Road Safety Performance Indicators: Database Development. Deliverable D3.12 of the EU FP6 project SafetyNet.

Deliverable D3.12:

Road Safety Performance Indicators: Database Development

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Executive Summary

Between November 2004 and March 2008 the Performance Indicators team, of the SafetyNet project distributed a number of questionnaires, the aim of which was to collect data for the calculation of a number of Safety Performance Indicators.

This paper describes work undertaken as part of this project to build a European database of the data collected. Contained in the database is information describing factors such as the contribution of impairment to fatalities, rates of use of protective systems, levels of speeding, use of daytime running lights and the operation of the trauma care system. Data is available for the majority of the EU27 countries (EU25 + Norway and Switzerland) and is generally suitable for the calculation and validation of safety performance indicators.

As well as final figures for a number of important road safety performance variables, the database contains a wealth of metadata, describing the methodologies used to measure, calculate or estimate the final figures, the sampling techniques used and details of any studies of random or systematic errors in the figures. Allowing researchers to make informed decisions about whether comparisons between countries are appropriate, and to what extent such comparisons can reflect genuine differences in road safety between countries.

Contents

1 Introduction

The prevention of road accidents and injuries has been a major focus for policy makers across Europe for a number of years. In 2003, the European Commission adopted a road safety action programme based on the 2001 white paper, European Transport Policy for 2010: A time to decide. The key feature of the programme was the ambitious target of reducing annual road deaths by 50% by 2010 (EC 2001).

However, it could be argued that framing policy in terms of outcomes (for example numbers of casualties, fatalities or accidents) and monitoring success on the basis of changes in these may result in analysis which is over-simplified, since only the trends in outcomes (such as injuries or fatalities) are examined, not the factors influencing the trends. Moreover, action can only be taken once the risks have already been translated into an accident or casualty problem. A complementary approach is that of constructing and monitoring Safety Performance Indicators (SPIs). According to SafetyNet (D3.1, 2005) a Safety Performance Indicator is "any variable, which is used in addition to the figures of crashes or injuries to measure changes in the operational conditions of road traffic". For examples of performance indicator measures see Hakkert et al (2007).

The performance indicator approach has enjoyed a higher profile recently through initiatives such as the European Transport Safety Council's Road Safety Performance Index, which ranks European countries according to their performance as measured by a number of different indicators. Examples of the topics examined include drink driving, seat belt reminders and capital city safety. (ETSC, 2008)

The aim of the performance indicator team of the SafetyNet project was to develop a uniform set of safety performance indicators for each of the member states of the European Union, plus a small number of non members.

However, the availability of data for supporting performance indicator type measures, as opposed to those based on measures of fatality or casualty totals is more limited. Whereas all countries collect fatality, casualty and accident details, fewer have rigorous and transparent methodologies for the collection of data which describe in a more general sense the operation of the road transport system. Where such data exist the comparability and consistency of data in different countries may also be problematic.

As a first step towards addressing this difficulty, a number of questionnaires were distributed by the SafetyNet project.

This paper describes the process of collecting, storing and using the data in SafetyNet, concentrating specifically on the work of the Performance Indicator team, and the lessons learnt during this process. Recommendations for best practice in data management for future road safety research activities and projects are made, and the SafetyNet experience is compared to the ideal case, in order to illustrate the potential pitfalls and help to identify ways to avoid them. The aim is to provide the reader with a guide for the coordinated collection, storage and disclosure of road safety related data and information. The following chapters discuss the relationship between data collection, storage disclosure; a case study illustrating the points raised is presented, along with the lessons learnt; and conclusions and

2 Data collection, Storage and Disclosure

2.1 Introduction

The successful completion of work which requires large-scale data collection depends on the satisfactory achievement of a number of consecutive steps including –

- Determination of end-use requirements
- Determination of the necessary information/data to be collected
- Determination of future disclosure requirements of the information/data collected
- Determine appropriate storage (with reference to disclosure requirements)
- Determine appropriate data collection methodology
- Collect
- Collate
- Store
- Disclose
- Evaluate

In the case of large integrated European projects, these stages often need to be planned earlier and documented more explicitly, because of the need to submit proposals well ahead of the work taking place, but also because of the importance of building cohesion between widely dispersed and very diverse groups of researchers and stakeholders. In practice this may mean that the determination of end-use requirements takes place some time before the other steps, and possibly does not involve the same stake-holders. These stages are discussed in turn, with the key issues highlighted and links between the various steps explored.

2.2 Determining end-use requirements

An important distinction at the design stage of the study is that between “Theoretical” and “Policy” research (Hakim, 2000). This can be explained in the following terms -

1. Theoretical research can be thought of as research which aims to further develop scientific knowledge and understanding, its intended audience generally being other research scientists and academics.
2. Policy research, as the name suggests, is geared towards supporting policy-makers in determining and implementing the appropriate measures to address specific problems.

The main significance of this distinction, particularly for European Commission supported projects, is the focus on variables which lend themselves to policy interventions. For example, in the context of European road safety, variables describing differences in weather conditions in different countries might help an understanding of why accident rates differ across Europe. However, such variables are not “actionable” in the same sense that variables describing variations in infrastructure quality, for example, would be. The distinction between theoretical and policy research also has implications for the disclosure of research results; in the case of the latter, a broader range of dissemination methods should be considered in order to communicate with diverse stakeholder groups.

