Accident Information from six European Countries Based on Self-reports

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IN-DEPTH UNDERSTANDING OF ACCIDENT CAUSATION FOR VULNERABLE ROAD USERS

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List of Abbreviations

BASt	Bundesanstalt für Straßenwesen The German Federal Highway Research Institute
InDeV	In-Depth understanding of accident causation for Vulnerable road users
INTRA	INGENIERIA DE TRAFICO SL
VRU	Vulnerable road user
WP	Work package
ER	Emergency Room

1. Executive Summary

A questionnaire survey has been conducted in Belgium, Denmark, Germany, Poland, Spain and Sweden in 2016-2017. Once every third month through one year respondents have received a link to an online questionnaire which asked them about information on any traffic accidents they might have experienced in the period. Different procedures for gaining respondents were used in each country, resulting in relatively small and skewed sample sizes from Germany, Poland and Spain, causing data analysis based on these numbers to be highly unreliable. Thus results are based on data from Belgium, Denmark and Sweden.

The study aims at providing an input to Task 5.3 on socio-economic costs within the InDeV project. Thus the questionnaire contains questions on various aspects related to the accidents that might contribute with costs as well as basic accident information such as means of transport and time of the accident.

A special focus in the survey is on pedestrian single accidents, which are not normally considered traffic accidents. The survey finds that more than 80% of the pedestrian accidents that have been self-reported are in fact single accidents, which illustrates the need for further investigation of the pedestrian single accidents as the number of these might be quite high. The study also provides knowledge of basic consequences of the pedestrian falls, for instance 16% result in medical treatment, 14% in one or more days of absence from work and 37% in property damage.

The self-reported traffic accidents have proved difficult to compare with official accident statistics, both due to different national guidelines on what constitutes a reportable accident and to the legal limitations on personal information which may be asked in the questionnaire; this eliminates the possibility of combining information with official accident records. However, based on the self-reports it can be concluded that in 8% of the accidents the respondent have been in contact with the police.

2. Introduction

The report at hand “Accident Information from six European Countries based on Self-reports” is a deliverable from WP5 within the InDeV project based on task 5.2.

2.1. Objective and scope

The study constitutes input to task 5.3 within the InDeV project, which deals with revising methods in the pricing of the socio-economic costs of different accident types. Thus the main objective of task 5.2 is to gain knowledge of traffic accidents with VRUs in order to learn of the costs related to accidents – and with a focus where possible on whether or not the accidents are reported by the police. Originally it was thought that the survey might be used as a basis for estimating the level of underreporting within each country, but due to rules on personal data limiting the possibility of correlating self-reported information with police records, this proved impossible.

The information on accidents will be based on self-reported traffic accidents over the period of one year. The main idea behind the self-reporting of accidents is to ask people about their possible traffic accidents and gain knowledge on these accidents as a supplement to the official records kept by the police and/or hospitals.

The report at hand is based on a questionnaire survey conducted in Belgium, Denmark, Germany, Poland, Spain, and Sweden. The survey is based on an online questionnaire distributed by email to all participants every third month through one year (2016-2017). Participants were asked to report any traffic accident they might have been involved in during the past three months.

2.2. Connection with other studies

A comprehensive literature study on the use of self-reported accident data has been carried out in project InDeV, entitled “*Review of current study methods for VRU safety. Appendix 7 – systematic literature review: Self-reported accidents*” (Andersen, Kamaluddin, Varhelyi, Madsen, & Meltofte, 2017). This is available at the InDeV homepage (www.indev-project.eu) in the *Documents* tab. A summary of the results can be found under the same tab in the main report: ”*Review of current study methods for VRU safety. Part I – Main report*”, (Olszewski et al., 2017).

The systematic literature review includes 136 publications that are used to map the current practice of self-reporting of traffic accidents. In these publications it is found that self-reporting studies most often deals with accidents with car users, but self-reports are also commonly used to shed light on accidents with VRUs. Adults are the most frequently studied age group, and 33% of the studies were carried out in Europe. Thus the study at hand does not seem to vary from the norm.

The literature review shows that the use of questionnaires is also congruent with the bulk of the studies, as 104 studies gain information via questionnaires (29 of these are specifically noted as online questionnaires). With regard to the number of respondents participating in the self-report studies, large variations occur, depending on the purpose of the studies. Even with regard to the studies in which the objective is congruent with the study at hand (estimating underreporting), the number of respondents varies from 98 to 10,000. Also the strategy for sampling shows great variation in the different

studies; the use of random sampling of participants is applied in 66% of the studies, and 25% use volunteers.

The short recall period in the study at hand is quite uncommon; only 4% of the studies found in the review use recall periods of three months or less. The study at hand balances the short recall period with a follow-up method, by which the respondents are asked every third month during a year about potential accident involvement. The use of a follow-up method – though not necessarily with the same frequency or duration – is applied in 15% of the studies.

At a glance it would seem that the use of self-reports in the study at hand is fairly congruent with the mapped practice of application of this methodology. But only a small proportion of the studies (8%) have the objective of estimating the level of underreporting of traffic accidents or deal with self-reports as input in socio-economic cost calculations; most commonly self-reports are used to estimate effects of a specific safety measure. Thus the use of this method of obtaining accident information has been applied in many studies, but the purpose of the study – and the subsequent data processing – is unusual and, which means that a best practice cannot yet be considered consolidated.

2.3. Definitions of reporting levels and accidents

2.3.1. Traffic accidents

A definition of what constitutes as an accident in the report at hand is needed to carry out the study.
A road traffic accident is often defined as: *“An accident which occurred or originated on a way or street open to public traffic; resulted in one or more persons being killed or injured, and at least one moving vehicle was involved. These accidents therefore include collisions between vehicles, between vehicles and pedestrians and between vehicles and animals or fixed obstacles.*” (OECD, 2016)

This definition could be considered somewhat unfavourable to the VRUs, as in this definition single accidents with pedestrians are not considered accidents. As will be discussed later in this report, pedestrian falls could perhaps be considered as constituting accidents similar to single bicycle accidents, even though they are not encompassed by any current official definition of traffic accidents.

Given the focus of the InDeV project on exactly vulnerable road users, it seems fitting to try to utilise the strength of questionnaire surveys in order to gain as much information on VRU accidents as possible, without limiting the study in advance.

There is no applied common definition of what constitutes as a slight or severe injury; assessment of severity degrees varies with national practices. One of the definitions that could be applied regarding slight injuries is:

”*Secondary injuries such as sprains or bruises. Persons complaining of shock, but who have not sustained other injuries, should not be considered in the statistics as having been injured unless they show very clear symptoms of shock and have received medical treatment or appeared to require medical attention.”*(OECD, 2016)

This definition results in accidents being classified as such if the person suffered a bruise due to the accident. But this is not in concordance with all national rules. The national variations in the rules for accident reporting does not end here – some countries also report accidents where no injury has been inflicted, but where there is

personal damage only. Thus very large variations exist across borders on what constitutes as a reportable traffic accident.

Instead of focusing on the national rules for accident reporting or the current definitions of traffic accidents, a more practical approach to the concept of accidents has been applied. As the main goal of this study is to provide input into task 5.3 to estimate socio-economic costs, our starting point has been to gain as much information on incidents which involve all road users, and which could be thought of as carrying a societal cost. We have thus focused on keeping the definition of accidents in the survey as broad as possible, while balancing the definition with the fact that we need a limit to the number of incidents on which we want to gain information.

This limit between accidents and not-accidents should be easily understandable by respondents in order to minimise measurement errors, and should, at the same time, provide us with incidents we find relevant for traffic research purposes. This has resulted in a much wider definition than that applied by OECD, as we have tried to encompass both pedestrian single accidents and accidents with no injuries. That not only incidents with a certain degree of physical severity are relevant in traffic research is also seen in the work regarding traffic conflicts. Here the main hypothesis is that conflicts between road users are similar to accidents, except for the fact that the road users manage to avoid the accident before it happens, and they can thus be applied as a surrogate for accidents (Hydén, 1987). The methodology of conflict technique is generally applied in the inDeV project. Thus the broader definition of an accident in the survey is in line with the overall project framework.

Respondents are given the following definition of an accident (cf. Appendix 3):

“*[An accident] includes falling as a pedestrian or bicyclist, even though no-one else was involved in the accident, as well as all other traffic accidents that happened for instance while you were using motorised vehicles. Accidents that happened while you were a passenger should not be reported here.”*

Instead of providing the respondents with an intricate definition of a traffic accident, we simply provided respondents with easier questions and removed the incidents reported as accidents that did not live up to our research definition of a traffic accident. This can be seen in chapter 5 *Data processing*.

An accident is considered as such in the report at hand if the following two requirements are met:

- The incident took place on either the road, a bicycle facility, the sidewalk or alongside the road, a pedestrian crossing facility, in a plaza, square, parking lot or similar or at a bus or tram stop
- The respondent was not a passenger in a vehicle

And at least one of the following two requirements is met;

