During the data collection for the alcohol and drugs SPIs for SafetyNet, explanations of shortcomings in the national data have come up informally. For example, in the Netherlands killed drivers are not tested. In Switzerland very few people are declared dead at the accident scene because dead bodies cannot be transported in ambulances, and other transport of dead bodies is difficult and costly. In Malta the data concerning fatal accidents are collected locally by the police, and the data are not compiled into statistics.

These are indications that the data sets on which the calculation of the alcohol and drugs SPIs are based, may be incomplete in many countries. Thus, there may be reason to believe that countries reporting very low alcohol SPIs may have some shortcomings in their data. However, the cases of Sweden and Norway have shown that some countries may also have provided too high SPIs.

6.8 Summary

In this chapter the quality of the data provided for the alcohol SPI for five countries have been studied more closely. For France it is concluded that the SPI is likely to have the right level. For the United Kingdom the conclusion was made, based on the data and information provided in the second questionnaire that the data quality was good and the SPI was correct. Consequently, it was not necessary to include the United Kingdom in the data quality study.

For Austria and the Czech Republic the conclusions are that the SPIs provided are obviously too low, but it is difficult to make exact estimates of the SPI. For Sweden and Norway new estimates are made, which are considerably lower than the ones provided to SafetyNet.

Of a total of six countries studied, the data quality is considered good enough for two. For the four countries with shortcomings in the data, two have too low SPI results and two have too high SPI results. Consequently, there may be reason to believe that more countries have incomplete data as bases for the calculation of their alcohol SPIs, and the comparison of the alcohol SPI results between countries should be done with utmost care, if at all.

- The question may be asked why the data can be incomplete. This study found several answers to this question:
- The costs of autopsy of killed drivers are high when there is no reason to check for alcohol as the killed drivers cannot be punished.
- Testing people killed in road accidents may even be legally prohibited unless there is a strong suspicion.
- Privacy. Even if autopsies including alcohol analysis are carried out, the results are not reported back to the police for reasons of privacy.
- Time-consuming routines. The police may have to make formal requests to the hospitals to get the results of the autopsy.
- In some cases death occurs several days after the accident. When the person dies several days after the accident, and the accident then gets the status of a fatal accident, it is too late to check the BAC.

- Incomplete or no publication. The data needed to calculate the SPI will be collected, but no statistics are compiled or the statistics are published in a way which makes the calculation of the SPI impossible.

The possibilities of improving the data quality will of course vary from country to country, but for two of the countries studied, it should be quite easy to compile and publish the data needed. The most important thing to do to improve the quality of the alcohol and drug SPIs is undoubtedly to report the number of drivers involved in fatal accidents, tested or not tested for alcohol and drugs. Only when these figures are reported is it possible to assess the quality of the SPI.

In the following part 3 of the report the results from the in-depth studies for the Czech Republic, Austria, Norway and Sweden are used in stead of the "original" alcohol SPIs described in figure 1, because the reestimated SPIs are considered to be more right. This means that the following alcohol SPI will be used:

- The Czech Republic: 4.8 % → 18.8 %
- Austria: 5.9 % → 18.0 %
- Norway: 22.2 % → 11.1 %
- Sweden: 25.0 % → 16.0 %.

7 Factors influencing the alcohol SPI

Why do the alcohol SPI results vary between the countries? Apart from the methodological reasons there may also be real differences between the countries implying different situations. Variation in the alcohol SPI could to some extent be explained by and be expected to correlate with all or some of the following factors:

- Drink-driving prevalence
- Legal BAC limits
- Alcohol consumption
- Motorisation
- Behaviour
- Demographic factors
- Norms and culture
- Enforcement
- Information campaigns and driver training.

In the following six chapters it is tried to analyse if the alcohol SPI correlates with drink-driving prevalence, legal BAC limit, alcohol consumption, motorisation, and self-reported behaviour. These factors have been chosen because it is possible to find relevant data for these factors that can be used in a macro analysis.

In this chapter exiting and relevant studies about the subject are summarized.

7.1 Demographic factors

In terms of demographic characteristics, a consistent picture of drink-drivers emerges across a number of studies. These drivers are characterised as being (GRSP 2007, Bernhoft et al. 2007, Bernhoft and Hansen 2008):

- Male
- Aged 18–24 years old
- From a low socio-economic grouping
- Single or divorced
- In a blue collar occupation
- Of low education and limited literacy
- Of low self-esteem.

Variations in these demographic characteristics form country to country can probably contribute to explain the variation in alcohol SPI. However information about several of these characteristics is difficult to collect and compare in a macro analysis.

7.2 Norms and culture

The use of alcohol is object to formal and informal norms and culture – what kind of alcoholic drinks, how much alcohol is acceptable – the occasions when alcohol is used and the combination of alcohol and driving of motor vehicles.

Steensberg (2007, p. 385) describes the Danish preventive policy concerning drinking and driving: *"the Danish efforts to prevent alcohol conditioned road traffic accidents have been less effective than in the other Nordic countries caused by different population attitudes, alcohol cultures, social conditions and political cultures."* Norms and culture may influence the drinking behaviour of the people directly or through public policy, legislation and enforcement. Formal and informal norms may also interact.

Australian research has found that the population can be divided into four groups regarding attitudinal characteristics of drink drivers. This division is based on three factors (Span 1995):

- Fear of being detected driving while impaired by alcohol
- Fear of crashing
- Acceptance of the BAC limit.

The four groups were characterised as (Span 1995):

1. *Believers:* High fear of being caught or crashing. They have the highest level of acceptance of a 0.05 BAC limit and associated countermeasures. They drank least on their last "drinking occasion".
2. *Pressured:* High fear of being caught or crashing, but a lower acceptance of the BAC limit and enforcement. They experienced social pressure to keep up with the group while drinking.
3. *Deterred:* Lower levels of fear of being caught or crashing, but accept the need for the 0.05 BAC limit and countermeasures.
4. *Opposers:* Low level of fear of being caught or crashing, and low levels of acceptance of the BAC limit and countermeasures. They drank most on the last "drinking occasion", and reported driving while impaired by alcohol more frequently than other groups.

The study concluded that opposers may well be the group with the highest risk of being involved in a drink-driving crash and are also likely to be those whose behaviour is most difficult to change.

The share of opposers in each country influences also the alcohol SPI. Like information about demographic characteristics this is difficult to collect. However, the SARTRE project described in chapter 12 offers the opportunity to get some information about self-reported opinions and behaviours among car

drivers that indicate average attitudinal characteristics of the population in each country.

7.3 Enforcement, information campaigns and training

Public countermeasures such as enforcement, information campaigns and driver training may very well affect the alcohol SPI, but if they do, they will do it through influencing individual behaviour and prevalence of drinking and driving.

Thus, for two reasons we have chosen to study the relations between individual behaviour and prevalence of drinking and drinking on the one hand and the SPI on the other, rather than studying the relations between public countermeasures and the SPI.

Firstly, it is way beyond the scope of this project to collect data on countermeasures against drinking and driving in European countries.

Secondly, such countermeasures may also be regarded as a consequence of drinking and driving or high SPI results, since both road authorities and the road users in general may demand more countermeasures if the prevalence of drinking and driving is high or alcohol-related fatalities make up a high percentage of all road fatalities.

8 The legal limit and the SPI

The legal blood alcohol concentration (BAC) limit may correlate with the alcohol SPI. Everything else being equal the SPI should be higher, the lower the legal limit is, simply because more drivers would be above a 0.0 limit than above for example a 0.8 limit. However, low legal limits may indicate that drinking and driving is considered a serious offence and of great concern to the society. Moreover, the degree of enforcement of the legal limit may be higher in countries with lower limits than in countries with higher limits, a fact which may produce exactly the opposite results.

A meta-analysis of studies from the United Stats, Australian, Japan and Sweden from 1986 to 1996 performed by Elvik and Vaa (2004, p. 975) shows that reducing the blood alcohol concentration limits for all drivers from 0.08 to 0.05 and from 0.05 to 0.02 reduces the number of fatal accidents by 8 % and the number of injury accidents by 4 %.

Another international review of studies of lowering the legal blood alcohol concentration in the United States, Canada, Australia, Sweden, Denmark, France and Austria give a reduction in alcohol related collisions, injuries and fatalities. However, in some cases it appears that the beneficial effects may decline over time (Mann et al. 2001).

A review of 14 independent studies in the United States indicate that lowering the legal BAC limit from 0.10 to 0.08 has resulted in 5-16 % reductions in alcohol related accidents. Five other studies also indicate that lowering the legal BAC limit from 0.08 to 0.05 also have a positive effect (Fell and Voas 2006).

Table 8. Legal blood alcohol concentration (BAC) limit (g/l) for 27 European countries.