2.3 Determination of the data and information to be collected

The research design (or research plan) phase is where key decisions regarding what information to collect and how to collect it must be taken.

Resource considerations lead many projects (especially those intended to be pan-European in nature) to use secondary analysis. This means that data primarily collected by other organisations for other purposes is re-examined in a different context, in order to serve a different research objective. The use of secondary analysis has implications for the extent to which decisions about populations and topics taken early in the work may have to be reconsidered later. This may have knock-on implications for the data collection phase.

The advantage of secondary analysis generally lies in the reduced cost of data collection. However, the main disadvantage of such studies is that the analytical possibilities may be constrained by the availability of data. In addition, the extent to which the results for different countries can be compared, and meaningful conclusions drawn is restricted by the different data-collection methods or sampling strategies used in different countries. In such cases researchers need to have a high level of flexibility, in order to adapt methodologies and analysis to compensate for difficulties with the data. The result of this may be a phase of iteration, where methodologies are developed, data availability is examined, limitations in the data lead to adaptation of methods, data availability is re-examined, data collection is attempted, and so on.

In some cases the data used for secondary analysis may be derived not from other research activity, but from administrative activity. For example, the use of vehicle fleet registers to make calculations of risk, or to draw conclusions about the capacity of vehicles in different European countries to protect occupants in crashes. The differences between data collected specifically for research purposes, and data that becomes available as the result of the day to day activities of national institutions (for example) must be recognised.

The quality, consistency and completeness of the data will vary according to the nature of such data and the original purpose for which it was collected. This will be an important consideration when interpreting results. In the case of vehicle fleet data, this is generally collected in the context of implementation of the law, so is likely to be more complete and standardised than other data. In the case of data on ambulance response times (used to derive measures of trauma management quality within SafetyNet), those countries which monitor such data generally do so within the context of service delivery; comparability and standardisation may therefore be more suspect.

Decisions regarding the data and information to be collected will feed into the determination of disclosure requirements. The use of secondary analysis, for example, has implications since researchers must rely on the organisations which own the data to provide it. They may do so only subject to additional conditions, for example, regarding data protection (storage and disclosure) and having opportunities to evaluate the results. It may also be the case that data is only available in aggregate form, and is therefore difficult to combine with and compare to other data

2.4 Determination of future disclosure requirements

Decisions regarding the data and information to be collected will feed into the determination of disclosure requirements. The use of secondary analysis, for example, has implications since researchers must rely on the organisations which own the data to provide it. They may do so only subject to additional conditions, for example, regarding data protection (storage and disclosure) and having opportunities to evaluate the results. It may also be the case that data is only available in aggregate form, and is therefore difficult to combine with and compare to other data

2.5 Determination of appropriate data storage

Appropriate data storage will be influenced by the relative importance of serving a number of different objectives, including

- The need to create a definitive record of the data that was collected.
- Facilitating the proposed data analysis.
- Preparing for follow-on activities such as updating the figures, disseminating the findings, or developing the analysis further.
- Meeting any conditions which may be attached by third parties as a condition in providing the data.

The proposed data storage solution should be a key factor in the design of the data collection approach.

2.6 Determination of appropriate data collection

As has been established, two issues which are of key importance in determining the appropriate design for the data collection activity are the anticipated use of, and planned method of storage of the collected data. In the case of the SafetyNet project, where macroscopic (or national level) data was required, questionnaires were distributed to a network of national representatives. This was the case for three distinct work areas within the project (Enhancement of CARE[1] data, Risk Exposure data, and Safety Performance Indicators). In the context of European projects this is not an unusual approach, and was also adopted by the team involved in the SUPREME[2] project.

In both projects, questionnaires were distributed electronically. This method has clear advantages in resource terms (distribution costs, time for example), but also facilitates some automated processing of the responses.

The work of analysing the data and portraying the essential features which begins once the questionnaires are returned can also be made easier if the questionnaire construction has been carefully thought out beforehand.

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[1] Community Road Accident Database http://ec.europa.eu/idabc/en/document/2281/5926

[2] http://ec.europa.eu/transport/roadsafety/publications/projectfiles/supreme_en.htm

There is a range of design features which can which can be incorporated into the data collection stage to facilitate the later stages of data storage, disclosure and evaluation. These include;

- Pre-coding of the questionnaire responses: In practice this means that using check-boxes and listing all possible answers, is preferable to open-ended questions.
- Where open-ended questions are unavoidable, it may be helpful to determine in advance a systematic way of coding the responses ("coding frame")

This coding frame can be determined with reference to the aims of the questionnaire, since different aims may determine or influence the significance of different pieces of information.

2.7 Collection, collation and storage of data

2.7.1 Handling incomplete or missing data

One of the important elements when determining how to handle missing data is to understand why data are missing. Potential explanations include;

- Lack of understanding of the question
- Uncertainty about how to complete the question
- Unwillingness to divulge the information
- Failure to spot the question
- Lack of available data (or data not in suitable format)

Online surveys can help to circumvent the issue of missing data by using software to prevent respondents from proceeding while answers remain incomplete. However, these can limit the response rate (because they may irritate respondents) and can result in meaningless answers (because some respondents may just enter anything to get around the problem). A strategy for handling the missing data should be determined before the questionnaires are distributed. Again, this should be done with reference to the research aims, which will influence factors such as

- The significance of the missing data in affecting the validity of conclusions.
- The possibility of getting data from other sources (this is a more realistic prospect in studies using secondary analysis)
- Where other data sources may be available, the importance of having an officially-recognised source for the data.