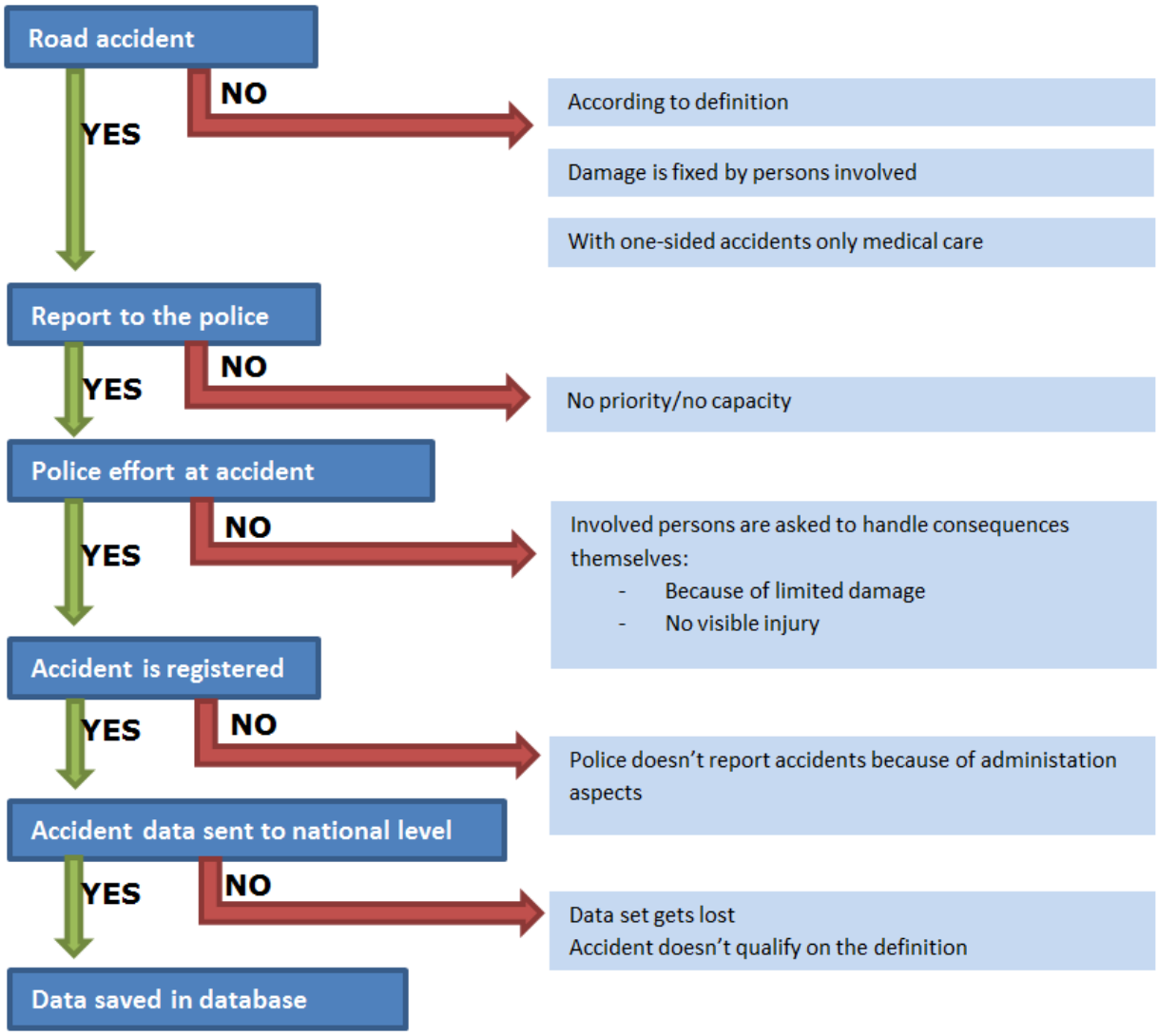
- The respondent or his/her vehicle was in physical contact with another road user or another vehicle
- The respondents fell, crashed, were hurt or had his/her belongings damaged.

2.3.2.Reported accidents

Not all traffic accidents result in a police report being filed. Underreporting refers to the discrepancy between the real number of reportable accidents and the number of accidents that are in fact reported by the police. As the definition of what constitutes a reportable accident is determined on a national level, no common standard exists for what is considered a reportable accident. This makes cross-national aggregation and comparison of accident numbers, and also underreporting levels, difficult (Olszewski et al., 2017).

There are many reasons why not all accidents are recorded in official accident records, cf. Figure 1. As police records are the most commonly used sources of gaining information on accidents – for instance numbers and severity – there are accidents which researchers know nothing about but which still contribute with socio-economic costs.

Figure 1: Registration process of a traffic accident showing possible reasons why an accident will not end up in official records, illustration inspired by Derriks & Mak, (2007).



The accidents that we know nothing or very little about are the key interest of the report at hand. In order to find these “un-reported” accidents, it becomes necessary to be able

to distinguish between “known” accidents and “unknown” accidents. The known accidents would ideally be similar to the accidents that are reported by the police (the data that are saved in the national database in Figure 1). But as the methodology in this study is restricted to survey data only, due to issues regarding personal data, it is not possible to match survey data with police records. Thus information on the accidents being reported or not must be based solely on that received from respondents in the survey. Here it is important to keep in mind the limitations that come with utilising survey methods. Measurement errors can be caused by the respondents’ inability to understand the questions, interpreting them differently or simply having no knowledge of the right answer – and respondents have no way of knowing whether or not their accident is correctly recorded into the accident database. Using survey methods alone, it is thus impossible to obtain information of the number of accidents recorded by the police. However, the respondent is expected to know whether or not he/she has been in contact with the police due to the accident. As shown in Figure 1, this does not equal a police report being filed – but it must be considered a form of surrogate measure that is needed when survey data are the only data source available. Thus, the report at hand defines “reported accidents” as accidents in which the respondent have been in contact with the police due to the accident – regardless of whether or not the contact resulted in a police report being correctly filed; these are the accidents that might be known in official statistics.

The number of police recorded accidents as well as the number of accidents that should have been reported to the police are impossible to identify using survey methods. Furthermore the official definitions are impractical, given their limitation on the following investigation of costs of VRU accidents. And no commonly applied threshold for severity can be adopted by the study. Consequently, the applied definitions are useful. The latter have consequences for the requested estimation of underreporting, as it is not possible to calculate the exact level of underreporting using survey data only. As the objective is to distinguish between “known” and “unknown” costs, this is found to be more important than keeping to the strict definition of underreporting, i.e. the discrepancy between police registered accidents and what falls under the national rules for reportable accidents. This is in line with the recommendations in WP2 of including pedestrian falls in accident data and as a workable solution to the problem mentioned in the same WP concerning the grey area between slight injuries and property damage only accidents (Olszewski et al., 2017).

3. Survey Design

The survey was constructed around an online questionnaire. Potential participants were invited to take part in the survey and directed to a sign-up questionnaire containing a few demographic questions and a request for their email addresses. Following this, the participants were contacted by email four times during a year. Each time they were asked to recall any possible traffic accident in which they were involved during the past three months.

Partner countries in the survey were Belgium, Denmark, Germany, Poland, Spain, and Sweden.

3.1. Recruitment strategy

Each project partner recruited participants in their respective countries. In this section, the overall proposed recruitment strategy is described, followed by a presentation of the recruitment process actually conducted in each country.

Each partner was advised to distribute the recruitment/informational letter to 40,000 people. This number was based on the expectation that approximately 30% of the people receiving the letter would respond. This approach would yield 12,000 people as participants. Many of the participants would not experience any accidents during the study period – in e.g. Denmark it was estimated that about 10% of the population would be involved in a traffic accident during one year (Agerholm & Andersen, 2015). With 12,000 participants, this would leave us with 1,200 expected accident reports.

3.1.1. Potential participants

The study deals only with adults above the age of 18. The ideal set-up requires participants who:

1. **Differ in age**, i.e. representative of the age distribution in each partner country. If this is not possible, it should be made sure that a variety of ages in the group of respondents are included.
2. **Differ in gender**, i.e. representative of the gender distribution in each partner country. If this is not possible, an equal gender distribution should be ensured.
3. **Differ in geography**, i.e. people from both rural areas and urban areas as well as from different parts of the country should be included. If this is not possible, the study may be limited to one municipality, but both rural and urban areas and cities of different sizes should be included.

3.1.2. Strategy on how to contact potential participants

Potential participants can be reached in various ways. The best method which ensures the most robust results, the least amount of bias, and data most useful for research is to contact people directly**.** Using volunteers, e.g. posting on Facebook/in the newspaper/hand out flyers to random people, was not a preferred alternative, since a sample of volunteers might deviate considerably from what is representative for the population of a certain country.

Applicable methods to reach a representative group of participants:

A. Contacting the National Bureau of Statistics to obtain a stratified sample of people and sending an information letter to all.
B. Contacting a private survey company to obtain a stratified representative sample for the specific country and sending an information letter to all.
C. Contacting a municipality and collaborate with them in order to contact all their citizens and sending the information letter to them.
D. Sending out information letters to people using random addresses.

If none of the above methods are viable, the following alternative methods could be considered:

E. Distributing a printed information letter to all households in a city/a smaller area.
F. Placing an advertisement in a newspaper or webpage – simply printing the information letter or a similar text.
G. Contacting a number of large companies and asking for permission to distribute the information letter to their employees.

3.1.3. Information letter

An information letter was formulated to inform potential participants about the study and how to enrol. The English version of the letter can be seen in Appendix 1. Every partner country adjusted the information letter to their local recruitment strategy, regulations regarding personal data and local customs regarding formulation and information level.

3.1.4. Ethical approval and personal data protection act

Before starting the study, ethical approval was obtained in each country according to each participating country's ethical regulations. Likewise, the requirements in the local data protection act were followed and approvals were obtained if needed.

3.1.5. Actual recruitment

Table 1 shows an overview of the recruitment strategies implemented in the participating countries.

Table 1: Recruitment strategy implemented in each partner country. Lettering refers to the above mentioned methods for recruitment.

	Belgium	Denmark	Germany	Poland	Spain	Sweden
Recruitment strategy implemented	**G**	**A**	**F**	**G**	**C,F,G**	**B**

Belgium
Belgium followed strategy G, and the following companies and organisations were contacted:

- Hasselt University (employees and students)
- the city of Antwerp
- the transportation research institute (participants of previous studies)

- a number of small and medium-size companies
- the Flemish Foundation of Traffic Knowledge (VSV), which included the information in their newsletter
- the Cyclist Association and Pedestrian Association
- the User Group of the Policy Research Centre
- the Flemish Association for Prevention and Protection (Prebes), which included the information in their newsletter and on their webpage
- personal contacts through email, Facebook and LinkedIn

The number of different companies and organisations contacted is the ideal version of strategy G as the coverage error is minimised (at least on some parameters such as gender, as successfully shown in the *Results* section). As Belgium is bilingual, it must be noted that questionnaire was sent out in Dutch only, which could induce some potential bias.

Denmark
Denmark used strategy A, i.e. contacting the National Bureau of Statistics and sending out an information letter to a stratified sample of 40,000 individuals.

Germany
Germany followed strategy F. The following approach was implemented:

- the information and participation request were published on several websites.
- the information and participation request were published in newsletters of the road safety association and of a large automotive company.
- the information and participation request were published in the BASt newsletter.

It should be noted that respondents might all share an interest in traffic as the recruitment took place in newsletters of organisations related to traffic and transport. This might cause a bias in the sample.

Poland
Poland followed strategy G, i.e. employees at the Municipality of Warsaw and employees and students at the technical University of Warsaw were contacted directly.

This employment of strategy G is not as widespread as was the case in Belgium. Thus the contacted respondents were geographically limited to the area around Warsaw. The recruitment procedure might also cause a bias due to coverage error in e.g. age and gender, cf. the *Results* section.

Spain
Spain pursued strategies C, F and G:

- Barcelona municipality’s websites (www.bcn.cat, LaFabricaDelSol, bcn+sostenible) and social networks (twitter) published the information/recruitment letter and the link to the questionnaire.

- Other municipalities, such as Moià, Sant Andreu de LLavaneres and El Masnou published the information/recruitment letter and the link to the questionnaire on their websites and social networks.
- Contact was made with associations such as PAT (www.pat-apat.org), Catalunya Camina (www.catalunyacamina.org/), Bacc (www.bacc.cat/), PTP (www.transportpublic.org/), Geographers association, Environmental science association, Parking day, Acord per Llavaneres, Grup Entesa, and BiTer, asking them to send the information/recruitment letter to their members.
- Private Companies, such as INTRA SL, DALEPH, Natureco, Montbru, EPIM, CINESI, and AIM were contacted.
- The information/recruitment letter and questionnaire link were published on INTRAs website and Linkedin.
- Information/recruitment letter was sent to friends and family of INTRA's employees.