0.0	0.2	0.3	0.4	0.5	0.8	0.9
- Czech rep	- Estonia	- Germany**	- Lithuania	- Austria	- United Kingdom	- Cyprus***
- Hungary*	- Norway			- Belgium		
- Romania	- Poland			- Bulgaria		
- Slovakia	- Sweden			- Denmark		
				- Finland		
				- France		
				- Greece		
				- Italy		
				- Latvia		
				- Portugal		
				- Slovenia		
				- Spain		
				- Switzerland		
				- The Netherlands		

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* The BAC limit for Hungary is 0.0 g/l, but data is also provided for BAC over 0.5 g/l.

** The BAC limit for Germany on 0.3 g/l is a limit for accident involved drivers.

*** The BAC limit for Cyprus was changed from 0.9 g/l to 0.5 g/l in 2006 (SafetyNet 2007).

Table 8 summarizes the legal blood alcohol concentration (BAC) limit for 27 European countries. The BAC limit varies between 0.0 and 0.9 g/l for the countries. The most frequent BAC limit is 0.5 g/l, which is used by 15 countries. A BAC limit of 0.0 and 0.2 g/l are both used by four countries. A BAC limit of 0.3, 0.4, 0.8 and 0.9 g/l is only used by one country. Note that the BAC limit for Cyprus was changed from 0.9 g/l to 0.5 g/l in 2006 and that the stated limit for Germany only is for accident involved drivers only.

Figure 6 compares the alcohol SPI and the BAC limit for 25 European countries. The figure shows that there is no correlation between the alcohol SPI and the BAC limit. R^2 for the trend line is 0.10. However, it should be noted that the trend line is positive meaning that higher BAC limit gives higher alcohol SPI. This finding party supports the hypothesis that low BAC limits mean higher focus and enforcement and therefore lower alcohol SPI. But again, it is a very weak support.

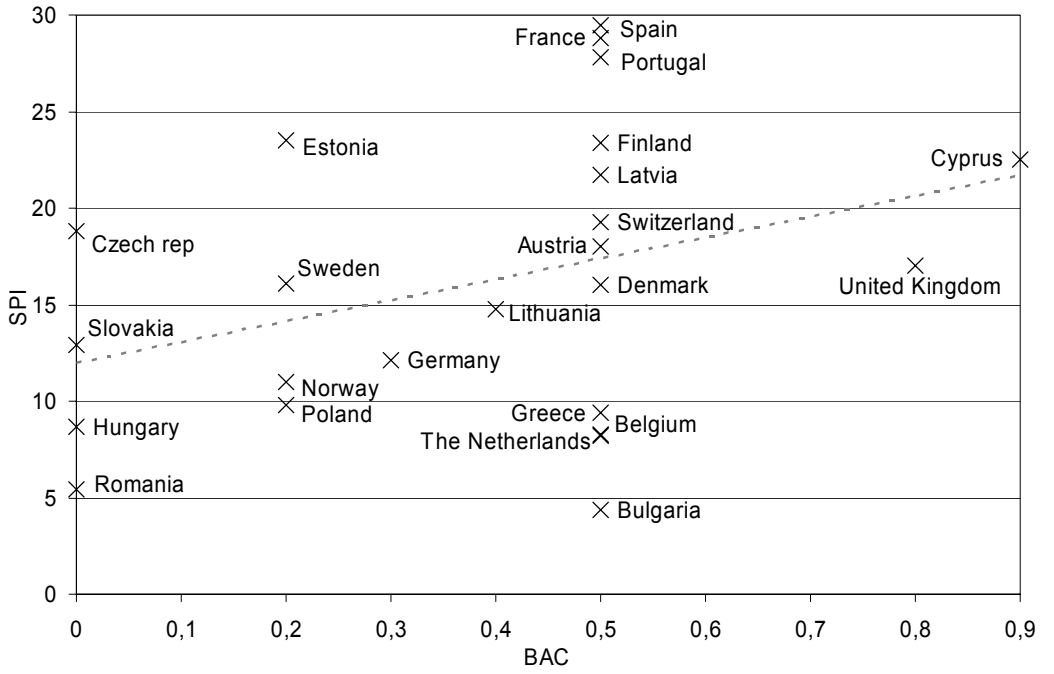

Figure 6. Comparison of the alcohol SPI for 2004-2005 and the legal blood alcohol concentration (BAC) limit. For Norway and Sweden the reestimated SPI in the in-depth study in chapter 6 is used. For Czech Republic and Austria 18.8 % and 18.0 % are used as suggested in the in-depth study. The alcohol SPI for 2007 is included for Bulgaria and Romania. Italy and Slovenia is excluded in the figure due to very high SPI.

9 Drink-driving prevalence and SPI

As described in the introduction the "ideal" safety performance indicator for alcohol and driving would be the prevalence and concentration of impairing substances among the general road user population. However, this ideal safety indicator may be difficult to achieve in practice (Assum et al. 2007, 2007a).

In this chapter the alcohol SPI will be compared to existing data for drink-driving prevalence. It is evident to assume that the drink-driving prevalence and the alcohol SPI will correlate. In fact, the drink-driving prevalence should probably be one of the main factors influencing the number of fatalities occurring in accidents where at least one driver is influenced by alcohol. Everything else being equal the SPI should be higher, the higher the drink-driving prevalence is and lower, the lower the drink-driving prevalence.

The calculation of the drink-driving prevalence is based on studies from 2006 and 2008 organised and described by the European Traffic Police Network (TISPOL). The control of drink-driving was a part of two big European drink drive safety campaigns in June 2006 and June 2008. The controls involved 19 countries in 2006 and 18 countries in 2008 (TISPOL 2008, 2008a). Table 9 describes what countries participated in the campaigns in 2006 and in 2008.

In each country the police carried out controls in the usual manner for their country. This means that vehicles were stopped in three different ways (TISPOL 2008):

1. Only drivers suspected to be under the influence of alcohol or drugs were stopped and tested
2. Drivers were stopped and tested randomly
3. All drivers on the selected roads were stopped and tested.

It is not described what method used in the different countries, and consequently the comparison of results between countries is difficult.

Table 9 summarizes the result of the controls. In 2006 nearly 600,000 drivers were tested for alcohol in the 19 countries participating. This means that about 30,000 drivers in average were tested in each country. The most controls were made in Spain, France and Poland, which made respectively about 170,000, 93,000 and 54,000 controls. Cyprus, Slovenia and Portugal made the fewest controls. They made between 2,000 and 5,000 controls (TISPOL 2008).

Among the tested drivers about 13,000 were found to have consumed excess alcohol. This corresponds to 2.2 %. The largest drink-driving prevalence was found in Slovenia, United Kingdom and Portugal. In these countries about 9 % of the controlled drivers were impaired by alcohol. The Nordic countries; Finland, Norway, Sweden and Denmark had the lowest prevalence between 0.1 and 1.1 % (TISPOL 2008).

Table 9. Drink-driving prevalence for 19 European countries in 2006 and 2008 (TISPOL 2008, 2008a). Note that the study is made for different countries in 2006 and 2008. The countries are listed by country code and EU membership.

	2006			2008		
Country	**Motorists controlled**	**Offences detected (number)**	**Offences detected (%)**	**Motorists controlled**	**Offences detected (number)**	**Offences detected (%)**
Belgium (BE)	992	44	4,4	3,567	119	3,3
Czech rep (CZ)	-	-	-	-	-	-
Denmark (DK)	18,717	206	1,1	13,585	110	0,8
Germany (DE)	167	2	1,2	49,375	591	1,2
Estonia (EE)	-	-	-	-	-	-
Greece (EL)	24,976	711	2,8	34,645	1,241	3,6
Spain (ES)	170,491	2,356	1,4	185,553	2,102	1,1
France (FR)	93,433	2,466	2,6	223,030	4,835	2,2
Ireland (IRL)	-	-	-	26,312	380	1,4
Italy (IT)	13,399	493	3,7	32,443	647	2,0
Cyprus (CY)	2,008	110	5,5	-	-	-
Latvia (LV)	-	-	-	-	-	-
Lithuania (LT)	-	-	-	23,219	491	2,1
Hungary (HU)	23,955	336	1,4	24,859	320	1,3
The Netherlands (NL)	16,693	213	1,3	30,647	470	1,5
Austria (AT)	-	-	-	-	-	-
Poland (PL)	53,596	3,095	5,8	-	-	-
Portugal (PT)	4,738	412	8,7	-	-	-
Slovenia (SI)	2,192	192	8,8	-	-	-
Slovakia (SK)	-	-	-	-	-	-
Finland (FI)	28,697	43	0,1	38,261	212	0,6
Romania (RO)	31,392	501	1,6	68,983	1,109	1,6
Sweden (SE)	50,317	372	0,7	74,506	467	0,6
United Kingdom (UK)	10,426	916	8,8	13,842	829	6,0
Norway (NO)	34,977	84	0,2	33,170	76	0,2
Switzerland (CH)	5,975	267	4,5	5,190	345	6,6
Moldova rep	-	-	-	1,548	301	19,4
Total	587,141	12,819	-	882,735	14,645	-
Average	30,902	675	2,2	49,041	814	1,7

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A total of 16,604 drivers were also tested for drugs with 301 corresponding to 1.8 % proving positive (TISPOL 2008).