Again, adequate planning early in the work can help to reduce the likelihood of problems with responses by communicating with respondents (to help them to see the value in the work), by trying to limit the length and complexity of the questionnaire, and by attempting simple formatting and good "readability".

2.7.2 Validation and cleaning of data

Cleaning of the data becomes less important if the questionnaire responses can be processed electronically, since miscoding and incorrect data entry (possible sources of "dirty" data) are less likely when these stages are not completed manually. However, some checks are still necessary, and these include;

- Removing default answers resulting from pre-coded questionnaires. For example, if drop-down lists are used, it may be that what looks like a response is actually just the first possible response in the drop-down list.
- Adding data labels to "check box" responses: In the database these responses take the value "1" or "0", depending on whether the box has been checked. However, without

knowing the original question, and the option represented by each checked box, knowing whether or not the box has been checked does not mean anything. For example, the question could be “for which years is data available?” and the box options a series of years, or the question “What type of breath tests do you carry out?” and the options - random, targeted, both, other etc.

2.7.3 Creation of repository tables

The purpose of repository tables is to create an accurate and lasting record of the data assembled, for reference or for use in the future. This can serve as a resource for further work, but also allows the validity of results and conclusions to be checked against the collected data.

It is therefore important that the format of the tables facilitates such uses.

3 Case study – Safety performance Indicator Data within the SafetyNet Project

3.1 Introduction

The data collected via these questionnaires describes factors such as the contribution of impairment to fatalities, rates of use of protective systems, levels of speeding, use of daytime running lights and the operation of the trauma care system. Data is available for the majority of the EU27 countries (EU25[3] + Norway and Switzerland) and is generally suitable for the calculation and validation of safety performance indicators.

As well as final figures for a number of important road safety performance variables, the questionnaire responses contain a wealth of metadata, describing the methodologies used to measure, calculate or estimate the final figures, the sampling techniques used and details of any studies of random or systematic errors in the figures. This allows researchers to make informed decisions about whether comparisons between countries are appropriate, and to what extent such comparisons can reflect genuine differences in road safety between countries.

The data was collected from a number of questionnaires, the first of which was distributed to the RSPI National Experts group in November 2004. (appendix)

The questionnaire was split into several chapters, eight of which contained questions which required a response, with the remainder being explanatory notes and guidance for respondents. The questions covered the seven topic areas for which SPI calculations were proposed (Alcohol and drugs, Speed, Protective systems, Daytime Running Lights, Vehicles (passive safety), Roads, and Trauma Management), and some basic definitions. For a detailed description of the reasons for selecting these topic areas, and the theoretical basis of the questionnaire design, refer to Hakkert and Gitelman (eds), (2007)

This initial questionnaire was followed by an additional set of questions for data on Alcohol and Drugs in February 2006, and the data from these two questionnaires together, along with the calculated Safety Performance Indicator values are the key data for which suitable storage needed to be designed.

In all cases the questionnaires were Word documents, which were sent electronically to the National Experts via the European Commission's Circa[4] site. Responses were also sent electronically, and saved as Word documents in Circa. The layout of the documents was very prescriptive; in many cases respondents selected their answer from a drop-down list, or indicated by checking a box. In a few cases text boxes were available for additional comments or explanations, but the whole document was password protected, to prevent respondents from modifying anything other than the answer fields. This made automatic coding of the responses (using computer programming) relatively straightforward.

Further questionnaires were sent in February 2008, the purpose of which was twofold;

- To update the data (& subsequently the SPI values), since the original figures, and indeed the list of EU member states, were becoming somewhat dated.

[3] The member states of the EU following the enlargement of 2004

[4] Circa – The collaborative workspace for European institutions

- To attempt to learn more about the reasons why some countries had not responded previously, and to make a further attempts to obtain the data from them.

These additional questionnaires were based very closely on the earlier versions. This made comparison of the responses easier, but also facilitated processing by enabling the procedures tried and tested on the first set to be implemented again. It was also felt that ensuring that the questionnaires were very similar would facilitate integration of the two sets of results.

Whilst the majority of countries did provide some data, when the initial deadline for returning the first questionnaire passed (February 2005) only eleven countries had responded.

Ultimately each country did provide data for at least one of the topic areas. However, a small group of countries provided only a very small part of the data: Ireland, Italy, Lithuania, Luxembourg, Slovakia and Slovenia provided data for only one or two indicator areas. Data for daytime running lights (DRL) was less widely available. This partly reflects the fact that in some countries (Denmark, Latvia, Norway, Sweden) the DRL usage rate is assumed to be at or approaching 100%, so these countries do not see a need to measure it. Conversely there are countries in which the use of DRL is not a policy issue, so there is no interest in collecting data.