With the many very different organisations and associations contacted, the hope was that the potential coverage error in the sample would be minimised.

The questionnaire was sent out in Catalan only, thus limiting the sample to the autonomous community of Catalonia (or more precisely, to Catalan-speaking respondents).

Sweden
In Sweden, Postnord provided a stratified sample of 40,000 addresses from their register of Swedish inhabitants, and an information/recruitment letter was sent to them.

3.2. Survey launch

Different recruitment strategies were chosen in each country as described above. This meant that different procedures had to be followed, and it also resulted in different timetables for the launch of the survey in each country; thus the survey was launched in different months in each country. Table 2 shows the dates.

As shown in Table 2, the first accident questionnaire was sent out twice in Germany (April and July) as the number of respondents in April was quite low.

Thus, only in Denmark did the data from the self-reported accidents cover an entire year; the data from the other countries cover nine months.

Table 2: Dates for sending out enrolment questionnaires and accident questionnaires in each country. Due to the deadlines in Task 5.2, it was not possible to send out four accident questionnaires in each country before the delivery of the report at hand; this is marked by [-] in the table.

	Enrollment	Accident Q1	Accident Q2	Accident Q3	Accident Q4
Belgium	14 June 2016	7 July	5 October	16 January	-
Denmark	21 March 2016	6 April	5 August	2 November	3 February
Germany	11 April 2016	28 April/7 July	5 October	16 January	-
Poland	1 June 2016	17 August	3 November	3 February	-
Spain	1 June 2016	8 July	5 October	16 January	-
Sweden	1 June 2016	15 August	2 November	7 February	-

4. Questionnaire design

In the following chapter, we will present the two questionnaires on enrolment and accidents (Appendices 2 and 3). We will also provide the details concerning the motivation for each of the questions that they contain.

Appendices 2 and 3 hold an English version of the questionnaires. The questionnaire was translated into Catalan, Danish, Dutch, German, Polish and Swedish before it was circulated in the respective countries.

The first questionnaire is an enrolment questionnaire (Appendix 2); this was where participants could sign up for the study by providing their email addresses. These email address was used later to send the accident questionnaire (Appendix 3) to the participants every third month.

4.1. Enrolment questionnaire (Appendix 2)

This questionnaire contains five questions A-E (see Appendix 2). The purpose of these is to allow us to categorise our respondents and, in cases where the sample is stratified/representative etc., to analyse for non-response bias.

A) Gender
This question was included in order to study if the gender distribution of respondents was skewed and to provide the research opportunity of studying whether results on e.g. reporting levels vary with gender. Some studies indicate that this could possibly be the case, while others find no gender differences in reporting level.

B) Age
Ages from 18 and up can be chosen as an answer alternative in the questionnaire. This makes it possible to decide on appropriate age groups while conducting the data analysis. It also enables the use of different categories for different forms of analysis (non-response, dropout rate etc.). As we were not allowed to obtain information from children, any respondent answering that they were below the age of 18 was automatically deleted.

C) Number of inhabitants in your city
This question was asked because a study by Tivesten, Jonsson, Jakobsson, & Norin (2012) of non-response bias indicates that differences in response rate may be found to be depending of the size of the respondent’s city. Thus, we needed the information for potential analysis of non-response rates. The reason for not just asking the name of the city and then finding the number of inhabitants ourselves are twofold: a) only asking about the number of inhabitants suggests greater trust in anonymity of the survey; this was debated at great length during our work with the questionnaire and b) workforce was not available to convert different names of towns in each country to the number of their inhabitants, especially when taking into account the possibility of typing errors.

D) Postal code
As stated above, we did not wish to have respondents state the name of their city. However, with a postal code we could pinpoint an area, which would give us better

possibilities of, for instance, concluding if some parts of the country were not represented in our sample. We made this answer field optional as in some of the participating countries this could cause potential respondents not to answer as they might feel that their privacy was not respected.

E) Email address
This was needed in order to contact the respondents with the follow-up Accident Occurrence questionnaires.

4.2. Accident questionnaire (Appendix 3)

The questionnaire on accidents was comprised of two parts. Part I, which all participants were asked to fill in, and Part II, which was only presented to respondents who acknowledged that they had suffered an accident.

4.2.1. Part I: Accident occurrence

Questions 1 and 2 – Have you had an accident and if so how many?
These questions were needed for us to know whether or not the respondents should be asked to fill in the rest of the questionnaire on accident occurrence and for how many accidents.

4.2.2. Part II: Accident details

Question 1 – Did you have physical contact? And Question 2 – Did you crash, were you hurt and/or was there material damage?
These questions were used for screening out the respondents who might actually try to report a close encounter/near-miss as an accident. The experience from a previous study “Cykeljakken” [the bicycle jacket] in Denmark (Lahrmann et al., 2014) prompted us to implement this. In this study, the participants reported approximately 700 “accidents“, but more than 60 of these were actually not accidents but close encounters. As there is no way of discovering these close encounters without questions 1 and 2, they were important to ensure high data quality.

Question 3 – Means of transport.
Respondents’ means of transport was important to categorise the accidents and be able to distinguish between VRU accidents and other accidents. Furthermore, we used the question to sort out the reports from passengers. The information at the beginning of the questionnaire states that only accidents where the respondent is not a passenger should be reported, but earlier experience from the “Cykeljakken” project (Lahrmann et al., 2014) shows that some respondents do not pay much attention to the informational text. Hence the possibility to exclude passengers at this point is needed.

Questions 4 and 5 – Where did the accident take place? And how was the geometry?
One of the objectives of task 5.2 is to try to establish situation-specific values for the level of reporting to the police. Thus we need to be able to sub-categorise in different situations. This question was a way of establishing whether any differences actually

exist in the numbers of accidents reported to the police with regard to the different site-specific situations.

Question 6 – What type of area?
This question was a way to identify if any differences actually exist in the numbers of accidents that are known by the police with regard to rural or urban areas. As motorways can be difficult to classify for a respondent (is it urban or rural?), there was a separate answer alternative for this, but it was expected not to be used very frequently since cyclists, pedestrians, etc. most likely do not have an accident there.

Questions 7 and 8 – What day of the week and in what month did the accident happen?
The idea was to ask about day and month so as to provide the opportunity for analysing any patterns, e.g. telescoping effects.

Questions 9, 10 and 11 – Lighting conditions, weather conditions, surface conditions.
The three questions were part of the quest for “situation-specific” levels of reporting to the police. As the knowledge of what prompts respondents to report their accidents is quite sparse, it was not possible to know for certain if these circumstances would influence reporting levels. We could hypothesise that reporting levels to the police might be influenced by lighting condition and weather as a person with a minor injury might be more reluctant to wait for the police to arrive if it was dark or raining. We could also hypothesise that accidents on icy roads might be less frequently reported to the police as the respondent might feel that the accident was more his/her fault as he/she could have foreseen low friction.

Question 12 – Traffic situation.
Since the results of task 5.2 are to be used to calculate socioeconomic costs of accidents, we wanted to be able to shed light on some of the costs and how different accident situations represent different costs. However, the road users’ subjective experiences of the level of traffic should be used with caution.

Questions 13 and 14 – Single accidents and the opponents’ means of transport.
Data from Statistics Denmark as well as a study by K. Janstrup, Hels, Kaplan, Sommer, & Lauritsen (2014) indicate that the level of underreporting is different for single accidents compared to multi-party accidents. Findings show that the level of underreporting is higher for single accidents than for multi-party accidents. To be able to make situational-specific estimations of level of reporting to the police, we needed to ask these two questions.

Accident circumstances

Question 15 – Possible contributory factors to the accident.
Whether an accident is reported by the police is not only dependent on the police (what accidents they choose to write reports on or not) but also on the person involved in the accident (whether or not he/she chooses to contact the police in the first place). Thus, it is hypothesised that not only accident factors such as geometry or mode of transport influence the level of reporting, but also psychological factors. Some of these possible factors are thus included in the question. Some of the factors/possible answering alternatives are based on what the police in Denmark and Germany already report, and

some of them are based on another study by Tivesten (2013). Thus, it could be assumed that people who have done something conflicting with traffic laws (disregarding priority, using cell phone, drinking etc.) might be less inclined to contact the police than people who simply experienced a mechanical error. As much of this has not been studied previously, this question might be regarded as quite exploratory, but nonetheless worthy of further research.

Question 16 – Guilt.
Versteegh (2004) found that it does not affect the correctness of recall whether or not the respondent is to blame for the accident or not. But no studies exploring how guilt affects whether or not an accident is reported to the police were found; the hypothesis was that people who think the accident is their fault might be more reluctant to contact the police.

Medical care / Consequences

Question 17 – Who did you contact?
The answer to whether or not respondents have contacted the police is our only method of attempting to assess the level of underreporting. When analysing data, we must thus assume that people who did not contact the police are those missing from official accident statistics, whereas people who answer that they have contacted the police are expected to be found in official records. Of course, this is not expected to be entirely true – we know from the study “Cykeljakken” (Lahrmann et al., 2014) as well as by simple logic that not all people who contact the police will prompt the police to write a report. However, it was not possible in this study to actually collect personal data and then find each respondent in the official database. That would require the obtainment of sensitive personal information, which we could not gather in all countries or transfer across borders (which made it impossible to conduct the data analysis anywhere but within each country).

Questions 18-27 – Fatalities, hospitalisation and rehabilitation.
As the results of this survey are to be used to calculate socioeconomic costs of accidents, we found it important to shed light on some of the costs and how different accident situations with different levels of reporting represent different costs. In Denmark, an estimation of the accident severity influence on underreporting has been carried out by Janstrup et Al. (2014), but similar studies have not been found in the other partner countries. The questions provide us with an opportunity to describe some of the consequences that carry societal costs regardless of whether or not the accident is defined as a traffic accident following the national definitions.

Questions 28-30 – Absence from work.
This was also one of the questions whose results are expected to be fed into task 5.3 on estimation of socioeconomic costs of accidents to enable the indication of the societal costs of the accidents.

Question 31 – Amount of material damage.
This question could both be used to establish how the level of material damage influences the level of reporting to the police and to enable the use of this information in task 5.3 for a better cost estimation method.

Question 32 – Amount of damage on road equipment.
The answers to this question would contribute to the input to task 5.3. The hypothesis could be that the accidents with no police contact are often less severe, thus they should not carry the same weight when calculating the costs of the accidents with regard to the material costs on the road and its surroundings.