In June 2008 about 880,000 drivers were tested for alcohol. This means that nearly 50,000 drivers in average were tested in each country. This is 20,000 more than in 2006. Most controls were carried out in France, Spain and Sweden, about 223,000, 186,000 and 74,000 controls respectively. Moldova Republic, Belgium and Switzerland made the fewest controls (TISPOL 2008a).

Among the tested drivers 14,645 were found to have consumed excess alcohol. This corresponds to 1.7. %. This is 0.5 % points less than in 2006. The largest drink-driving prevalence was found in Moldova Republic, Switzerland and United Kingdom. In Moldova Republic almost one in five of those stopped were over the

limit. Again the Nordic countries had the lowest prevalence, all less than 1 % (TISPOL 2008a).

13 countries also tested for drugs in 2008. In total 1,019 were impaired by drugs. TISPOL (2008a) has not described how many drug test made in 2008, so it is not possible to calculate the percentage of impaired.

Table 10. Drink-driving prevalence in 18 European countries in 2006 and 2008 (TISPOL 2008, 2008a). The countries are ranked by drink-driving prevalence 2006. The table also described alcohol safety performance indicator for SafetyNet 2005 and SPI rank among the 18 included countries. For Norway and Sweden the reestimated SPI in the in-depth study in chapter 6 is used.

Country	SPI (%)	SPI (Rank)	Drink-driving prevalence (%) 2006	2008	Prevalence 2006 (Rank)
Finland	23.4	14	0.1	0.6	1
Norway	11.0	6	0.2	0.2	2
Sweden	16.1	10	0.7	0.6	3
Denmark	16	9	1.1	0.8	4
Germany	12.1	7	1.2	1.2	5
The Netherlands	8.3	2	1.3	1.5	6
Hungary	8.4	3	1.4	1.3	7
Spain	29.5	17	1.4	1.1	8
Lithuania	14.8	8	-	2.1*	9
France	28.8	16	2.6	2.2	10
Greece	9.4	4	2.8	3.6	11
Italy	72.2	18	3.7	2	12
Belgium	8.2	1	4.4	3.3	13
Switzerland	19.3	12	4.5	6.6	14
Cyprus	22.5	13	5.5	-	15
Poland	9.8	5	5.8	-	16
Portugal	27.8	15	8.7	-	17
United Kingdom	17	11	8.8	6	18
Correlation	-	-	-	-	0.15

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* The 2008 number for prevalence is used for Lithuania because no number for 2006 exists.

Table 10 and figure 7 describe and compare the rank for the alcohol SPI and the rank for drink-driving prevalence for the 18 European countries included in the calculation of both the alcohol SPI and the drink-driving prevalence.

Contrary to expectation figure 7 shows that there is no or a very small correlation between the SPI and drink-driving prevalence. The correlation is calculated to be 0.15.

The largest negative difference calculated as the rank for SPI minus the rank for drink-driving prevalence is found for Belgium, Poland, United Kingdom, and Greece, i.e. differences of respectively -12, -11, -7 and -7. This means that these countries have a high drink-driving prevalence, but a low or medium number of fatalities occurring in accidents where at least one driver is influenced by alcohol.

The Nordic countries; Finland, Sweden and, to a lesser extent, Denmark and Norway, and the south European countries; Spain, France and Italy have the largest positive differences calculated as the rank for SPI minus the rank for

motorisation. This means that despite a low drink-driving prevalence they have a high or medium alcohol SPI.

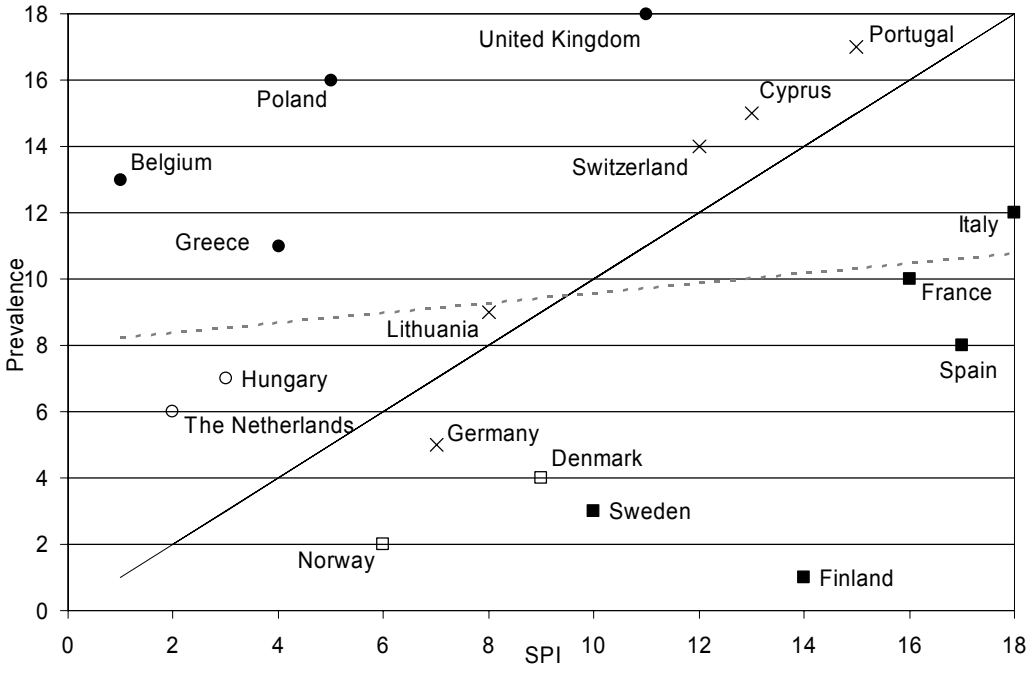

Figure 7. Comparison of the rank for SPI and drink-driving prevalence.

- The 45° line: The situation if there is 100 % correlation.
- The dotted grey line: The actually trend line.
- x: Same or almost the same rank for SPI and drink-driving prevalence.
- ●: The rank for drink-driving prevalence is considerably higher than the rank for SPI.
- ○: The rank for drink-driving prevalence is higher than the rank for SPI.
- ■: The rank for SPI is considerably higher than the rank for drink-driving prevalence.
- □: The rank for SPI is higher than the rank for drink-driving prevalence.

The analysis shows that there is no correlation between the alcohol SPI and the drink-driving prevalence as was expected. However, the prevalence figures are driving under the influence offences, meaning drivers above the legal limit in each country. This limit varies from 0.0 to 0.8 g/l BAC. Even if the same limits apply to the alcohol SPI, drivers involved in serious road accidents tend to have much higher BACs than the legal limit (Assum 2001, Mann et al. 2001, Bernhoft et al. 2007, Elliott et al. 2008).

However, the missing correlation may also be explained by biased or not representative numbers. As described the vehicles were stopped in three different ways in the involved countries, but it was not described which of the three methods was used in each country. Obviously the drink-driving prevalence found will be higher in countries which only test suspected drivers than in countries testing all drivers or selecting drivers at random, everything else being equal.

Even with a random selection it very difficult to find the “right” drink-driving prevalence, i.e. a representative and unbiased result. In a Norwegian study (Gjerde et al. 2008), about 12,000 drivers were stopped randomly and asked to

provide an anonymous sample of oral fluid to find the prevalence of alcohol and drugs among Norwegian drivers. Alcohol above the cut-off of 0.1 g/l was found in 0.4 % of the samples. In 0.3 % of the oral fluid samples the alcohol concentration was above 0.2 g/l (the legal limit) and in 0.1 % above 0.5 g/l (Gjerde et al. 2008).

However these results can also be biased. (Gjerde et al. 2008):

- Each driver was asked to participate voluntarily in the study. Even though the study was anonymous, 12 % of the drivers who were stopped refused to participate. It is reasonable to assume that a higher percentage of those who refused had used alcohol or drugs prior to driving.
- The prevalence of drink drivers at control site decreases over time, probably because drivers passing the control site warn other drivers.
- For some drugs oral fluid give false negative results compared to blood. Small sample volume might also cause false negative results.

An earlier roadside study carried out in 1981-1982 in Norway (Glad 1985) found 0.27 % of the drivers to have breath alcohol levels reflecting blood concentrations above 0.5 g/l. Due to these possible biases it is not possible to conclude whether the prevalence of drunken driving has changed since 1981-1982 (Gjerde et al. 2008). These studies illustrate the difficulties in finding the “right” drink-driving prevalence.

In conclusion, we have found no correlation between the prevalence of drinking and driving and the alcohol SPI chosen in SafetyNet. This may be an indication that the data quality is poor for either the SPI or the data for drinking and driving prevalence, or both, but it may also be an indication that the actual relation between the prevalence of drinking and driving and alcohol-related road accidents is more complex than expected.