In some cases the responses were not complete for all sections. In general the willingness of member states to provide data increased as the project progressed. It is likely that this reflected the close working relationship between the members of the National Experts groups and the SafetyNet team. It can probably also be explained by increasingly good communication between the project and the member states. This generated a better understanding of what the project was trying to achieve, which in turn helped member states to see the potential benefits of involvement. Table 1, below summarises the responses received. In some cases questionnaire responses did not contain data for all topics. In others, data was obtained from sources other than the questionnaire responses. For a detailed breakdown of data availability and results per topic see *reference of final deliverable*

Country	Responded 2004	Responded 2006	Responded 2008	Responded update
BE	YES	YES	YES	
BG	N/A		N/A	YES
CZ	YES	YES	YES	
DK	YES	NO	NO	
DE	YES	YES	YES	
EE	YES	YES	YES	
EL	YES	YES	YES	
ES	YES	YES	YES	
FR	YES	YES	YES	
IE	NO	NO	NO	
IT	NO	NO	NO	
CY	YES	YES	YES	
LV	YES	NO	YES	
LT	NO	YES	YES	
LU	NO	NO	NO	
HU	NO	YES	NO	
MT	YES	YES	YES	
NL	YES	YES	NO	
AT	YES	YES	YES	
PL	YES	NO	YES	
PT	YES	YES	YES	
RO				YES
SI	NO	NO	YES	

SK	NO	YES	YES	
FI	YES	YES	YES	
SE	YES	YES	YES	
UK	YES	NO	YES	
NO	YES	YES	NO	
CH	YES	NO	NO	

Table 1; Summary of responses to questionnaires

3.2 Description of the collected data

The type of data available is summarised in Table 2, below.

Topic Area	Meta data/background information	Data
Drugs and alcohol	Legal BAC limits per country. Methods for Impairment measurement. Possible disaggregations by road, driver type, by time variables etc. Drug driving legislation, testing and availability.	% BAC offenders
Speed	Measurement methodologies, possible disaggregations of data, measures of variability	Average speed % speed limit offenders
Protective systems	Data gathering methods for seat belt use data. Legislation regarding child restraint use. Possible disaggregations of data. Airbag presence – data availability and gathering methods. VRU helmet use legislation. Measurement methods.	% use of different protective systems for various categories of road user
Daytime Running lights	DRL legislation. Measurement techniques for DRL use rates.	DRL use rates
Vehicles (Passive safety)	No background information/meta data requested. Entire vehicle fleet database, disaggregated by make, model and year of first registration.	Vehicle age distribution and EuroNCAP scores for national fleet
Roads	Data describing settlement sizes, traffic flows between settlements of different sizes, distances involved.	Characteristics of the network connections (proportion grade separated or not, dual carriageway or not, for example)
Trauma care	Standards/guidelines for emergency response times. Level of equipment/qualifications for emergency vehicles and personnel. Operational procedures. Availability (or not) of injury databases.	Numbers of ambulances, paramedics, trauma beds available either within country or in representative area.

Table 2; Summary of database contents.

The following section discusses in more detail the data available for each topic area explored by the questionnaires. Some of the possibilities for further analysis that the database offers are introduced and some examples presented.

3.2.1 Alcohol and Drug Use

Driver impairment remains a key road safety issue: About 25% of all road fatalities in Europe are alcohol related whereas about only 1% of all kilometres driven in Europe are driven by drivers with 0.5 g/l alcohol in their blood or more (www.erso.eu). It is known that the crash rate and also the likely severity increase with increased blood alcohol concentration (www.erso.eu). However, reliably estimating the proportion of drivers in traffic who are impaired by alcohol consumption is difficult. European comparisons are problematic for a number of reasons, including; different legal BAC limits for drivers in different countries (and in some cases, different categories of driver), different driver testing regimes (random, targeted, mandatory or not in fatal accidents).

Twenty-three of the 27 countries provided data that could be used to calculate a safety performance indicator for alcohol. For details see Vis, M.A. and Van Gent, A.L. (Eds.) (2007)

To make realistic comparisons between countries, the statistics must be defined and collected in the same way in the countries to be compared. However, from the detailed methodological data collected by SafetyNet, we know that this is not the case: There are several differences between the countries which have provided data.

In most cases the database contains data for drivers *above the legal alcohol limit*. However, as has already been discussed, these legal limits vary: Details of these differences can in most cases be checked using the collected data.

The same is also true of the testing regime; whilst we know it varies across countries (and may even vary within countries, depending on local conditions or accident circumstances for example) we can make some judgements about the likely significance of these differences by reference to the meta data which was collected by the questionnaires alongside the data. It is clearly important to keep the links between the two, so that decisions about compatibility and comparability can be

According to Vis and Van Gent

> *"Producing reliable and valid, and thus comparable safety performance indicators for alcohol and drugs for the 27 countries is likely to require considerable efforts in harmonizing definitions, data collection and data analysis methods. The most important aspect is likely to be the number of drivers involved in fatal accidents, who are actually tested for alcohol and/or drugs"*

The data collected at least makes it easier to identify the differences in definitions, data collection and analysis methods, making steps towards harmonisation easier to design.

3.2.2 Speed

Speed is an issue of central importance to road safety practitioners for two reasons; speed affects the risk of being involved in an accident, and it affects the likely severity of injuries. At a higher speed, it is more difficult to react in time and prevent an accident. At higher impact speeds, more energy is released, some of which will need to be absorbed by the human body. Very strong relationships have been established between speed and accident risk and severity. (www.erso.eu)

The extent to which international comparisons of performance with regard to speed can be undertaken is currently limited. It is not generally lack of data that prevents meaningful analysis; most countries make large-scale speed surveys and even calculate the safety performance indicators proposed by the SafetyNet project. Average speed and the percentage of offenders are frequently reported indicators. However, significant differences in the way countries conduct their surveys prevent wide-scale comparisons. The main issues are (Vis and Van Gent, (Eds.), 2007):

- Representativeness of measuring locations
- Traffic conditions

- Comparability of roads
- Period of measurement
- Accuracy of data

The conclusion for the work on this topic area was very similar to that of the Drug and Alcohol team;

"Nothing can be stated with enough certitude at the moment about absolute values due to the difference in the methodologies used across countries."