Demographic questions

Questions 33 and 34 – Employment and income.
The answers to these questions constitute input to task 5.3 as this is important for the socioeconomic cost calculation. However, they could also be relevant for demographic analysis – it could be hypothesised that contact to the police could be influenced by societal, economic and educational status.

Question 35 – Further information/text field.
This question was included to give the respondents a possibility of providing information if they feel the need for this. The experience from “Cykeljakken” (Lahrmann et al., 2014) was that people who have experienced a traffic accident are much interested in providing information of their accident. We would like to give them the opportunity of giving further information simply to provide them with a feeling of contentment from filling out the questionnaire so they that do not end up with a feeling of not having had the possibility to voice everything they had on their mind. Therefore the question is optional and being placed as the final question respondents do not get tired by answering this text field.

4.3. Possible sources of error

The survey has a number of potential sources of error, which must be taken into consideration when analysing the data. This section points out potential errors related to this survey.

When working with survey data, one often divides the possible errors into four different categories: Coverage Error, Sampling Error, Nonresponse Error and Measurement Error, (Dillman, Christian, & Smyth, 2014).

- **Coverage Error** occurs when you construct your sample framework without giving every member of the population an equal opportunity of being included in your sample. In the stratified samples used in Denmark and Sweden, this error would be minimal as Statistics Denmark and Postnord, respectively, would have handled this.
- **Sampling Error** occurs when only a sample of respondents are asked rather than the entire population; even in a stratified sample, we will expect the results found to be only within some margin of the truth.

- **Nonresponse Error** arises when those who choose to participate in a survey differ (in ways that affect your results) from those who choose to not participate.
- **Measurement Error** occurs when respondents provide inaccurate answers to survey questions – perhaps because they do not understand the question, do not recall, are unwilling to answer or are simply unable to answer correctly.

Some obvious points regarding the survey needs attention as they affect the total survey error regardless of the recruitment strategy implemented in each country.

Email address. Only people with an email address have the opportunity to participate in the survey. This might give a biased sample since the share of people who have no email address is most likely highest in the elderly segment of the population.

Children. Due to the Data Protection Act in the EU, children are not a part of the survey. This obviously results in a biased sample since children are also involved in traffic accidents.

Reported to the police. It has not been possible to compare the self-reported information with police records, and thus the reporting levels provided in the report rely on answers from the people involved rather than on actual police records. This affects the Measurement Error since the police might not have taken up a report even though the concerned road users contacted the police.

Accident or near-miss. Some road users might report an accident which was in fact a near-miss. The questionnaire is designed so as to enable the ruling out of at least part of the near-misses reported. However, some near-misses might be reported and not filtered out before the analysis of data is conducted.

Ability to recall accidents. In general, self-reporting depends upon road users being able to recall quite a few details of their accident. Some might find it difficult to recall specifics about the weather, the geometric layout of the road, street lights, etc.

Telescoping effects (remembering an important event as more recent than it actually is) can also affect the recall of accidents. This could possibly affect only the first round of questionnaires; as an example we might imagine a person who was involved in a traffic accident five months ago enrolling in the study at hand and reporting the accident in the first of the questionnaires, hence claiming it to have happened within the last three months.

Accident severity. Questions regarding the severity of the accident – medical attention, the value of material damage, absence from work, etc. – can suffer from strategic answers in order to make the accident seem more severe than it really was. However, this survey is anonymous and in no way connected to insurance or medical systems, which should minimise this source of error.

Non-response bias. People who are severely injured (e.g. permanently handicapped or hospitalised) due to an accident are expected to have a higher non-response rate than less severely injured individuals. This is due to the fact that the period of recall is only three months, thus it is likely that the severely injured are not yet fit to answer the online questionnaire.

5. Data processing

After the respondents' answers on self-reported accidents have been collected, the data is cleaned by undergoing the following process:

1. Unfinished answers are removed.
2. Near-misses are removed. The incident is considered a near-miss if the respondent answers "no" to both having had physical contact with another road user and having fallen or crashed, having been hurt or having suffered property damage (question 1 and question 2).
3. Answers not congruent with the research purpose are removed. This could be the case if the accident happened while the respondent was a passenger in a car or a bus. These incidents are removed since it is not expected that the respondent can account accurately for some of the questions asked in the questionnaire; individuals might take less notice of the accident circumstances if they were not driving the vehicle at the time of collision. Answers referring to accidents that happened on forest paths or trails or on the beach are also removed as only accidents happening on a public road can be considered traffic accidents.
4. Respondents without a valid participant ID are removed. These are respondents who have gained access to the questionnaire without registering (meaning that they used a direct link only given out to use by researchers on the InDeV project to test the questionnaire).

The process described above is presented in Figure 2, and the numbers of entries removed in the corresponding steps are shown in Table 3. It is clear that especially the removal of near-misses reduces the dataset. The fact that so many respondents have been trying to report a near-miss as an accident stresses the need for data to be cleaned before analysis – seemingly quite a few respondents do not intuitively share a traffic researcher's definition of an accident; this measurement error needs to be minimised.

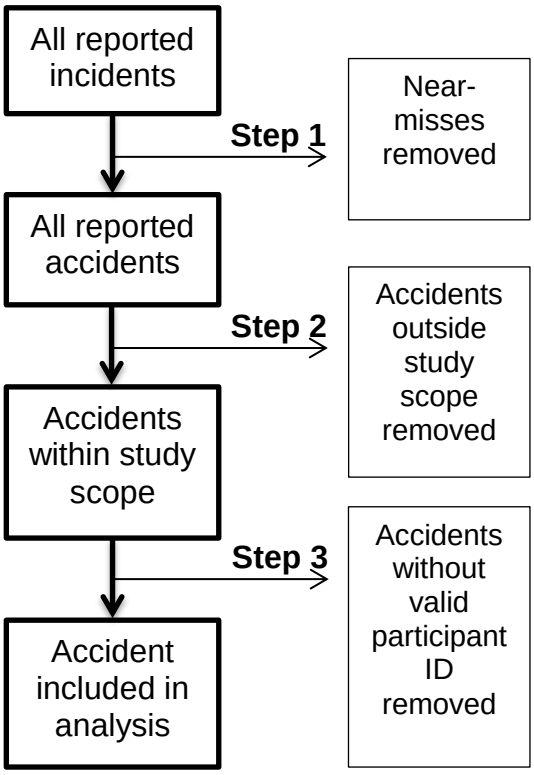


Figure 3: Schematic overview of the data cleaning process

Table 3: Number of data entries removed due to data clean-up as described in Figure 2 as well as the numbers of all reported incidents and accidents included in further analysis.

	All reported incidents	Step 1	Step 2	Step 3	Accidents included in analysis
Belgium	214	34	6	2	172
Denmark	670	129	9	0	532
Germany	122	9	6	7	100
Poland	37	4	0	3	30
Spain	52	10	1	1	40
Sweden	166	55	11	0	100

6. Results

The following section provides several results from the study. Firstly, we will comment on some of the demographic answers from participants in order to further address some possible biases. Secondly, we will look into some of the characteristics of the reported accidents and the question as to whether or not the accidents reported in this study could be expected to be known in other records. Secondly, some of the monetary and medical consequences of the accidents will be addressed. Lastly, we will focus on pedestrian accidents in order to shed light on the pedestrian single accidents reported in the survey.

6.1. Participants

The recruitment of participants has been a challenge in some of the partner countries. This provides very different samples, both with regard to the amount of data and to errors affecting the sample.

Table 4 provides an overview of the number of participants and the answers received in the different partner countries.

Table 4: Numbers of participants signed up in the different partner countries. Numbers of answers to the questionnaires in each round (each round covering three months).

	Belgium	Denmark	Germany	Poland	Spain	Sweden
Number of participants	1,190	5,536	471	245	295	970
Answers in 1st round	746	4,383	289	108	186	749
Answers in 2nd round	987	3,027	359	136	349	773
Answers in 3rd round	899	4,217	334	137	201	777
Answers in 4th round	-	4,163	-	-	-	
Total number of answers	2,632	15,790	982	381	736	2,299

The recruitment strategies employed in Belgium, Denmark and Sweden were quite effective in terms of numbers, causing these countries to have the highest numbers of participants. This is noteworthy, taking into account that these countries also have the lowest number of inhabitants.

The participants are distributed evenly on gender in Belgium, Denmark and Sweden, whereas the distribution of gender in the samples from Germany, Poland and Spain is skewed, cf. Table 5.

Table 5: The gender of the participants. * Data on gender are missing from five Danish participants and two German participants.

	Female	Male	Total	%	SE	z	p
Belgium	590	600	1,190	49.6	0.014494	-0.28989	0.771904
Denmark*	2,801	2,730	5,536	50.6	0.006723	0.954677	0.339741
Germany*	193	276	471	41.2	0.023088	-3.83258	0.000127
Poland	89	156	245	36.3	0.031944	-4.28047	1.86E-05
Spain	129	166	295	43.7	0.029111	-2.15422	0.031223
Sweden	494	476	970	50.9	0.016054	0.577945	0.563301

Table 6 and Figure 4 show the ages of the respondents in aggregated groups. Some of the countries show quite different distributions of the respondents' age, which is a result of the differences in the recruitment procedure applied in each country. For instance, both Belgium and Poland have a large proportion of respondents in the younger age groups, which is concurrent with the practice of contacting university students in the call for participants. Denmark and Sweden both have relatively high proportions of respondents in older age groups, which is concordant with the stratified sample used in these countries.

Table 6: Number of respondents in each age group.

Age	18-27	28-37	38-47	48-57	58-67	68-77	78-87	88-	Total
Belgium	339	308	239	194	100	11	0	0	1,191
Denmark	721	600	922	1200	1098	827	154	15	5,537
Germany	44	96	95	134	77	19	6	0	471
Poland	70	70	49	24	25	5	2	0	245
Spain	40	58	87	62	38	10	0	0	295
Sweden	107	147	159	187	218	147	1	4	970

Figure 4: Distribution of age of the participants. Numbers are in percentages of the total number of participants in each country.