10 Alcohol consumption and SPI

Alcohol consumption is likely to be one of the factors influencing the extent of drinking and driving, which in turn, should be one of the main factors influencing the number of fatalities occurring in accidents where at least one driver is influenced by alcohol. Thus, the larger alcohol consumption the larger alcohol SPI, everything else being equal.

Skog (2001) has studied the association between per capita alcohol consumption and fatal accidents in 14 European countries and Ramstad (2008) has made a similar study for the United States. The studies are made as time series analysis where changes in alcohol consumption in a country or a region are compared with the rate of fatal accidents in the same area.

The hypothesis is that an increase in per capita consumption reflects an increase in the number of drinking occasions and thus also an increased number of circumstances involving risk of accidents. However, note that this is not an obvious outcome if the consumption increase is due to lower abstention rate or an increased number of low consumptions occasions (Ramstad 2008).

The main conclusions of the time series studies of alcohol consumption and fatal traffic accidents is that accident mortality typically is significantly related to population drinking, but that there are cross-cultural differences in the magnitude of this association. In central Europe a 1 litre increase in per capita consumption gave a significant increase on 2.1 male deaths per 100,000 inhabitants. Similar numbers for northern Europe, southern Europe, United State and Canada are 0.05, 0.8, 3.2 and 3.6, where the last three numbers are significant. The results depend of country, sex and age (Skog 2001, Ramstad 2008).

Table 11 summarizes the alcohol consumption in litre pure alcohol per person in 2004 in the 23 European countries that SPI ’05 have been calculated for (WHO 2004). The countries are ranked by the consumption rate.

The average for the countries is 10.8 litres per person. Norway has the smallest consumption with 5.8 l/person. Beside Norway, Cyprus and Sweden have a low consumption, i.e. less than 7 litres per person.

The Czech Republic has the largest consumption with 16.2 l/person. This means that the consumption in Czech Republic is almost three times that of Norway. The second largest consumption per capita is found in France, 13.5 litres per person. This means that the consumption in the Czech Republic is almost 3 litres per person more than France, the second largest consumption. Germany, Austria, Portugal, Slovakia, Spain and Lithuania have a large consumption with over 12 litres per person.

It is beyond the scope of this project to assess the quality of the alcohol consumption data. These data may contain biases such as unregistered imports

and exports, home making and distillery, and alcohol consumption by tourists and other foreigners.

Table 11. European countries by safety performance indicator and rank for SafetyNet 2005 and by alcohol consumption rate (WHO 2004). For Norway, Sweden, the Czech Republic and Austria the suggested SPI in the in-depth study in chapter 6 is used.

Country	SPI (%)	SPI (Rank)	Alcohol consumption (l/person)	Alcohol (Rank)
Norway	11.0	7	5.8	1
Cyprus	22.5	18	6.7	2
Sweden	16.1	12	6.9	3
Poland	9.8	6	8.7	4
Italy	72.2	24	9.1	5
Greece	9.4	5	9.3	6
Latvia	21.7	17	9.3	7
The Netherlands	8.3	2	9.8	8
Estonia	23.5	20	9.9	9
Belgium	8.2	1	10	10
United Kingdom	17	13	10.4	11
Finland	23.4	19	10.4	12
Switzerland	19.3	16	11.5	13
Hungary (0.5)	8.4	3	11.9	14
Hungary (0.0)	8.7	4	11.9	15
Denmark	16	11	11.9	16
Lithuania	14.8	10	12.3	17
Spain	29.5	23	12.3	18
Slovakia	12.9	9	12.4	19
Portugal	27.8	21	12.5	20
Austria	18.0	14	12.6	21
Germany	12.1	8	12.9	22
France	28.8	22	13.5	23
Czech rep	18.8	15	16.2	24
Average	18.8	-	10.8	-
Correlation	-	-	-	0.17

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Figure 8 compares the rank for SPI and the rank for alcohol consumption. It is necessary to compares the ranks, because it is not possible to compares the actually numbers.

Figure 8 shows that there is no or a very small positive correlation between SPI and alcohol consumption. The correlation is calculated to be 0.17.

The largest negative difference calculated as the rank for SPI minus the rank for alcohol consumption appears for Germany, Hungary and Slovakia. The differences for these countries are between -14 and -10. This means that these countries have a high alcohol consumptions and a low or medium rank in the alcohol SPI.

The largest positive differences calculated as the rank for SPI minus the rank for alcohol consumption are found for Italy, Cyprus, Estonia and Latvia. Italy has the largest positive difference of 19 (24 minus 5). This calculation is based on the SafetyNet SPI, which is very different compared to the ETSC SPI. If the ETSC SPI is used, the difference is only -4.

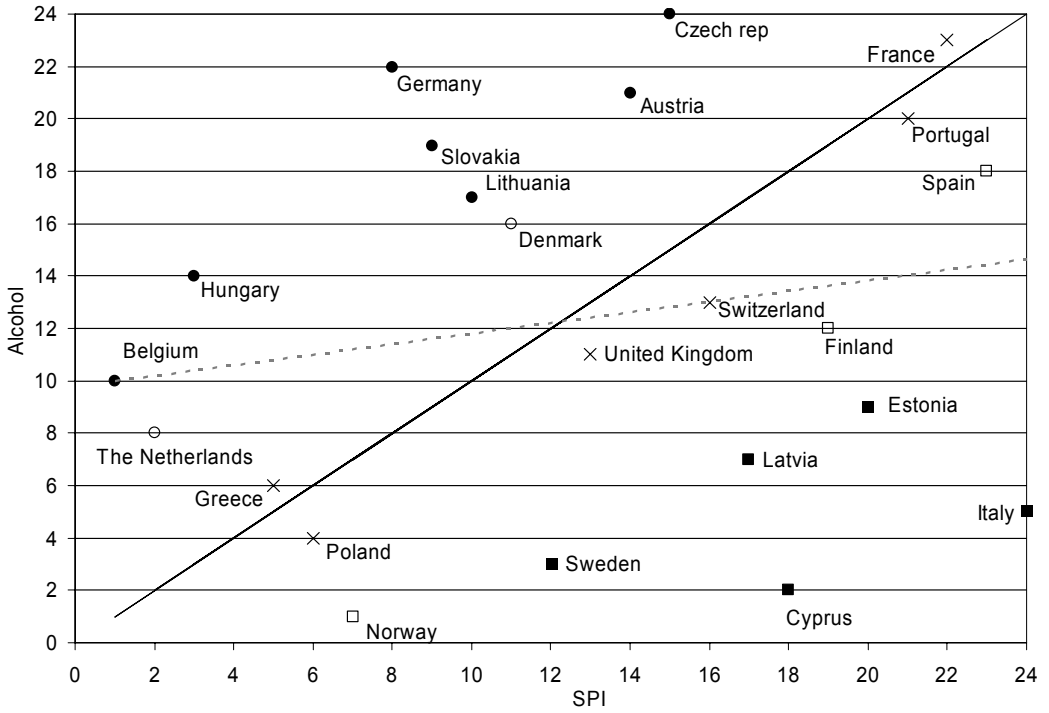

Figure 8. Comparison of the rank for SPI and alcohol consumption.

- The 45° line: The situation if there is 100 % correlation.
- The dotted grey line: The actually trend line.
- x: Same or almost the same rank for SPI and alcohol consumption.
- ●: The rank for alcohol consumption is considerably higher than the rank for SPI.
- ○: The rank for alcohol consumption is higher than the rank for SPI.
- ■: The rank for SPI is considerably higher than the rank for alcohol consumption.
- □: The rank for SPI is higher than the rank for alcohol consumption.

The differences for the two rankings can be explained in different ways:

- Some or all of the numbers for the SPI and alcohol consumption are incorrect, for example the WHO figures may be methodically biased with regard to unregistered imports and exports, home production and alcohol consumed by tourists and other foreigners.
- There is no correlation as assumed. This can be explained by parameters as:
  - Where people drink (at home, at private parties, at public pubs etc.)
  - How people drink (one beer or glass of vine every day, a lot of alcohol at parties now and then etc.)
  - Who drinks (young men without education, middle-aged people with long education etc.)
  - How to drink and drive (young people who think they are invincible and drivers without seat belt and too fast, elderly people who compensate etc.)
  - Transport (public transport, numbers of cars etc.).

This is illustrated by some fictive and "extreme" examples:

- Cyprus has a small alcohol consumption and a big SPI. Possible explanation: People from Cyprus drink at parties (have to go home), they drink a lot (get drunk), they are young men without education (do not compensate, on the contrary they are speeding), and there is no public transport (have to drive their own car).
- Germany has a big alcohol consumption and a small alcohol SPI. Possible explanations: Drinking at home or close to home (no need to drive after drinking), walking or using public transport to get home after drinking, middle-aged people who drink and drive, compensating by driving slowly and carefully.