However, the collected data allows one to explore and understand the differences between the countries' data collection methodologies. From this base, work could be done either to harmonise data collection, or, in the short term, to incorporate the effect of these differences into analysis, by elaborating transformation rules, for example.

3.2.3 Protective systems

Studies have shown that, when used, seat belts reduce serious and fatal injuries by 40-65% (UNECE 2006). The use of protective system in traffic has been assessed through independent roadside surveys in almost all countries. The database contains information about the type of survey methods used, the disaggregations possible and references for any sources of error in the estimations. Data is also available on seat belt wearing rates, and in some cases for cycle helmet use. Using the questionnaire responses it has been possible to make some judgements on the accuracy and comparability of the calculated wearing rates in different countries.

3.2.4 Daytime running lights

The database contains DRL rates per road type for eight countries. These rates can be compared, but with some caveats, mostly pertaining to the legislation: DRL can be recommended or obligatory, and which it is can vary by season, by vehicle or road user-type, and by road type. The database contains information about relevant legislation, but also about when and how surveys are undertaken, and any studies undertaken by data providers of possible sources of error in the final figures.

3.2.5 Vehicle Fleet Data

The questionnaire resulted in vehicle fleet data from 19 countries. However, there were variations in the level of detail and degree of accuracy between different countries. Common problems included; failure in some countries to remove all scrapped vehicles from their national database; lack of detailed information about vehicle make and/or model in some countries.

The database contains calculated SPIs for vehicle crashworthiness (based on age and EuroNCAP score) and for compatibility (based on the mix of different vehicle types and sizes in the fleet.)

Unfortunately no information regarding data collection protocols was requested. Unlike in the case of most of the other topic areas, vehicle fleet data is generally not collected or monitored for road safety research or policy purposes. In general it is the result of vehicle registration processes. Whilst countries' performance has been compared by the performance indicator team (Vis and van Gent (Eds) 2007) more information is required about the collection of vehicle fleet data in the different countries before robust scientific analysis would be possible.

3.2.6 Roads

17 countries provided data on roads, some of which was suitable for calculation of performance indicators as proposed by the SafetyNet project. Road infrastructure safety can be thought of as having two distinct elements;

- the “Self Explaining Road” (Theeuwes, 1988),

  This is defined as being

  A road and traffic environment that elicits safe driving behaviour simply by its design

  This approach recognises that the majority of accidents have human error as a major causal factor, but suggests that increasing the predictability of the infrastructure can reduce the potential for driver (or user) error. In practice this means aiming for roads which fulfil only one function. This will limit the degree to which road users with different characteristics (for example, speed, mass, protective capacity) share infrastructure.

- the forgiving roadside (Perchonock et al, 1978)

  This aims to ensure that there are as few hazards as possible adjacent to the travelling lane, and those which are there have physical characteristics which aim to reduce the severity of any impact.

Infrastructure is growing in importance as a road safety policy issue, perhaps because initiatives such as IRAP and EuroRAP, have raised the profile. The data provided facilitates comparisons of these elements of safety for the member states of Europe.

3.2.7 Trauma Management

According to the European Commission, improving emergency response times and post-impact care could have a significant influence on the numbers of fatalities that result from traffic collisions (European Commission, 2003) However, in terms of data collection, analysis and implementation of policy measures, management of post-impact care has tended to be a somewhat neglected area in both transport and health. Whilst adequate data was collected for the calculation of a number of performance indicator measures for trauma care, in general, data was difficult to find and validate. Health data provides a potential source of complementary data to that traditionally used by road safety practitioners. Initiatives such as the Injury Database (Angermann et al (2007)) may offer scope to increase the availability to the road safety community of this type of data, in order to improve the analysis of road trauma in a public health context.

3.3 Problems encountered

Two main issues were encountered in attempting to analyse the data contained within the questionnaire;

1. While the questionnaire responses provided a detailed set of data *for each country* it was more common in calculating SPI values and analysing results to require data *for each task.*
2. In order to find the figures relevant to the calculation of a specific SPI, it was necessary to read through the full documents to find the information. In other words, no search function was possible. This was also true for information relating to the origin of such data: Detailed methodological information would be somewhere within the document, but it may be necessary to read the entire document to find it.

These difficulties only became apparent as the completed questionnaires began to be returned.

Storing the data as Word documents was thus not ideal for the purposes of the SafetyNet analysis. The limitations of the original format were further highlighted when the issue of repository tables was examined. It was not possible (or was extremely difficult) to derive from the published project reports any sense of the raw data. It was also not possible, or arguably relevant, to include in those reports the collected meta-data and knowledge describing the methodologies, sampling procedures sources of error and so on which lay behind the final measures or estimated values. However, access to this information could be vitally important in assessing the validity of cross-country comparisons, or when looking at changes over time in various performance measures.

In attempting to create some kind of definitive record of the data collected by the project it became clear that some further processing of the questionnaire responses would be necessary.