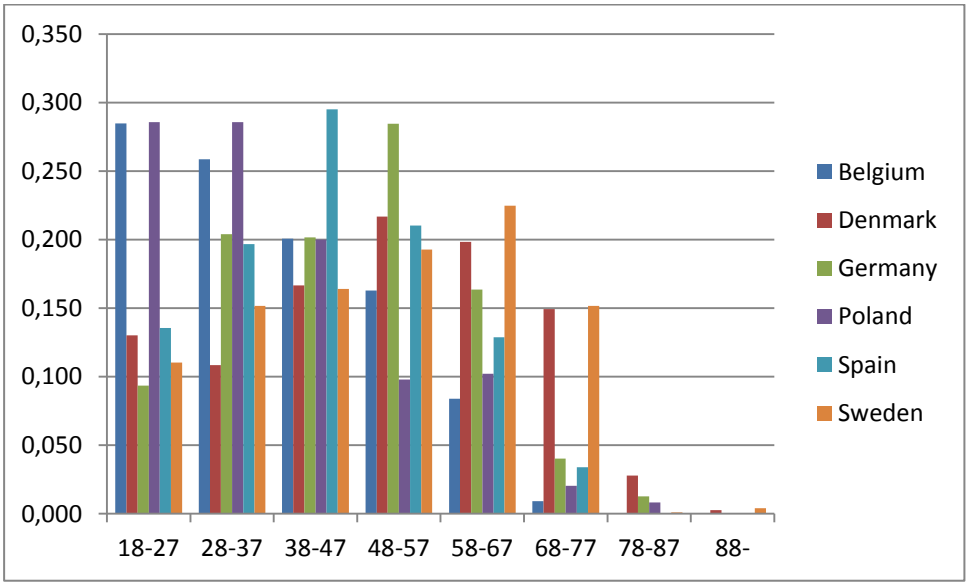


Table 32 in Appendix 4, section 12.1, shows the employment of the respondents at the time of their reported accident.

6.1.1. Precautions due to sample issues

Large differences are seen in the quality of the data obtained from different countries due to differences in recruitment and the success rates of the recruitment procedures. It is clear that the low number of participants from Germany, Poland and Spain makes it extremely difficult to make any general conclusions on national levels in these countries. The small sample size from Poland and Spain results in a low number of reported accidents (as we will show in Table 8), which makes it difficult to generalise about accident occurrence based on the sample.

Besides having very few participants, the three countries all show a skewed distribution of gender, indicating that the data is not representative. In Poland and Germany, the recruitment procedure gives rise to suspected Coverage Error; moreover, it is suspected that that the people who have seen the call for participants are not representative of the population. In Poland, this could also explain the skewed gender distribution (more male employees at the Technical University and the Municipality of Warsaw are likely). In Germany, the coverage error could possibly also account for the relatively high level of reported accidents per participant (see

below); more than 20% of the respondents in Germany have reported that they have had an accident during the past nine months. This seems to be an extremely high number compared with the other countries ($P<0,05$). When considering that recruitment was primarily conducted among people who were in contact with the Road Safety Association, an automotive company and BASt, it is possible that the respondents share an interest in traffic. This could make them an overreporting subgroup due to social desirability effects (Wåhlberg, Dorn, & Kline, 2010); their attitude towards driving or behaviour in traffic in general could be different from that which would be considered representative of the majority. It could also be suspected that the respondents' mileage and use of transportation differ from that of the general public. Because of lack of

information on for instance the respondents' general beliefs and attitudes towards traffic, it is not possible to make any certain conclusions, but this could be suspected due to the recruitment procedure and the relatively high level of accident involvement.

Due to the problems with sample size mentioned, i.e. sample error and coverage error, it must be emphasised that the results on reported accidents from Germany, Poland and Spain must be treated cautiously. However, this does not mean that the data cannot prove interesting for instance in further studies that might aggregate them with other data sources. Thus the following graphs and tables present the numbers from these countries, but we will make no further comment on them in relation to the results of this study. To indicate the uncertainty of the validity of this data, it is given a clear visual distinction in the figures and tables in the following reporting of results.

6.2. General accident information

In Denmark, an involvement of approximately 10% of the road users during one year was expected (Agerholm & Andersen, 2015). As seen in Table 8, 9.6% of the Danish participants reported to have been involved in a traffic accident during the study period of one year. Thus agreement exists between the expected results and the findings, indicating that respondents are neither underreporting nor overreporting their accident involvement.

The percentage of road users involved in traffic accidents varies from one country to another, following the general level of traffic safety in the given country. Thus it was not expected that all countries would yield the same percentage of accident involvement. There was no knowledge of the expected level of accident involvement in the other countries previous to this study, so it is not possible to make any further comments on the accident involvement.

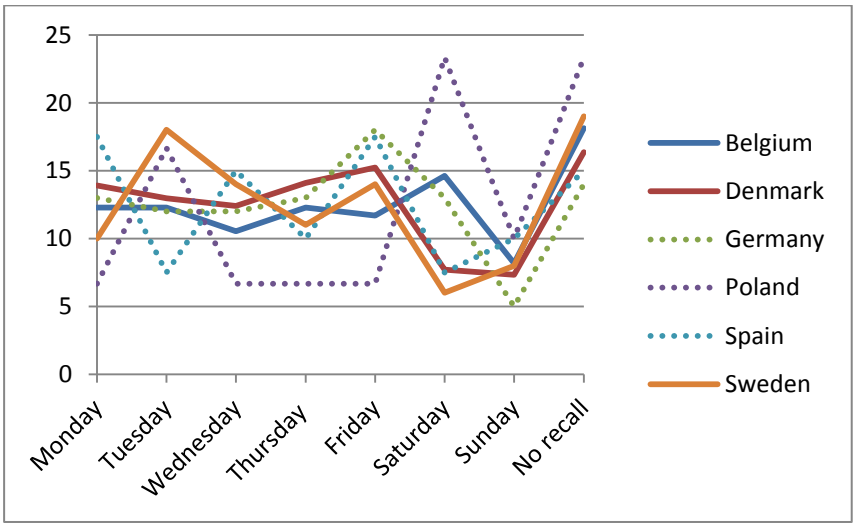
Table 8: Number of participants signed up in the different partner countries and their self-reported accident involvement.

	Belgium	Denmark	Germany	Poland	Spain	Sweden
Number of participants	1,19	5,536	471	245	295	970
Reported accidents	172	532	100	30	40	100
Percentage involved in accident	14.5%	9.6%	21.2%	12.2%	13.6%	10.3%
95% CI	12.5-16.6	8.8-10.4	17.6-25.2	8.4-17.0	9.9-18.0	8.5-12.4

6.2.1. Time and season

Figure 5 illustrates the distribution of accidents throughout the week. In the majority of the countries, a typical pattern of accidents is seen; more accidents are reported during weekdays than at the weekends, although this is not the case in Belgium where more accidents are recorded on Saturdays than on other days of the week.

Figure 5: Distribution of accidents throughout the week. The numbers are in percentages of the total number of recorded accidents in each country.



When looking at the distribution of accidents across the year (Figure 6), it becomes evident that the data from Belgium and Sweden covers nine months, whereas the Danish data covers a year, which explains the lack of accident data in the spring in Belgium and Sweden. There are no extreme spikes in the beginning of the study period in each country, indicating that telescoping effects (i.e. respondents reporting an accident as more recent than it actually was) is not a problem in the study at hand.

When comparing Figure 5 and Figure 6, it can also be seen that the respondents found it more difficult to recall the day of the week of their accidents compared to the month.

Figure 6: Distribution of accidents throughout the year. The numbers are in percentage of the total number of recorded accidents in each country.

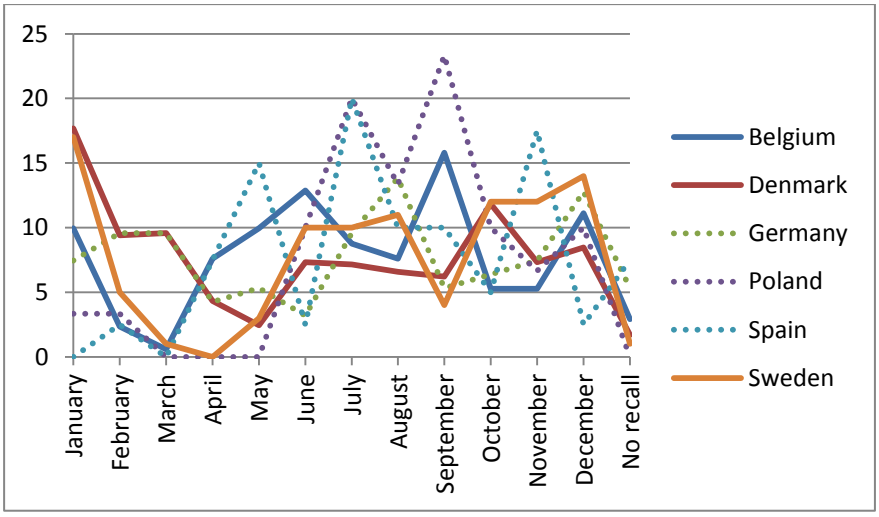


Table 7: Lighting conditions at the time of the accident.

	Daylight	Darkness	Twilight	No recall
Belgium	117 (68.0%)	29 (16.9%)	23 (13.4%)	3 (1.7%)
Denmark	367 (70.0%)	117 (22%)	43 (8%)	5 (0.9%)
Germany	70 (70%)	12 (12%)	14 (14%)	4 (4%)
Poland	18 (60%)	5 (16.7%)	7 (23.3%)	0
Spain	26 (65%)	12 (30%)	2 (5%)	0
Sweden	69 (69%)	22 (22%)	9 (9%)	0

As seen in Table 9, the majority of the accidents were reported to have taken place during the day. Very few of the respondents did not remember the lighting conditions at the time of the accident.

6.2.2.Road geometry and elements

When examining the geometry of the road at the place of the accidents, we see in Appendix 4 section 11.1 that the circumstances for VRU accidents and all accidents show quite similar distributions, yet with a slightly higher percentage of VRU accidents taking place on straight stretches of road. 40-49% of VRU accidents happen on straight stretches of road, making these the most common road layout for accidents with VRUs.

The road element at the place of the accident is very different, depending on whether all accidents are examined or only VRU accidents (see Appendix 4 section 11.1). This is in accordance with our expectations, as many elements, such as sidewalks and bicycle paths, are reserved for VRUs. Nonetheless, the second most common place for a VRU accident to take place is the road. Not unexpectedly, due to the large proportion of VRUs in the study being bicyclists, bicycle paths are the most frequent places.

6.3. Known and unknown accident information

The objective of wanting to gain information on the accidents that are not to be found in police records has prompted the need to distinguish between possibly known accidents and accidents that are not found in other records. One might argue that not only accidents in police records can be considered known as some countries also utilise information from hospitals. But as the use of hospital records in combination with police records is uncommon, we have chosen in this report to consider contact with the police as the most relevant and interesting authority contact. Thus, the level of respondents' reporting to the police will be shown in the following tables as an indication on the number of accidents that might be considered known in official statistics.

The authorities with whom the respondents have been in contact due to their accident are presented in Table 10. Here it is clear that the percentage of self-reported accidents

in the survey that entail contact to the police is very small. This indicates that only a small percentage of accidents are known in the official statistics, which corresponds with previous studies (Agerholm & Andersen, 2015; K. Janstrup et al., 2014). The ER or doctor is contacted more often than the police, but in no more than one fourth of the accidents. Thus, even when utilising hospital records in combination with police records, the main part of the accidents included in the study would not be found in records. Insurance companies are the bodies most frequently contacted by the respondents. So if one would like to compare information of self-reported accident data with another data source, the most comprehensive source for matching would be insurance records.