These are only some possible explanations to illustrate why it is possible that there is no or a very small correlation between the SPI and alcohol consumption. We do not know what the situation is like in the different countries. It has to be investigated to explain the missing correlation.

11 Motorisation and SPI

In the previous chapter it was suggested that SPI result can be affected by motorisation. The assumption is that a small number of cars mean that few people have motor vehicles for leisure time use. Consequently, many people will have to travel by public transport or by bicycles. Moreover, people in countries with fewer cars may in general travel shorter distances than people in countries with many cars. This kind of travel behaviour produces fewer road accidents, especially fewer alcohol-related accidents compared with countries with many cars.

Table 12 summarizes the motorisation in cars per 1000 persons in 2005 in the 23 European countries for which the SPI '05 is calculated. The countries are ranked by motorisation.

Table 12. Motorisation for 23 European countries (EU 2008a). The countries are ranked after motorisation. The table also described alcohol safety performance indicator and rank for SafetyNet 2005. For Norway, Sweden, the Czech Republic and Austria the suggested alcohol SPI in the in-depth study in chapter 6 is used.

Country	SPI (%)	SPI (Rank)	Motorisation (Cars/1000 persons)	Motorisation (Rank)
Latvia	21.7	17	134	1
Slovakia	12.9	9	189	2
Lithuania	14.8	10	199	3
Hungary (0.5)	8.4	3	218	4
Hungary (0.0)	8.7	4	218	5
Estonia	23.5	20	269	6
Poland	9.8	6	321	7
Denmark	16	11	356	8
Czech rep	18.8	15	386	9
Greece	9.4	5	393	10
Portugal	27.8	21	396	11
Cyprus	22.5	18	427	12
Norway	11.0	7	439	13
The Netherlands	8.3	2	442	14
Belgium	8.2	1	458	15
Finland	23.4	19	459	16
Sweden	16.1	12	460	17
France	28.8	22	494	18
Spain	29.5	23	501	19
United Kingdom	17	13	503	20
Austria	18.0	14	507	21
Switzerland	19.3	16	513	22
Germany	12.1	8	559	23
Italy	72.2	24	596	24
Average	18.8	-	393	-
Correlation	-	-	-	**0.32**

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The average for the countries is 393 cars per 1000 persons. Latvia has the lowest motorisation with 134 cars/1000 persons. Beside Latvia, Slovakia and Lithuania have a low motorisation with 200 cars/1000 persons. Generally, the countries in Central and Eastern Europe have low motorisation. They all have lower than average motorisation. The Czech Republic has the highest motorisation of these countries with 386 cars/1000 persons.

Italy has the highest motorisation, 596 cars per 1000 persons. This means that the motorisation in Italy is over four times greater than in Latvia. The second highest motorisation is found in Germany, 559 cars/1000 persons. Switzerland, Austria, United Kingdom and Spain also have a motorisation of over 500 cars/1000 persons.

It is beyond the scope of this project to assess the quality of the data for motorisation, and it is assumed that the data are correct. However, some countries may have problems with registering of cars gone out of use, and may thus have an unrealistically high number of cars per 1000 people.

Figure 9 compares the rank for SPI and the rank for motorisation. Like alcohol consumption the ranks are used in the comparison.

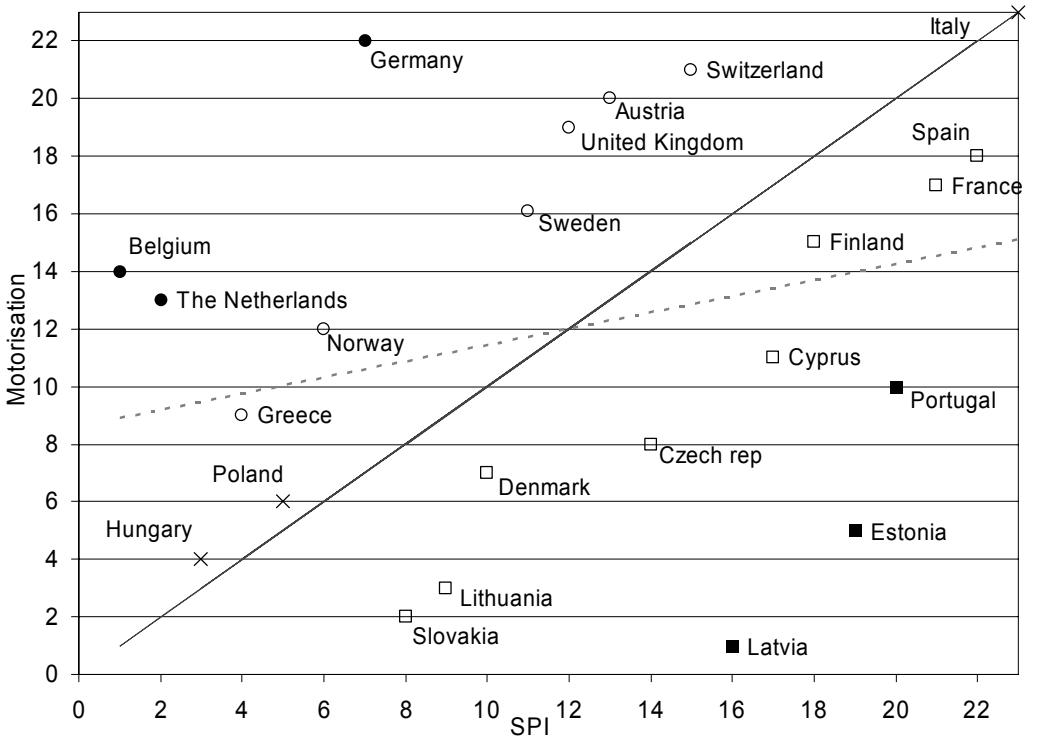

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Figure 9. Comparison of the rank for SPI and motorisation.

- The 45° line: The situation if there is 100 % correlation.
- The dotted grey line: The actually trend line.
- x: Same or almost the same rank for SPI and motorisation.
- ●: The rank for motorisation is considerably higher than the rank for SPI.
- ○: The rank for motorisation is higher than the rank for SPI.
- ■: The rank for SPI is considerably higher than the rank for motorisation.
- □: The rank for SPI is higher than the rank for motorisation.

Figure 9 shows that there is a small positive correlation between SPI and motorisation. As shown in table 12 the correlation is calculated to be 0.32.

The largest negative difference calculated as the rank for SPI minus the rank for alcohol consumption is found for Germany, Belgium and the Netherlands, i.e. differences of -15, -13 and -11 respectively. As shown in the previous chapter Germany and Austria also have large negative differences regarding alcohol consumption. These means that they both drink a lot and have a lot of cars, yet have a small or medium SPI.

Latvia, Estonia and Portugal have the largest positive differences calculated as the rank for SPI minus the rank for motorisation. This means that they have relatively few cars and a relatively high SPI.

12 Self-reported behaviour and SPI

The SPI ranking is also compared with ranking from the SARTRE project. SARTRE is the acronym for "Social Attitudes to Road Traffic Risk in Europe". It is a research project, which aims at studying the opinions and reported behaviours of car drivers in 23 European countries. Among the countries included in SafetyNet, Lithuania, Latvia and Norway are not included in the SARTRE project data. In addition not all relevant data exist for Finland.

The SARTRE project is based on a representative questionnaire survey, including between 754 and 1,694 respondents in each country with and average on 1,045 respondents per country. This means that the total number of respondent is about 21,000 (Cauzard 2004).

One of the main topics of the study is drinking and driving. Among all the questions asked about this topic, we have chosen to compare the SafetyNet SPI with the answers to three of the questions. These are:

1. Over the last week, how many days did you drive, when you may have been over the legal limit for drinking and driving?
2. How often do you think drinking and driving causes road accidents?
3. Frequency of alcohol checks over past 3 years.

These three questions are chosen because it can be assumed that the answers will explain or correlate with the alcohol SPI. Table 13 summarizes the answers from each country on the three questions. The table also summarize the country ranking for each question.

The first result is the percentage of the drivers who have answered that they have been driving one day or more last week when they might have been over the legal limit for drinking and driving. These percentages vary between 0 and 21.8 % with an average on 4.1 %. Sweden, Poland, Denmark and United Kingdom have the best result with a percentage under 1 %. Cyprus has the worst result with a percentage of 21.8 %. Greece, Italy and Spain have also a bad result with a percentage between 7.2 % and 7.9 %.

The second result deals with the percentage of the drivers who think that drinking and driving always or very often causes road accidents. The percentage saying always or very often is used as the analysis parameter. This percentage varies between 35 % and 78 % with an average of 56 %. The Netherlands, the Czech Republic and Germany have the lowest percentages and Greece, Sweden, Italy, Estonia and United Kingdom have the highest percentages. Note that a high percentage is assumed to be good.