3.4 Main considerations

Considering the initial aims of the questionnaire activity, a number of key features for data storage were quickly identified. These included;

- The ease with which one could assess the responses that had been received. For example, being able to see at a glance which countries had supplied data, or for which tasks fairly complete data was available.
- The ability to link connected data. For example, could all data from France be linked together? Could all data concerning seat belt wearing rates for car drivers be linked?
- The usefulness of some kind of search function, so that data could be retrieved without the need for the user to search documents visually.
- The ability to handle both data and meta data, so that information about the methodologies and processes that delivered data could be easily referenced when using the data. This is important, especially when making European comparisons, as it is necessary to make judgements about the extent to which observed differences in results stem from different data collection methodologies rather than material differences in the operation of the traffic system in different countries.
- The ability to develop some form of repository tables, in order to create a definitive and more accessible record of the data collected.

These formed the fundamental requirements of the system; however, a number of potentially desirable extensions to the functionality also emerged, such as;

1. The possibility to link with other sources of related statistics, such as the results of other SafetyNet work packages and existing resources such as the CARE database.
2. A degree of “future-proofing”. In other words, to be developed in such a way that data could be renewed at determined intervals (annually, every five years) without the need for extensively redesigning procedures or documentation.
3. In addition (and related to the earlier points) the possibility to link the data with resources that might become available in the future. For example, risk exposure data (RED) which may become available in the future as a result of a pan-European mobility study, or work on detailed vehicle kilometres data currently being undertaken by UNECE[5]
4. The advantages of a protocol that requires only a minimal amount of manual processing, since collecting data for 20 – 30 EU member states and other cooperating non-members is already a substantial task. Having the possibility to undertake much of the processing using programming would clearly be an advantage.

[5] UNECE.org

3.5 Development stages

Having identified the key requirements for the storage of the questionnaire responses, it was felt that a database offered the best way to meet them. Since the original questionnaire documents had been password protected it was relatively straight forward to write programming to transfer the data from their original form into a database.

A small amount of "cleaning up" was necessary, including;

- Removing default answers resulting from drop down lists
- Adding data labels to check box responses

Once this was done, the relevant links between the tables could be made, and a search function added.

Although it was not possible to complete this within the scope of the SafetyNet project, it would have been desirable to complete the development of the database by adding a user interface. In its current form it could not easily be used by anyone who was not closely involved in its development due to the difficulties of understanding the coding frame, the incompleteness of the links between the tables and the necessity to always make reference to the meta data before attempting to draw scientifically sound conclusions.

3.6 Discussion

Previous chapters have set out the ideal order in which the necessary steps for successful data collection exercises should be undertaken. These are –

- Determination of end-use requirements
- Determination of the necessary information/data to be collected
- Determination of future disclosure requirements of the information/data collected
- Determine appropriate storage (with reference to disclosure requirements)
- Determine appropriate data collection methodology
- Collect
- Collate
- Store
- Disclose
- Evaluate

However, in the case of this study, the data collection methodology was designed first, without reference to considerations of appropriate data storage or disclosure requirements. This led to a number of issues, not least of which was that when it became apparent that a better way of storing the collected data was required, there was little budget within the project to undertake the work, and a lack of expertise. The following section will set out the main lessons learnt from this work, in order to provide guidance about how best to undertake similar work in the future.

4 Lessons Learnt

4.1 Introduction

This section is intended to use the example of the SafetyNet project to set out "best practice" guidelines. These guidelines have been developed on the basis of the experience gained by the Safety Performance Indicator team of the SafetyNet project, and are illustrated by reference to this case study. In all cases, the key ideas are presented first as bullet points, with the rationale for their inclusions and examples (where relevant) in the following text.

4.2 Determining end-use requirements

- Distinguish clearly between policy and scientific research.
- In the case of policy research, establish relevance of proposed end-use requirements with data providers *before* deciding on data collection.
- Consider at an early stage the impact that missing data will have on the extent to which end-use requirements will be met.

At its most fundamental level, determination of end use requirements will dictate whether only actionable variables or a broader set of variables should be collected. Early consultation with stakeholders is important, especially when the main target is secondary data, because those providing it are generally more willing to do so when they understand the need for it. It also enables the owners of data to comment early in the process on the likely suitability of the data for the intended purpose. This allows for contingencies to be put in place in cases where appropriate data is unlikely to be available.

Where missing data will have a significant impact on the extent to which project aims can be met, steps can be taken to maximise likely responses. Decisions taken here about missing data may influence the precise data to be collected, and will also impact data collection. For example, in the case of Impairment data it was recognised that while the "ideal" performance indicator might be the prevalence and concentration of impairing substances among the general road user population, practical and methodological difficulties meant that the necessary data to construct such an indicator would not be likely to be available. In this case the indicator was refined to take account of data availability, and data collection reflected the slightly different focus.

4.3 Determination of the data and information to be collected

- Undertake pilot studies to indicate likely availability of data
- Consider relevance of meta data and its potential impact on the extent to which scientifically robust analysis can be performed using the proposed data.

Undertaking pilot studies not only helps to identify what data is available, but may also give some indication of how easy (and costly) data may be to obtain, and how likely it is to be compatible and comparable. Again, this is particularly important for projects which will be relying on secondary data, where researchers may be forced to adapt methodologies to suit the available information.