Table 8: Whom did the respondent contact in connection with their traffic accident?
*** Respondents who have not answered the question or who have not yet contacted any authorities but are planning to do so.**

	ER or Doctor	Insurance	Police	None	Other*	Total acc. reported
Belgium	39 (22.7%)	78 (45.3%)	23 (13.4%)	75 (43.6%)	1 (0.5%)	172
Denmark	124 (23.3%)	249 (46.8%)	35 (6.6%)	228 (42.9%)	8 (1.5%)	532
Germany	13 (13.0%)	28 (28.0%)	30 (30.0%)	52 (52.0%)	3 (3.0%)	100
Poland	5 (16.7%)	8 (26.7%)	13 (43.3%)	13 (43.3%)	0 (0.0%)	30
Spain	5 (12.5%)	14 (35.0%)	5 (12.5%)	21 (52.5%)	3 (7.5%)	40
Sweden	20 (20.0%)	33 (33.0%)	8 (8.0%)	58 (58.0%)	0 (0.0%)	100

6.3.1. Means of transport

The tables below show which means of transport the respondent was using while experiencing the accident. Bicycles, on foot and cars are the most frequently used in all countries. It is also obvious that the number of drivers of scooters/mopeds and MCs is so low that these means of transport cannot be said to be represented fairly in the study, which is evident form the size of the CI shown in tables 11-16.

Table 9: Means of transport of respondents in Belgium, including reporting rate by respondents to police.

BELGIUM	Police contact	No police contact	Total	Reporting rate to police	95% CI
By foot	2	10	12	16.7%	2.1-48.4
Bicycle	5	54	59	8.5%	2.8-18.7
Scooter/ moped	0	0	0	-	-
MC	0	4	4	0%	0-60.2
Car	15	76	91	16.5%	9.5-25.7
Other	1	5	6	16.7%	0.4-64.1

Table 10: Means of transport of respondents in Denmark, including reporting rate by respondents to police.

DENMARK	Police contact	No police contact	Total	Reporting rate to police	95% CI
By foot	0	60	60	0%	0-6.0
Bicycle	6	163	169	3.6%	1.3-7.6
Scooter/ moped	1	5	6	16.7%	0.4-64.1
MC	2	3	5	40%	5.3-85.3
Car	26	255	281	9.3%	6.1-13.3
Other	0	11	11	0%	0-28.5

Table 11: Means of transport of respondents in Germany, including reporting rate by respondents to police.

GERMANY	Police contact	No police contact	Total	Reporting rate to police	95% CI
By foot	3	5	8	37.5%	8.5-75.5
Bicycle	3	29	32	9.4%	2.0-25.0
Scooter/ moped	1	0	1	100%	2.5-100
MC	1	2	3	33.3%	0.1-90.0
Car	20	30	50	40.0%	26.4-54.8
Other	2	2	4	50%	6.8-93.2

Table 12: Means of transport of respondents in Poland, including reporting rate by respondents to police.

POLAND	Police contact	No police contact	Total	Reporting rate to police	95% CI
By foot	0	1	1	0%	0-97.5
Bicycle	4	10	14	28.6%	8.4-58.1
Scooter/ moped	0	0	0	-	-
MC	0	0	0	-	-
Car	9	6	15	60.0%	32.3-83.7
Other	0	0	0	-	-

Table 13: Means of transport of respondents in Sweden, including reporting rate by respondents to police.

SWEDEN	Police contact	No police contact	Total	Reporting rate to police	95% CI
By foot	0	34	34	0%	0-10.3
Bicycle	1	32	33	3.0%	0.1-15.8
Scooter/ moped	0	1	1	0%	0-97.5
MC	0	0	0	-	-
Car	7	23	30	23.3%	9.9-42.3
Other	0	2	2	0%	0-84.2

Table 14: Means of transport of respondents in Spain, including reporting rate by respondents to police.

SPAIN	Police contact	No police contact	Total	Reporting rate to police	95% CI
By foot	0	8	8	0%	0-36.9
Bicycle	1	7	8	12.5%	0.3-92.7
Scooter/ moped	0	1	1	0%	0-97.5
MC	2	5	7	28.6%	3.7-71.0
Car	2	14	16	12.5%%	1.6-38.3
Other	0	0	0	-	-

6.3.2.Opponent

It can be deduced from Table 17 that the level of reporting by respondents to the police is higher in multi-party accidents than in single accidents. This trend is consistent in all countries.

Table 15: Number of road users involved in accidents.

	Single accident	Reporting rate to police single	95% CI	Multi-party accident	Reporting rate to police multi-party	95% CI
Belgium	78	3.8%	0.8-10.8	94	21.3%	13.5-30.9
Denmark	300	1.7%	0.5-3.8	232	10.3%	6.7-15.0
Germany	47	4.3%	0.5-14.5	63	44.4%	31.9-57.5
Poland	12	1.0%	0-26.5	18	66.7%	41.0-86.7
Spain	13	0%	0-24.7	27	18.5%	6.3-38.1
Sweden	58	0%	0-6.2	42	19.0%	8.6-34.1

6.3.3. Surrounding area

Most of the reported accidents in all countries happened primarily in urban areas, secondly in rural areas. Very few of the reported accidents took place on motorways. When comparing the reporting rate from accidents in urban areas with accidents in rural areas, there is a tendency of higher reporting levels in rural areas. This is congruent with the expectation that accidents in rural areas would often be more severe due to the higher speed limits – and that the more severe accidents are more frequently reported to the police (K. H. Janstrup, Kaplan, Hels, Lauritsen, & Prato, 2016).

Table 16: Types of surroundings of the accident locations in Belgium.

BELGIUM	Police contact	No police contact	Total	Reporting rate to police	95% CI
Urban	14	99	113	12.4%	6.9-19.9
Rural	7	41	48	14.6%	6.1-27.8
Motorway	2	4	6	33.3%	4.3-77.7
No recall	0	5	5	0%	0-52.2

Table 17: Types of surroundings of the accident locations in Denmark.

DENMARK	Police contact	No police contact	Total	Reporting rate to police	95% CI
Urban	17	392	409	4.2%	2.4-6.6
Rural	10	82	92	10.9%	5.3-19.1
Motorway	8	19	27	29.6%	13.8-50.2
No recall	0	4	4	0%	0-60.2

Table 18: Types of surroundings of the accident locations in Germany.

GERMANY	Police contact	No police contact	Total	Reporting rate to police	95% CI
Urban	24	61	85	28.2%	19.0-39.0
Rural	3	5	8	37.5%	8.5-75.5
Motorway	3	2	5	60.0%	14.7-94.7
No recall	0	2	2	0	0-84.2

Table 19: Types of surroundings of the accident locations in Poland.

POLAND	Police contact	No police contact	Total	Reporting rate to police	95% CI
Urban	11	16	27	40.7%	22.2-61.2
Rural	2	1	3	66.7%	9.4-99.2
Motorway	0	0	0	-	-
No recall	0	0	0	-	-

Table 20: Types of surroundings of the accident locations in Spain.

SPAIN	Police contact	No police contact	Total	Reporting rate to police	95% CI
Urban	4	30	34	11.8%	3.3-27.5
Rural	1	3	4	25%	0.6-80.6
Motorway	0	2	2	0%	0-84.2
No recall	0	0	0	-	-

Table 21: Types of surroundings of the accident locations in Sweden.

SWEDEN	Police contact	No police contact	Total	Reporting rate to police	95% CI
Urban	7	80	87	8.0%	3.3-15.9
Rural	1	10	11	9.1%	0.2-41.3
Motorway	0	2	2	0.0%	0-84.2
No recall	0	0	0	-	-

6.4. Consequences of the accidents

The severity of the self-reported accidents is quite low. Only two respondents have reported fatal accidents. These were both from Germany, reporting one fatality per accident (Table 24). When looking at the hospital admission due to accidents (Table 25), we see that very few of the accidents result in the respondent being admitted to hospital for one or a number of nights. It is of course important to notice that different

national guidelines are expected to apply as to which injuries would result in a patient being admitted overnight, rendering complete comparison flawed.

Table 22: Reported fatal accidents.

	Fatal accident	Reporting rate to police of fatal accidents	No. of fatalities
Belgium	0	-	0
Denmark	0	-	0
Germany	2	100%	2
Poland	0	-	0
Spain	0	-	-
Sweden	0	-	0

Table 23: Hospitalization.

	Hospitalised	Reporting rate to police of hospitalised	95% CI	Not hospitalised	Reporting rate to police of not hospitalised	95% CI
Belgium	6	16.7%	0.4-64.1	166	13.3%	8.5-19.4
Denmark	12	25%	5.5-57.2	520	6.2%	4.2-8.6
Germany	3	33.3%	0.8-90.6	97	29.9%	21.0-40.0
Poland	0	-	-	30	43.3%	25.5-62.6
Spain	3	66.7%	9.4-99.2	37	8.1%	1.7-21.9
Sweden	0	-	-	100	8.0%	3.5-15.2

6.4.1.Rehabilitation

The respondents were asked if their accident resulted in a need for rehabilitation, i.e. whether they had been referred to an occupational therapist, a physiotherapist or the like to help them recover from their accident. Table 26 shows the results. It can be seen that somewhere between 5.3% and 7% of the accidents resulted in the respondent having received some sort of rehabilitation due to the severity of the accident.

Table 24: Rehabilitation received by respondents.

	No rehab.	Rehab. at hospital	Ongoing rehab. at hospital	Rehab. outside hospital	Ongoing rehab. outside hospital	No recall	Percentage of accidents resulting in rehab.
Belgium	161	0	0	2	8	1	6.4%
Denmark	504	0	0	11	15	2	5.3%
Germany	93	1	0	3	1	2	7.0%
Poland	29	0	0	0	1	0	3.3%
Spain	37	0	0	3	0	0	7.5%
Sweden	93	0	0	6	1	0	7.0%

6.4.2. Absence from work

As seen in Table 25 above, relatively few respondents were hospitalised as a consequence of their accident. But as can be deduced from Table 27, this does not mean that they did not suffer any injuries. Compared to the low number of hospitalised respondents, a relatively higher number experienced one or a number of days of absence from work due to their injuries. We also see that a higher percentage of the accidents resulted in the respondents having at least one day of absence from work, compared to the percentage of respondents who needed rehabilitation.

Table 25: Absence from work due to an accident.

	No absence	Absence	Still absent	Percentage of accidents resulting in absence
Belgium	151	16	5	12.2%
Denmark	480	44	8	9.8%
Germany	90	9	1	10.0%
Poland	26	4	0	13.3%
Spain	37	1	2	7.5%
Sweden	91	9	0	9.0%

6.4.3.Damage

More often than not, the road and its surroundings are untouched by the accident (Table 28), whereas more often than not, the respondents’ personal belongings are damaged (Table 29).