The last result is the percentage of the drivers having been controlled for alcohol while driving during the passed three years. The percentage controlled one or

more times varies between 4 % and 64 %. Finland, Estonia and Slovakia have the most controls and Italy, United Kingdom and Denmark have the fewest controls.

Table 13. Results form the SARTRE project for 20 European countries (Cauzard 2004) and alcohol SPI and rank for SafetyNet 2005. The countries are ranked by SPI. For Sweden, the Czech Republic and Austria the suggested alcohol SPI in the in-depth study in chapter 6 is used.

Country	SPI (Rank)	Drink and drive last week (%)	DD (Rank)	Drink and drive is accident cause (%)	Accident cause (Rank)	Over zero controls at 3 years (%)	Controls (Rank)	Total (Rank)
Belgium	1	5.8	16	62	7	23	13	12.0
The Netherlands	2	1.9	8	35	21	37	5	11.3
Hungary (0.5)	3	1.3	5	47	17	22	15	12.3
Hungary (0.0)	4	1.3	6	47	18	22	16	13.3
Greece	5	7.9	19	78	1	30	10	10.0
Poland	6	0.3	2	66	6	22	14	7.3
Germany	7	2.4	10	46	19	24	12	13.7
Slovakia	8	3.9	12	49	14	51	3	9.7
Denmark	9	0.3	3	49	12	13	19	11.3
Sweden	10	0	1	71	2	41	4	2.3
United Kingdom	11	0.6	4	70	3	9	20	9.0
Czech rep	12	2	9	45	20	32	9	12.7
Austria	13	2.6	11	49	13	15	18	14.0
Switzerland	14	4.2	13	54	9	20	17	13.0
Cyprus	15	21.8	20	54	10	30	11	13.7
Finland	16	-	-	51	11	64	1	6.0
Estonia	17	1.6	7	70	4	60	2	4.3
Portugal	18	4.2	14	55	8	33	6	9.3
France	19	5.1	15	49	15	33	7	12.3
Spain	20	7.2	17	48	16	32	8	13.7
Italy	21	7.3	18	70	5	4	21	14.7
Average	-	4.1	-	55.5	-	29.4	-	-
Correlation	-	-	**0.36**	**-**	**-0.26**	**-**	**-0.12**	**-0.21**

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- Drink and drive last week: Number of asked people who have answered that they have been driving one day or more last week when they have been over the legal alcohol limits.
- Drink and drive is accident cause: Number of asked people who mean that drinking and driving always or very often cause road accidents.
- Over zero controls at 3 years: Number of asked people who have been controlled for alcohol while driving the past three years.

Figure 10 compares the rank for SPI and the rank for the drink and drive question. There is about the same correlation as for motorisation. This means a positive and very small correlation on 0.36.

Belgium and Greece have the largest negative difference calculated as the rank for SPI minus the rank for alcohol consumption. This means that they have a low SPI rank but many people who drink and drive.

Estonia and Sweden have the largest positive difference. This means that few people drink and drive but even though the countries have a relative high SPI.

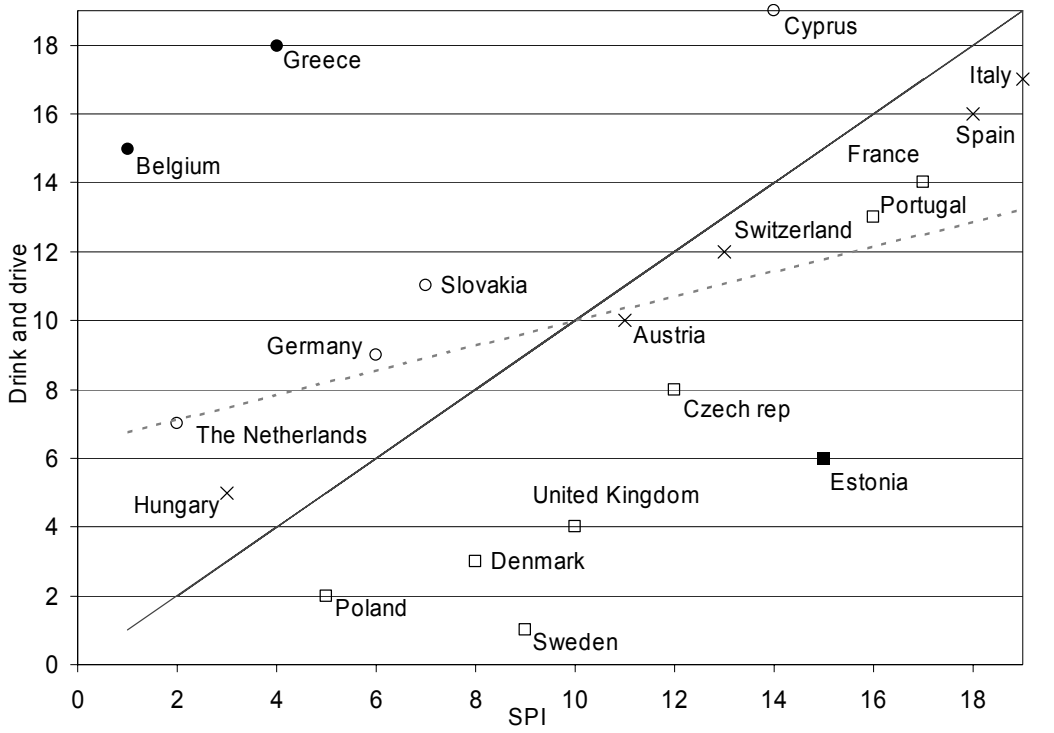

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Figure 10. Comparison of the rank for SPI and people who drink and drive.

- The 45° line: The situation if there is 100 % correlation.
- The dotted grey line: The actually trend line.
- x: Same or almost the same rank for SPI and people who drink and drive.
- ●: The rank for people who drink and drive is considerably higher than the rank for SPI.
- ○: The rank for people who drink and drive is higher than the rank for SPI.
- ■: The rank for SPI is considerably higher than the rank for people who drink and drive.
- □: The rank for SPI is higher than the rank for people who drink and drive.

Figure 11 compares the rank for SPI and the rank for the second question about accident cause. There is no correlation between the two ranks. The correlation coefficient is calculated to be -0.26.

The Netherlands, Hungary and Germany have the largest negative difference calculated as the rank for SPI minus the rank for alcohol consumption. This means that they have a low SPI rank even though people do not think that drinking and driving is a traffic safety problem.

Italy, Estonia and Portugal have the largest positive difference. This means that many people mean that drink and drive is a traffic safety problem but the countries have a relative high alcohol SPI.

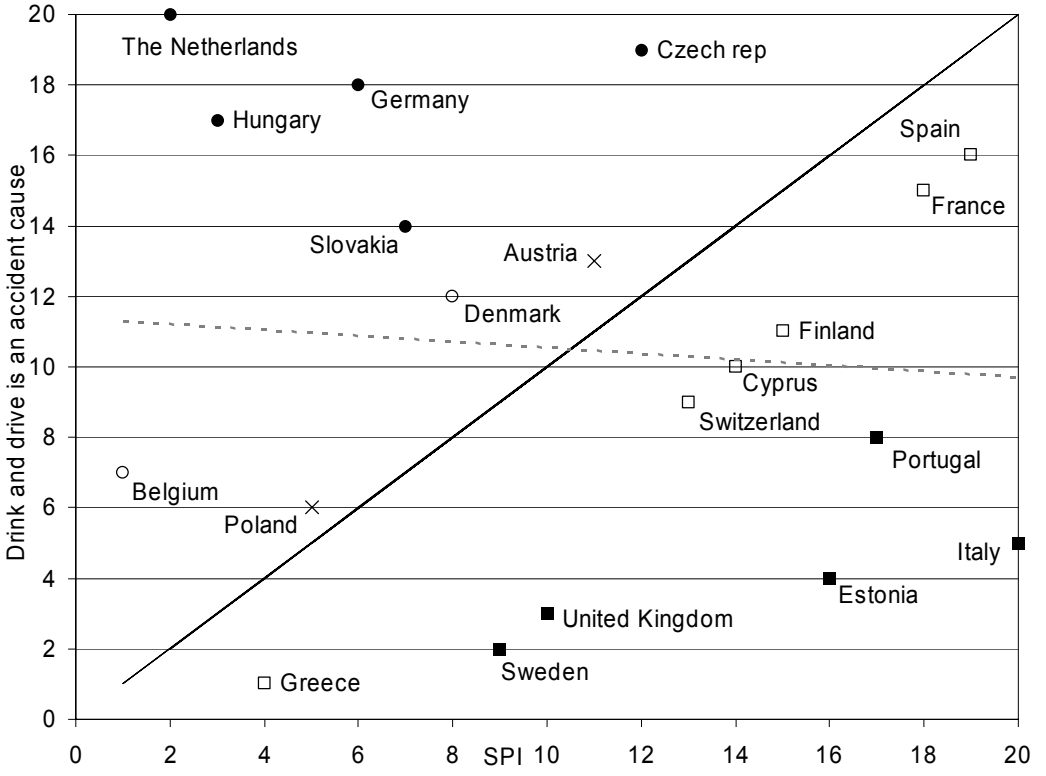

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Figure 11. Comparison of the rank for SPI and drivers who think that drinking and driving very often is an accident cause.