In the case of meta data, there are instances in the SafetyNet case where data was collected without sufficient information about the process which delivered the data, thus limiting the conclusions which could be drawn. For example, in the case of the vehicles (passive safety) topic; the entire vehicle fleet was requested from each country. In some cases there appeared to be obvious problems with the data (for example, doubts about the efficiency with which scrapped vehicles were removed from the database), but without more information about the origin of the database it was impossible to reach robust conclusions about the comparability of different countries' data, to know for certain which were the problem countries (or vehicles) and to have confidence in the extent to which observed differences in results stemmed from a real differences in traffic conditions.

4.4 Determination of future disclosure requirements

- Early consideration should be given to any disclosure restrictions which may be imposed by data-providers.
- Disclosure is linked to dissemination activity. The significance of this will vary greatly from project to project, and could be a particularly pertinent issue in cases where there is some sensitivity around the collected data. In cases where disclosure could be problematic, consideration should be given to any negative effects on the project aims of restrictions on disclosure.

4.5 Determination of appropriate data storage

- Consider data storage *before* designing data collection.
- In designing appropriate storage consider the proposed analysis, dissemination, likely follow-on activities and any conditions (for example, concerning data protection) which may be imposed by data providers.

Different means of storage can facilitate or hamper all of these related activities. In the case of SafetyNet, proposed data storage was not considered until after the first round of data collection activities. Had this been considered before questionnaires were distributed, some useful changes could have been made. The process of designing data storage was made easier by the highly prescriptive format of the questionnaires; password protection made it possible to transform the Word questionnaires into both Excel and Access using programming rather than manual data entry. However, this happened rather more by luck than by design. Had the processes for data storage been designed into the study at an earlier stage it would also have made the design and distribution of the follow-up questionnaires easier. The follow up questionnaires were designed with data storage in mind, since they were issued *after* this issue began to be addressed. However, a compromise had to be struck between keeping some continuity with the earlier questionnaires and producing something that would fit easily into the database that was beginning to be designed to accommodate both sets of data.

4.6 Determination of appropriate data collection

- Where possible, electronic questionnaires should be used, both for ease of use and for cost reasons.
- Pre-coding is a useful way of maximising the scope for automated processing of responses.
- Restricting the extent to which respondents can alter the questionnaire (by using check boxes, drop down lists, text boxes and password protection) will also help to maximise automated processing.
- On-line surveys can help to minimise missing data by use of software, but they can affect the response rate by inconveniencing respondents.

Again, in the case of the Performance Indicators team of the SafetyNet project, most of these issues were satisfactorily addressed, by the prescriptive design of the original questionnaire. However, other parts of the SafetyNet project did not use password protected questionnaires. Had they done so, it would have been possible to link all of the related data together. For example, the Performance Indicators questionnaires asked for a small amount of information about population sizes and road lengths in different European countries. This information might have been useful to the team working on Risk Exposure data, and could in some cases have prevented the need for different parts of the project to request the same information from the national experts.

5 Conclusions and Scope for Further Work

5.1 Introduction

The purpose of the data collection exercise which resulted in this database was to calculate Safety Performance Indicators for the member states of the European Union. This has largely been successfully concluded. The resultant body of information could one day provide an invaluable source of data not only for road safety practitioners, but also for policy-makers and scientists in a number of other fields. One main result of the project is the Road Safety Performance Indicators Manual (Hakkert and Gitelman (eds) 2007). This should assist countries in establishing the necessary systems of data collection for producing national SPIs in each of the predefined fields, and ensure comparability on a European scale.

There are a number of limitations which currently prevent the database being accessible to researchers and/or policy-makers outside of the SafetyNet project. These include -

- The amount of development work that would be necessary to make it “user friendly” enough for other users.
- The necessity of obtaining permission from the member states which provided the data.
- The potential problems that could be caused by indiscriminate use of the data by those who do not fully understand the potential pitfalls.
- The need to constantly update such data in order for relevant conclusions to be draw. The SafetyNet project began in March 2004 and concludes this month (October 2008). There are currently no plans to update this data in the future. It should be borne in mind that the frequency with which data need to be updated will vary between topics (for example, a roads indicator is likely to evolve more slowly than a speed indicator)

In undertaking this exercise a number of practical lessons have been learnt about how to maximise the likely success of such pan-European data collection work, and how to avoid the pitfalls.

It has not been possible within the scope of the SafetyNet project to build a fully-functioning database of results, which could be used by a wider range of stakeholders. Nevertheless, it has shown what could potentially be achieved within Europe with a broader range of compatible data. This would be a good base on which to build future similar data collection exercises in a European context.

Password protected electronic questionnaires allow high degree of automatic processing, which means a large amount of very diverse data from a high number of countries can be collected and collated.

Future similar data-collection activities should adopt this approach, since data can then be easily transferred to a database format, which opens up new analytical possibilities beyond those originally envisaged by those issuing the questionnaires.

Given the time, effort and cost which many countries have invested in providing this data, being able to extend its usefulness could be a way of providing countries with an additional incentive to provide their data.

It may also reduce the need for different institutions and projects to make separate requests for very similar data, since the database format would make it easier to share data, and to make it available in a format which can be generalised for different uses.

The main purpose of the data collection was to make possible the calculation of the identified SPIs. Whilst it was possible to make those calculations whilst the data was still in its original format (i.e. word processed documents) it is clear that the change to a database makes this process easier. The lessons learnt undertaking this exercise will be useful in informing similar pan-European data collection activities in the future. However, the added value of the database format may be in the possibilities it opens up for extensions to this work.