Table 26: Damage to the road and/or the surroundings.

	No damage	Damage	No recall	Percentage of accidents resulting in damage
Belgium	158	10	4	5.8%
Denmark	503	25	4	4.7%
Germany	96	2	2	2.0%
Poland	28	1	1	3.3%
Spain	38	2	0	5.0%
Sweden	97	1	2	1.0%

Table 27: Property damage (to personal items)

	No property damage	Property damage	No recall	Percentage of accidents resulting in property damage
Belgium	51	120	1	69.8%
Denmark	173	357	2	67.1%
Germany	28	70	2	70.0%
Poland	11	19	0	63.3%
Spain	17	23	0	57.5%
Sweden	37	63	0	63.0%

Table 28: Comparison of accidents with property damage and contact to the insurance company

	Percentage of accidents resulting in property damage	Percentage of accidents resulting in contact to insurance company	P
Belgium	69.8%	45.3%	<0.001
Denmark	67.1%	46.8%	<0.001
Germany	70.0%	28.0%	<0.001
Poland	63.3%	26.7%	0.04
Spain	57.5%	35.0%	0.04
Sweden	63.0%	33.0%	<0.001

The number of accidents resulting in property damage is quite high, especially when compared to the number of accidents in which the respondent was in contact with the police (Table 30); more accidents resulted in property damage than in contact with the insurance company, i.e. not all property damage accidents were reported to the insurance. This can be explained by the (relatively) low level of property damage. The cost of reported property damage for each country can be seen in Appendix 3 section 11.3, from which it can be concluded that more respondents reported relatively small amounts than large sums. This was to be expected as many accidents were less severe, and because, at the time of the accident, not many involved pedestrians and bicyclists were in possession of very expensive property which might be damaged, in contrast to car users.

6.5. Pedestrian accidents

Official accident statistics normally only include pedestrian accidents with an opponent in a vehicle. Thus, a single accident with pedestrians does not constitute a traffic accident, whereas a single accident with e.g. a bicyclist is considered a traffic accident. Given the focus of InDeV on vulnerable road users as well as the recommendation in WP2 to include pedestrian single accidents in accident statistics (Olszewski et al., 2017), it seems appropriate to pay more attention than normal to pedestrian accidents in accident statistics. As respondents are asked to register all accidents that have happened in traffic including pedestrian single accidents, it is possible to shed light on the number of these accidents, which are normally excluded from accident statistics.

Table 31 shows the number of pedestrian accidents. The levels of single accidents compared to the multi-party accidents are very high; the vast majority of pedestrian accidents happen without an opponent.

Table 29: The number of pedestrian single accidents and multi-party accidents.

	Pedestrian single accidents	Pedestrian Multi-party accident	Pedestrian accident total
Belgium	10 (83.3%)	2 (16.7%)	12
Denmark	54 (91.5%)	5 (8.5%)	59
Germany	4 (50%)	4 (50%)	8
Poland	1 (100%)	0 (0%)	1
Spain	5 (83.3%)	1 (16.7%)	6
Sweden	31 (91.2%)	3 (8.8%)	34

Due to the study's focus on vulnerable road users, the pedestrian single accidents have been included in all of the results as accidents on equal terms with multi-party pedestrian accidents.

6.5.1. Consequences of pedestrian single accidents

Table 30: Consequences of pedestrian single accidents

	Hospital admission	Rehabilitation	Absence	Property damage	Total pedestrian single accidents
Belgium	**0 (0%)**	**0 (0%)**	**0 (0%)**	**4 (40%)**	**10**
Denmark	**2 (3.7%)**	**9 (16.7%)**	**6 (11.1%)**	**16 (29.6%)**	**54**
Sweden	**0 (0%)**	**6 (19.4%)**	**7 (22.6)**	**15 (48.4%)**	**31**

The pedestrian falls which are included in the study as accidents are not without consequences, cf. Table 32. Pedestrian single accidents result in property damage, absence from work, rehabilitation and hospital admission, which carries socioeconomic costs related to the accident.

7. Conclusions

In accordance with other suggestions made within the InDeV project, pedestrian single accidents have been included in this study on equal terms with multi-party pedestrian accidents. The results from the survey show that the number of multi-party pedestrian accidents is much lower than that of pedestrian single accidents, i.e. single pedestrian falls are much more common than pedestrian accidents with an opponent. More than 80% the pedestrian accidents in the study are in fact single accidents. The fact that the number of single accidents is so high compared with accidents with an opponent calls for attention and indicates that single accidents with pedestrians result in socio-economic costs as well personal consequences for the individual. The severity of the pedestrian single accidents in this study varies; few of these result in hospitalisation, however absence from work and the need for rehabilitation are more common. Property damage is the most common consequence and happens in more than one third of the accidents. A need for further research into the consequences of pedestrian single accidents seems evident.

The objective of estimating the amount of underreporting within each country could not be pursued directly due to legal issues regarding personal data and coordination with police records. Instead a distinction was made between known and unknown accidents. The results on this show that 86.6%, 93.4% and 92.0% of the self-reported accidents in Belgium, Denmark and Sweden respectively are not expected to be known by the police, as the respondents were not in contact with them. The survey did not yield enough respondents in Germany, Poland or Spain to base any conclusions on the results from these countries. National differences exist between the levels of reporting to the police, both generally speaking and in more specific situations. But some trends were found which were consistent across the different countries.

- When accidents happen in rural areas, the respondent is more likely to make contact with the police than if the accidents happen in urban areas
- When more than one party is involved in an accidents, the respondent is more likely to make contact with the police than if the accident is a single accident
- When an accident results in the respondent being admitted to hospital, the respondent is more likely to make contact with the police than if the accident does not result in hospital admission.

It is clear that the accidents included in this study are less severe than accidents in general; it is a methodological consequence of using self-reports that information on fatal accidents and accidents with severe medical injuries are not reported due to the respondents’ inability. But this does not mean that the accidents in the study at hand had no consequences for the respondents; roughly speaking 10% of the accidents resulted in the respondent having one or more days of absence from work, and at least 60% of the accidents resulted in property damage.

Somewhere between 40 and 60% of all of the self-reported accidents did not result in the respondent making contact with the police, their insurance company or medical personnel. Hence, self-reports provide information on a substantial number of accidents that are not recorded anywhere else in statistics.

7.1.1. Methodological findings

The recruitment procedures in Denmark and Sweden were quite similar, i.e. stratified sample of 40,000 people were contacted and asked to participate in the project. In Denmark, this resulted in a 13.8% response rate, whereas the response rate in Sweden was only 2.4%. Finding such big differences (P>0,001) in response rates in surveys with comparable information letters and survey purposes is surprising; it was expected that rather similar attitudes towards participating in traffic safety studies would be seen among inhabitants in the neighbouring Scandinavian countries. This finding indicates that non-response analyses are not easily comparable across borders, as substantial national differences could be present.

7.2. Lessons learnt and further research to be conducted

The findings on reporting levels to the police by the respondents are in some way or another expected to correlate. For instance, one could expect more severe accidents to happen in rural areas due to the higher speeds involved, thus correlating the accidents resulting in a hospital admission and accidents that happen in rural areas. Accident severity could perhaps also be an explanatory reason why multi-party accidents have a higher reporting level than single accidents. In-depth analysis of the data could perhaps shed more light on this.

The results are based on responses from adults; it is not known if accidents involving children share the same characteristics. The respondents' means of transport at the time of the accident were primarily cars, bicycles or on foot thus the results should not be extrapolated to other means of transport without careful consideration and further studies.

The very low levels of reporting by respondents to the police call for further research into underreporting and its consequences. Further research could shed light on the consequences of underreporting with regard to cost calculations. But the variations found on national levels of both the general degree of contact to the police and the situation specific values indicate that cross-national aggregation of results from such a study would be difficult and pose a challenge that is not easily resolved. This would be further complicated by the non-existence of common definitions as to what should be considered a reportable accident by the police.

7.2.1. Methodological considerations

As the likeliness of being involved in a traffic accident is relatively low, it is important to have a very large sample size in order to obtain knowledge of a usable number of accidents. The recruitment procedures in Germany, Poland and Spain did not yield enough participants for this. It would be recommendable in future work to allocate more resources to the recruitment procedure in order to obtain a substantial number of participants in each country. However, as the response rates show, very large national differences seem to exist as to which survey designs might yield the most respondents. Expanding the study period, e.g. by asking participants of their accident involvement during several years, might also have been an option. However, this would be expected to severely influence the dropout rate and was not an option within the limited timeframe of WP5. Another possibility would be to expand the first period of recall; instead of

asking about accident involvement in the previous three months, researchers might for instance have asked about accident involvement the previous two years. On the other hand, this approach would influence results by giving rise to suspicion about the correctness of recall of the accident details; very little knowledge is available on this.

With regard to the questionnaire design, it seems very important to include questions that provide an opportunity to exclude near-misses as many respondents affirm that they have experienced a traffic accident but actually have not had any physical contact with another road user nor experienced any sort of fall, crash, injury or damage. If this is not taken into account, surveys on self-reports of traffic accidents could provide erroneous results. On thorough inspection, the questions used for screen-out of near-misses in the study at hand were not entirely fitting; in hindsight, it would have been an improvement to include vehicle crashes with objects in the explicit text as the current text does not mention them and therefore some vehicle crashes with objects may unintentionally have been screened out.

Some methodological drawbacks on the use of self-reported accident information are worth noticing:

- It is difficult to construct a questionnaire with a definition of traffic accidents which is practical and understandable for respondents, can be used stringently and compares with the official definition of a traffic accident
- The respondents should only be asked questions on which they are expected to have knowledge; thus, some information, such as the accident being correctly filed in police records or the duration of queues due to the accident, cannot be studied using self-reports
- Cross-national studies with self-reports have proved difficult and time consuming due to different national rules and guidelines on for instance the design of ethical clearance and the handling of personal data

On the other hand, the advantage of using self-reported information seems to be:

- Self-reports provide an opportunity to research pedestrian single accidents that are otherwise not described in accident statistics
- Knowledge may be gained of accidents with a severity rate lower than that of the accidents that can be found in police or hospital records
- A survey provides data that are independent of police records, thus unaffected by the incomplete accident recording carried out by the police

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Appendices

9. APPENDIX 1: Information Letter

Dear road user,

You are randomly selected to participate in an extensive study on traffic safety, because you, due to your age, sex and residency, are particular important in order for us to obtain valuable data for research purposes. The study is part of a research project funded by the EU, with the purpose to find out how many traffic accidents that are not recorded in the official statistics. We will also investigate how these un-reported accidents differ from the traffic accidents that are recorded in official statistics – this will help us obtain valuable information used in traffic safety research with the ultimate goal to help improve traffic safety.