- The 45° line: The situation if there is 100 % correlation.
- The dotted grey line: The actually trend line.
- x: Same or almost the same rank for SPI and people who mean that drinking and driving very often is an accident cause.
- ●: The rank for people who mean that drinking and driving very often is an accident cause is considerably higher than the rank for SPI.
- ○: The rank for people who mean that drinking and driving very often is an accident cause is higher than the rank for SPI.
- ■: The rank for SPI is considerably higher than the rank for people who mean that drinking and driving very often is an accident cause.
- □: The rank for SPI is higher than the rank for people who mean that drinking and driving very often is an accident cause.

Figure 12 compares the rank for SPI and the rank for the third question about police controls. There is no correlation between the two ranks. The correlation coefficient is calculated to be -0.12.

10 of the countries have a big difference between the two ranks. Positive difference means indicate low SPI and few controls (Belgium, Hungary, Denmark, Poland, and United Kingdom) and negative difference indicate high SPI and many controls (Finland, Estonia, Spain, Portugal and France).

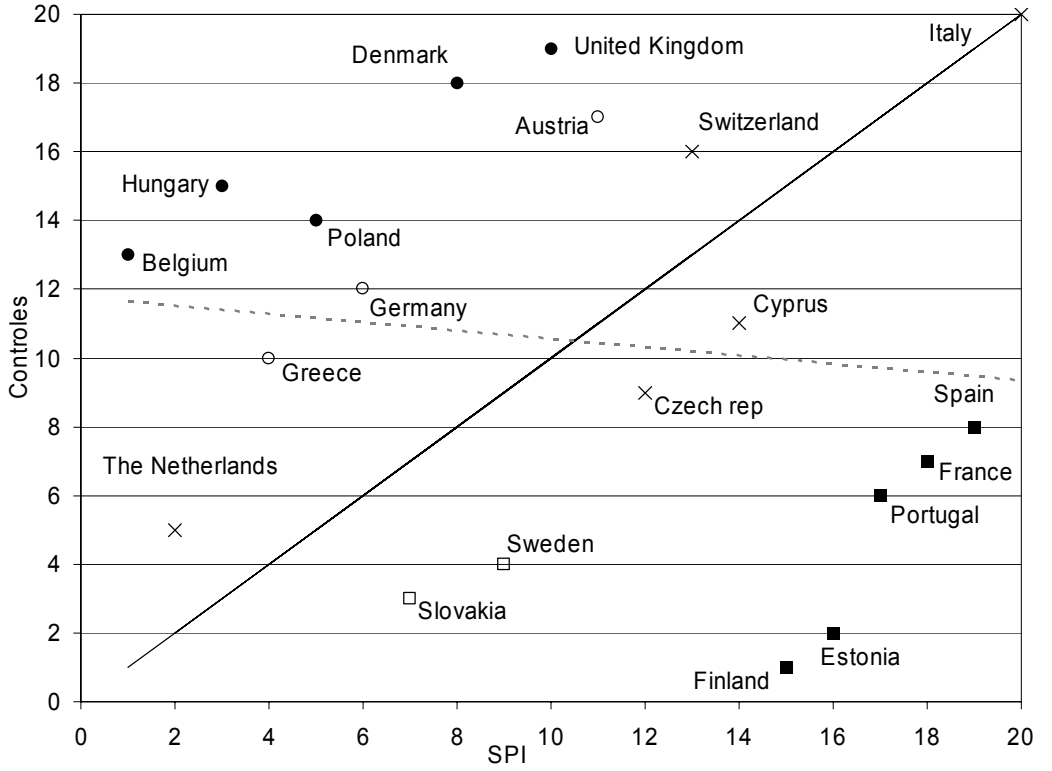

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Figure 12. Comparison of the rank for SPI and people who have been controlled the last three years.

- The 45° line: The situation if there is 100 % correlation.
- The dotted grey line: The actually trend line.
- x: Same or almost the same rank for SPI and people who have been controlled.
- ●: The rank for people who have been controlled is considerably higher than the rank for SPI.
- ○: The rank for people who have been controlled is higher than the rank for SPI.
- ■: The rank for SPI is considerably higher than the rank for people who have been controlled.
- □: The rank for SPI is higher than the rank for people who have been controlled.

13 Summary and discussion

Table 14 summarizes the five described rankings for alcohol SPI; SafetyNet ’05, SafetyNet ’07, ETSC and the two WHO rankings. The table also describes an average ranking calculated as the sum of the ranks divided by the number of rankings and the difference between the largest and the smallest rank.

Table 14. Ranks for the five SPIs for 27 European countries. The countries are listed by the total average ranking. For Norway, Sweden, the Czech Republic and Austria the SafetyNet alcohol SPI suggested in the in-depth study in chapter 6 is used.

Country	SafetyNet 05	SafetyNet 07	ETSC	WHO 1	WHO 2	Total	Difference
Bulgaria	-	1	-	-	-	1,0	-
Romania	-	2	-	-	-	2,0	-
Netherlands	1	-	11	4	5	5,3	10
Greece	3	5	7	5	8	5,6	5
Poland	4	4	5	6	11	6,0	7
Italy	23	-	1	2	2	7,0	22
Germany	6	7	2	14	7	7,2	12
Slovakia	7	3	9	10	12	8,2	9
UK	11	8	12	7	3	8,2	9
Hungary	2	-	6	12	13	8,3	11
Cyprus	17	13	15	1	1	9,4	16
Czech rep	13	12	3	11	9	9,6	10
Sweden	10	-	23	3	4	10,0	20
Austria	12	11	4	17	6	10,0	13
Lithuania	8	6	8	13	16	10,2	10
Switzerland	15	-	13	16	10	10,8	6
Spain	14	10	10	-	-	11,3	4
Norway	5	-	18	-	-	11,5	13
Denmark	9	-	16	9	17	12,8	8
Belgium	20	9	-	-	-	14,5	11
Latvia	16	14	14	15	14	14,6	2
Finland	18	15	17	8	15	14,6	10
Estonia	19	-	20	18	18	18,8	2
Ireland	-	-	19	-	-	19,0	-
France	21	16	21	-	-	19,3	5
Slovenia	-	17	22	-	-	19,5	5
Portugal	22	-	-	-	-	22,0	-

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- **Light grey:** Good performance defined as the one third of the countries with the best performance. The actually number varies from ranking to ranking.
- **Medium grey:** Medium performance.
- **Dark grey:** Bad performance defined as the one third of the countries with the worst performance.
- **Total:** The total rank calculated as the sum of the ranks divided with the number of rankings.
- **Difference:** The difference between the largest and the smallest rank.
- **WHO 1 and WHO:** See table 6.

Bulgaria, Romania, the Netherlands and Greece have the best average ranking for the five rankings. Note, however, that the alcohol SPIs for Bulgaria and Romania have only been calculated in one of the five possible rankings. Portugal, Slovenia, France and Ireland have the largest average ranking.

The difference between the largest and the smallest rank vary between 2 for Latvia and Estonia and 22 for Italy. The average difference for all the countries is about 10. These great differences between the rankings indicate that some of the rankings cannot be trusted at least for some of the countries. The rankings for the countries with the smallest differences are probably the most reliable.

Table 15. Ranks of six possible influencing factors for 23 European countries. The factors are not known for Bulgaria, Romania, Ireland and Slovenia. The countries are listed by the total average ranking.

Country	Preva-lence	Consump-tion	Motor-isation	Drink and drive last week	Accident cause	Con-trols	Total	Difference
Latvia	-	7	1	-	-	-	4,0	6
Sweden	3	3	16	1	2	4	4,8	15
Norway	2	1	12	-	-	-	5,0	11
Estonia	-	9	5	6	4	2	5,2	7
Lithuania	9	-	3	-	-	-	6,0	6
Poland	16	4	6	2	6	14	8,0	14
Finland	1	12	15	-	11	1	8,0	14
Greece	11	6	9	18	1	10	9,2	17
Slovakia	-	17	2	11	14	3	9,4	15
Netherlands	6	8	13	7	20	5	9,8	15
Denmark	4	15	7	3	12	18	9,8	15
Hungary	7	14	4	5	17	15	10,3	13
Cyprus	15	2	11	19	10	11	11,3	17
Belgium	13	10	14	15	7	13	12,0	8
Portugal	17	18	10	13	8	6	12,0	12
UK	18	11	19	4	3	19	12,3	16
Czech rep	-	22	8	8	19	9	13,2	14
Spain	8	16	18	16	16	8	13,7	10
Italy	12	5	23	17	5	20	13,7	18
France	10	21	17	14	15	7	14,0	14
Switzerland	14	13	21	12	9	16	14,2	12
Germany	5	20	22	9	18	12	14,3	17
Austria	-	19	20	10	13	17	15,8	10

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- **Light grey:** Good performance defined as about one third of the countries with the best performance. The actual number varies between the rankings depending on the total number of countries ranked in the specific ranking.
- **Medium grey:** Medium performance.
- **Dark grey:** Bad performance defined as among the one third of the countries with the worst performance.
- **Total:** The total or average rank calculated as the sum of the ranks divided by the number of indicators.
- **Difference:** The difference between the largest and the smallest rank.