There are number of ways in which it is envisaged that this could be done. These are divided here into five categories which are discussed in turn in the following chapter;

- New countries
- Better road safety data
- A wider range of road safety data
- Cross-disciplinary links and broader policy objectives
- Future possibilities

5.2 New countries

The original questionnaires were sent to the existing members of the European Union (as at November 2004), plus Norway and Switzerland, making a total of 27 countries. As can be seen from table 1, of these only 20 provided any data at all, and some of those were unable to provide all of the required data. Since that time Bulgaria and Romania have joined the EU, and a number of other countries are officially recognised as potential candidates. These are Croatia, the Former Yugoslav Republic Of Macedonia and Turkey; the western Balkan countries of Albania, Bosnia and Herzegovina, Montenegro and Serbia and Kosovo.

The potential for further development by extension of the number of countries with useable data is significant. In general, the countries which offer potential can be categorised as being either –

- Countries with suitable data available who failed to provide it so far.
- Countries who are willing to help, but who don't, at present, appear to have suitable data.
- Countries who were not approached last time because they did not have representation on the National Experts group.

The necessary steps to extend the number of countries are as follows;

1. Identification of the factors preventing countries which are believed to have good data from contributing to this work.

   Some preliminary work undertaken in this field using informal contacts with the National Experts group, suggests a number of reasons including;

   - lack of resources to identify the necessary data, or to transform it into a suitable form for analysis;
   - a feeling in some countries that they already had well-developed and successful approaches to road safety, and the SPI approach was not relevant or necessary in their country;
   - a lack of clarity about which government department "owns" the data, since in many cases it was not "traditional" road safety data, and may have been the responsibility of another department such as health.

- problems with the level at which data is aggregated, meaning that nationwide totals do not exist, and a representative sample cannot be identified.

2. Identification of ways to aid collection of suitable data in countries where it does not exist. Possible ways of working towards this could include;

   - Providing support for countries who wish to adopt the methodologies described in the SPI manual.
   - Looking at ways of deriving transformation rules for data which appears to be unsuitable, such as those used when national accident data is integrated into the CARE database.

5.3 More relevant data

Since the calculation, use and monitoring of SPIs on a European level is a relatively new idea, the need for this kind of data in the past has not been significant. However, it may be that SafetyNet and other initiatives in this field (for example, the ETSC PIN[6]) will generate some momentum behind the idea, which could create a drive to improve the collection of the necessary data in the member states.

There may also be some efficiency gains, such that countries who have already collated their data for the first and second rounds of SafetyNet questionnaires would find it easier and cheaper to provide data as they become more used to what is required and where within their administrations they can find it.

Furthermore, it was necessary in the first instance to undertake an iterative process; the precise form of the SPI could not be determined until the availability of the required data had been established, but it was necessary to have some idea which SPIs might be desirable in order to know what kind of data to ask for. This may have led initially to the member states being asked to provide data that was ultimately not used. This unnecessary effort could be largely avoided now that there is better knowledge about what is generally available and which SPIs are feasible. This may allow member states to focus more on collecting and validating the data that is most important.

In time it may become possible and desirable to compare performance with other countries such as America or Australia. There are already examples of initiatives which are almost global in their scope, such as IRAP[7], which is an umbrella for a number of road assessment programs across the world, including Europe, America and Australia.

5.4 A wider range of road safety data

Risk Exposure Data and In-depth Accident data are two examples of data that could be incorporated within the database to expand the possibilities offered. In the case of in-depth data, for example, seat belt wearing rates in fatal accidents could be compared to estimates for the general driving population. Comparisons between these two could inform research into the cost-effectiveness of measures to raise seat belt wearing rates.

5.5 Cross-disciplinary links and broader policy objectives

As has already been stated, public health data offers considerable potential to expand the range of information that could be used to assess road safety and design policies. However, there are a number of other two-way links that could be established between the data contained in the database and other policy areas at EU level. For example,

[6] www.etsc.be

[7] www.irap.net

- Economics – for example, road length as a measure of economic development
- Environment – for example, the use of speed data as an input to environmental policy.
- Social policy – for example using drug and alcohol data, or enforcement data.

The main limitation of the database as it currently stands is that the quality of the provided data is often unknown. It is clear that this would affect the validity of any work which used it as the source. For work on a European level, missing values would also be a significant issue, affecting the type of research that could be undertaken and the extent to which the conclusions could generalised to the whole of Europe.

5.6 Conclusions

The purpose of the data collection exercise which resulted in this database was to calculate Safety Performance Indicators for the member states of the European Union. This has largely been successfully concluded. The resultant body of information could one day provide an invaluable source of data not only for road safety practitioners, but also for policy-makers and scientists in a number of other fields.

However, at the moment there are no plans to make the database publicly available. There are a number of reasons for this, including –

- The amount of development work that would be necessary to make it “user friendly” enough for users outside of the SafetyNet project.
- The necessity of obtaining permission from the member states which provided the data.
- The potential problems that could be caused by indiscriminate use of the data by those who do not fully understand the potential pitfalls.
- The need to constantly update such data in order for relevant conclusions to be draw. The SafetyNet project began in March 2004 and concludes this month (October 2008). There are currently no plans to update this data in the future.

Nevertheless, it has shown what could potentially be achieved within Europe with a broader range of compatible data, and has also provided a useful learning exercise which could inform future similar pan-European data collection activities.

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