Table 15 summarizes the rankings for six possible influencing factors; drink-driving prevalence, alcohol consumption, motorisation, self-reported drinking and driving last week, accident cause and controls. The result from the analysis of the

legal blood alcohol concentration is excluded, because the countries cannot be ranked by BAC in a meaningful way as several of the countries have the same BAC limits.

Latvia, Sweden, Norway and Estonia have the best average ranking for the six possible influencing factors, while Austria, Germany, Switzerland and France have the largest average. However, the rankings vary a lot for each country. For example the average difference between the largest and the smallest rank is about 13 for all the countries.

Table 16. The 27 European countries divided into 11 categories with low, medium and high SPI and low, medium and high rank for the other indicators.

Category	Country	Total	Other indicators
1.1	**Poland**	Low	Low
1.2	**Netherlands**	Low	Medium
1.2	**Greece**	Low	Medium
1.2	**Slovakia**	Low	Medium
1.3	**Italy**	Low	High
1.3	**Germany**	Low	High
1.3	**UK**	Low	High
1.4	**Bulgaria**	Low	?
1.4	**Romania**	Low	?
2.1	**Sweden**	Medium	Low
2.1	**Norway**	Medium	Low
2.1	**Lithuania**	Medium	Low
2.2	**Hungary**	Medium	Medium
2.2	**Cyprus**	Medium	Medium
2.3	**Czech rep**	Medium	High
2.3	**Austria**	Medium	High
2.3	**Switzerland**	Medium	High
2.3	**Spain**	Medium	High
3.1	**Latvia**	High	Low
3.1	**Finland**	High	Low
3.1	**Estonia**	High	Low
3.2	**Denmark**	High	Medium
3.2	**Belgium**	High	Medium
3.2	**Portugal**	High	Medium
3.3	**France**	High	High
3.4	**Ireland**	High	?
3.4	**Slovenia**	High	?

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Table 16 summarizes the results described in tables 14 and table 15. Here it is tried to put the results from 27 European countries in 11 different categories to get a better overview of some results that "point in every directions".

The countries are divided into three overall categories with low, medium and high SPI results. These three categories are subdivided into nine categories based on the other analyzed indicators except accident cause, and supplemented with two categories for countries with no information about the other analyzed indicators.

The need to make compromises in the categorisation is emphasized. Without compromises it would not have been possible to make these categories because all the indicators or influencing factors do not have the same level for any country.

The different categories are described in the following. Low rank is good and high rank is bad.

Category 1.1

Category 1.1 consists only of Poland. This country has both a low SPI and low other indicators. This category may be regarded as a uniform category because countries in this category have the same rank for both SPI and possible influencing factors.

Category 1.2

The Netherlands, Greece and Slovakia are included in category 1.2. These countries have low SPI results and a mixture of other indicators which are low, medium and high, but primarily high.

Category 1.3

Italy, Germany and the United Kingdom are included in category 1.3. Countries in this category also have low SPI results, but the other indicators are generally high. This means that these countries have succeeded to have a low SPI even though the alcohol consumption and motorisation are high; there is quite a lot of drink-driving and few police controls.

Category 1.4

Category 1.4 consists of Bulgaria and Romania. These countries have low SPI results. For these two countries we have no information about the other indicators. The countries are presently not part of the SARTRE project, so it is not possible to get information from this project about opinions and reported behaviours of car drivers. Moreover, no information about drink-driving prevalence, alcohol consumption and motorisation has been found, though it may be possible to find information about these parameters by further research.

Category 2

Categories 2.1 -2.3 consist of all the countries in the middle regarding SPI. All of these countries have low, medium and high other indicators.

Category 3.1

Category 3.1 consists of Latvia, Finland and Estonia. These countries have a high SPI even though the other indicators in general are low. This means that they have a high share of alcohol fatalities though the alcohol consumption is low and motorisation is medium; there is quite few people who drink and drive and there are many police controls.

Category 3.2

Countries in category 3.2 have high SPI and in general medium level for the other factors. Denmark, Portugal and Belgium are included in this category.

Category 3.3

In the other end of the scale are countries with a high SPI. France is the only country in category 3.3 with both has a high SPI and high other indicators.

Category 3.4

Category 3.4 consists of Ireland and Slovenia. Slovenia has a high SPI, and Ireland has not provided data for the SPI. For these two countries we have no information about the other indicators. By further investigation it may be possible to find information about some of the parameters.

The initial hypothesis for this study was that the SPI should be correlated with the other factors, i.e. the ranking for both SPI and the other indicators should be the same or almost the same. However that is not the case for many countries, especially the countries in category 1.3 and 3.1. Thus, these categories are especially interesting.

If the officially original reported SPI results where used in stead of the results of the data quality studies summarised in chapter 6 the correlations between the alcohol SPI and the possible influencing factors would be even less and more countries would belong to category 1.3 and 3.1. Thus, there may be reasons to study the data quality of the more countries, especially countries in these two categories.

Two overall explanations are possible:

1. **Incorrect data:** Some of the data for the alcohol SPIs (SafetyNet and ETSC), drink-driving prevalence (TISPOL), alcohol consumption (WHO) and opinions and reported behaviours of car drivers (SARTRE) may be incorrect, biased or not representative. Some examples or possibilities:
   - Some of the SafetyNet alcohol SPI results are incorrect. Special attention should be paid to the countries with very low or very high SPI. Thus, an in-depth study of the Czech Republic and Austria having a low SPI and France, Sweden and Norway having a high SPI is described in chapter 6. The high number for Spain can be explained by the method used to handle untested drivers. Finally an attempt was made to follow up the extreme result for Italy, but no further reply was received.
   - The WHO statistics may be methodically biased with regard to import, export, home distillery and alcohol consumed by tourist and other foreigners.
   - Respondents in the SARTRE project do not comprise a representative group.
2. **No correlation:** There is no correlation between SPI and the other indicators as it was assumed.

Different parameters can explain the fact of no correlation.

Explanations for category 1.3 could for example be:

- Drinking at home: no need to drive
- Drinking a little many times, so the BAC limit is not exceeded

- Driving long time after drinking
- Good public transport: no need to drive
- Walking or riding a cycle instead of driving
- Compensating when drink-driving (middle aged).

Explanations for category 3.1 could for example be:

- Drinking at parties, bars and pubs: need to go home
- Drinking so much that the BAC limit is exceeded
- Driving soon after drinking
- No public transport: need to drive their own car
- Not compensating when drink-driving, on the contrary the drivers are speeding etc. (young maybe petty criminal men)
- High general safety level, i.e. relatively few other fatalities: the percentage of alcohol fatalities get high
- High general safety level: "normal" people do not drink and drive, it is only young maybe petty criminal men, who have an extremely high accident risk (and Sartre questionnaire surveys addresses primarily the "normal" people).

These are of course only some ideas to illustrate why it is possible that there is no correlation between SPI and alcohol consumption. We do not know what the situation is in the different countries. More research is needed to explain the missing correlation.

In chapter 7 nine factors were listed that may be expected to explain and thus correlate with the SPI results. The relations between five of these factors and the SPI have been studied in chapters 8 through 12, but surprisingly no correlation was found between these factors and the SPI. Only further research can decide whether this lack of correlation is due to poor quality of the SPI data or substantial reasons, but this lack of correlation may be an indication that there may be problems with the quality of the alcohol SPI data collected in SafetyNet.

14 Conclusion

The results of the data quality study described in chapter 6 shows that there is reason to believe that the data used as basis for the calculation of the alcohol SPI may be incomplete in many countries. In chapters 8 through 12 the factors expected to correlate with the alcohol SPI and the actual correlations with this SPI are studied. Except for the legal BAC limit, we find no positive correlation between these factors and the SPI. This lack of correlation may be an indication that the alcohol SPI based on the data provided from the countries, is not valid, but there may also be other and more substantial reasons for this finding.

The results of the data quality study and the correlation study indicate clearly that there is a need to improve the quality of the data on the basis of which the alcohol SPI is calculated. Most importantly, the total number of drivers involved in fatal accidents, the number tested for alcohol and the number not tested, should be reported, in addition to the number of alcohol positive and negative drivers among those tested. When these figures are made available, adjusted SPI results can be estimated, as shown in chapter 2. Until these improvements are made for most countries, it is difficult to compare the alcohol SPI results across countries.

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