We would like to ask you every third month (from February 2016 to February 2017) if you have been involved in a traffic accident in the given period. We would like to ask you this by sending a questionnaire to your email address. If you have not experienced a traffic accident in the three month period, then you do not have to do anything else than open the questionnaire and answer "*no"*. If you answer *"yes"* to having been involved in an accident you will be asked additional questions – for instance which means of transportation you were using and whether or not you were hurt. It is expected that your completion of a questionnaire where you report an accident will take approximately 20 minutes.

If you would like to participate in the study, please follow this link:

HERE THERE WILL BE A LINK TO THE ONLINE QUESTIONNAIRE

If the link isn't active, then please copy-paste it into the address line on your browser.

The link will take you to a questionnaire with five questions on personal details to start off you participation in the study. Here we will ask for your email address; when giving this, you give consent to your participation in the research project and enable us to send you the questionnaire every three months. We will not use your email address for anything else than sending you the research questionnaires and will never share your email address with any other parties.

Your participation and your answers are completely anonymous; we will not ask you for your name, social security number or anything else that could be used to identify you.
All of your answers in our study are confidential. This means that we will not share your information with anyone – not the police nor the insurance companies or anybody else.

We hope that you will participate in the study; it is important for us even though you may not experience any traffic accidents in the period. Your participation is of course voluntary, but will help us gain important knowledge on traffic safety.

We hope for your participation!

On behalf of [Insert institution in InDeV partner country and name of researcher]

InDeV-logo

"In-depth Understanding of Accident Causation for Vulnerable Road Users" (InDev) is an European research project in the field of road safety, co-funded within the Framework HORIZON2020 by the European Commission

10. APPENDIX 2: Self-report questionnaire 1

The following questionnaire was used for participants to sign-up for participation in the study (the email address the provided in the questionnaire was used to distribute the other questionnaires.

A) What is your sex?
   a. Female
   b. Male

B) What is your age? If 17 or below = screenout
   a. Dropdown menu 18-120
   b. I am 17 or younger

C) How many inhabitants live in your city?
   a. More than 500.000
   b. 100.000-500.000
   c. 20.000-100.000
   d. 5.000-20.000
   e. Less than 5.000
   f. I do not know

D) To help us make better research, you can provide your postal code /zipcode. This is optional, and we will only use the information for statistical purposes. What is the postal code/zipcode of your home address?
   a. Text field
   b. I do not wish to share this information

E) Please state the email address to which the questionnaires on your accident involvement will be sent. It is very important that you enter a correct email address, so please check it carefully for any typing mistakes.:
   a. Text field

Finalizing text saying: We are very grateful that you will participate in the research project. Shortly you will receive an email with a link to the questionnaire on any traffic accidents you may have experienced lately. In three months we will send you another questionnaire to the same email address. It is very important for us and the usefulness of the research, that you answer the questionnaires (four in total) that will be sent to your email during the next year.

11. APPENDIX 3: Self-report questionnaire 2

The following questionnaire was sent out to respondents every third months. Depending on whether or not respondents indicated that they had an accident or not they are presented with the questionnaire questions in Part II: Accident Details*.*

Part I: Accident occurrence

1) Have you, in the previous three months, been involved in one or more traffic accidents? This also includes falling as a pedestrian or bicyclist, even though no-one else was involved in the accident, as well as all other traffic accidents that happened for instance while you were using motorised vehicles. **Accidents that happened while you were a passenger should not be reported here**.
    a. Yes
    b. No

2) How many accidents did you experience in the previous three months?
    a. One
    b. Two
    c. Three
    d. Four
    e. More than four

Respondents answering two, three, four or more than four will get the following text and the questionnaire in loop-form for two, three or four times. “You have stated that you have experienced multiple accidents. Please start by answering only with regards to your first accident. After you have finished the questions related to the first accident, we will ask you questions regarding your second accident. We will inform you when it is time for you to think of anything other than your first accident.”

Part II: Accident details

1) During your accident, were you or your vehicle in physical contact with another road user or another vehicle?
    a. Yes
    b. No

2) During your accident, did you fall or crash, were you hurt or were your belongings ruined?
    a. Yes
    b. No

3) What means of transport were you using when the accident happened?

a. On foot
b. Rollerblades or skateboard
c. Bicycle
d. Scooter or moped
e. Motorcycle
f. Car
g. I was passenger in a car
h. I was driving a truck, van or bus
i. I was passenger in a bus
j. None of the above

4) Where were you when the accident happened?
   a. On the road
   b. On a bicycle facility *(this could for instance a bicycle path or a bicycle lane)*
   c. On the sidewalk or alongside the road
   d. On a pedestrian crossing facility *(this could for instance be a zebra crossing with or without lights or a safety island)*
   e. In a plaza, square, parking lot or similar
   f. On a forest path, trail or at the beach
   g. At a bus or tram stop
   h. None of the above

5) How would you describe the geometry of the place where your accident took place?
   a. Straight or curved road with no intersection present
   b. Intersection with traffic lights *(this could for instance be either a four-legged or a three-legged junction)*
   c. Intersection without traffic lights*(this could for instance be either a four-legged or a three-legged junction)*
   d. Entrance to property
   e. Roundabout
   f. None of the above

6) In what type of area did your accident happen?
   a. Urban area
   b. Rural area
   c. Motorway
   d. I do not remember

7) On which day of the week did the accident happen?
   a. Monday
   b. Tuesday

c. Wednesday
d. Thursday
e. Friday
f. Saturday
g. Sunday
h. I do not remember

8) In which month did the accident happen?
   a. January
   b. February
   c. March
   d. April
   e. May
   f. June
   g. July
   h. August
   i. September
   j. October
   k. November
   l. December
   m. I do not remember

9) How were the lighting conditions when the accident happened?
   a. Daylight
   b. Darkness
   c. Twilight
   d. I do not remember

10) How was the weather when the accident happened? [Multiple answers can be chosen]
   a. Dry
   b. Intense sun
   a. Rain, snow, sleet or hail
   b. Fog, haze or mist
   c. Strong wind
   d. Do not recall/none of the above

11) How was the surface of the road/bike path/sidewalk where the accident happened?
   a. Dry
   b. Wet
   c. Slippery due to snow/ice
   d. Slippery due to (wet) leaves, dirt etc.

e. Do not recall/none of the above

12) How would you characterize the traffic situation at the time of the accident?
    a. Rush hour, lots of traffic
    b. Very little traffic
    c. Neither little nor much traffic
    d. I do not know

13) Was another road user besides yourself involved in the accident?
    a. No, I was the only road user
    b. No, I was the only road user, but I hit or tried to avoid an animal or an object.
    c. Yes, one or more road users was involved in the accidents (this also includes parked vehicles)

14) What means of transportation did the other road user use? If there was more than one other road user involved, you should chose the counterpart that was the primary reason that the accident occurred (for instance the road user you tried to avoid, overtake or collided with)
    a. On foot
    b. Bicycle
    c. Car
    d. Truck or van
    e. Bus
    f. Rollerblades, skateboard
    g. Scooter or moped
    h. Motorcycle
    i. Light rail/tram
    j. Something else
    k. There was more than one other road user involved, but I cannot say which one was the primary reason for the occurrence of the accident.

ACCIDENT CIRCUMSTANCES

15) Please state if the following conditions apply to your accident. You can choose all the conditions you find applicable. [Multiple answers can be chosen]
    1) I was listening to music
    2) I was talking to someone (this includes use of cell phones)
    3) I was immersed in thoughts
    4) I was looking at my cell phone
    5) I was in a hurry
    6) I was tired
    7) I was affected by alcohol or other intoxicating substances (e.g. medication or drugs)

8) I was distracted by something (eg. another road user's behavior, a sign or a shop)
9) I was ill/unwell
10) I was looking at my radio or navigation system. Only respondents in car, motorcycle truck or van (answer 1)f, 1)h or 1)e) gets this option.
11) My speed exceeded the speed limit at the location of the accident. Only respondents driving a scooter, moped, motorcycle, car, van or truck gets this option (answer 1)d, 31)e, 31)f or 1)h)
12) There was a mechanical error / technical fault on my means of transport. Respondents who said they were pedestrians(answer 1)a) does not get this option
13) I thought the other road user was aware of my presence. Respondents with solo-accidents (answer 13 a or 13b) does not get this option
14) I was not aware of the other road user. Respondents with solo-accidents (answer a and b) does not get this option
15) I disregarded another road user's priority. Respondents with solo-accidents (answer a and b) does not get this option
16) The other road user disregarded my priority. Respondents with solo-accidents (answer a and b) does not get this option

16) Please choose the option with which you agree the most. Respondents with solo-accidents (answer a and b) does not get this question
1) I think the accident was mainly the other road users fault.
2) I think the accident was mainly my own fault.
3) We were equally to blame for the accident.

MEDICAL CARE / CONSEQUENCES

17) Have you been in contact with one of the following due to your accident? [Multiple answers can be chosen]
a. The police
b. Your own general practitioner
c. The emergency room or the hospital
d. Your insurance company
e. I have not been in contact with the above mentioned
f. I have not been in contact with the above mentioned yet, but I plan on contacting the police

18) Have your counterpart contacted one of the following due to your accident: [Multiple answers can be chosen] Only respondents answering that they had a opponent (answer 13 c) will get this question
a. The police
b. His/her general practitioner
c. The emergency room or the hospital

   d. His/her insurance company
   e. I do not know if my counterpart made any contact with the above mentioned

19) Have there been any fatalities because of the accident?
   a. No
   b. Yes
   c. I do not know

20) How many fatalities have there been due to the accident? (only participants answering b to the previous question will get this question)
   a. [Dropdown menu with numbers 1-15]

21) Have you been hospitalized as a result of your accident? *Please only choose "Yes" if you have been an overnight patient.*
   a. No
   b. Yes, I was hospitalized
   c. Yes, I am still in the hospital and do not know for how many nights I will stay here.

22) How many nights have you been hospitalized? (Only respondents answering b) to the previous question will get this question)
   a. [Dropdown menu with numbers 1-90]

23) How many nights have you been hospitalized so far? (Only respondents answering c) to the previous question will get this question)
   a. Dropdown menu with numbers 1-90

24) Have you been on rehabilitation as a result of your accident? *Rehabilitation is when you referred to an occupational therapist, a physiotherapist or alike to help you recover from the accident. [Multiple answers possible]*
   a. No
   b. Yes, I have been to the rehabilitation facility (outpatient) for a number of meetings/treatments
   c. Yes, the treatment took place while I was admitted to a hospital/stayed overnight at another treatment facility (stationary patient)
   d. Yes, I am still in rehabilitation and do not know how many meetings/treatments I will need.

25) How many treatments/meetings did you receive in a rehabilitation facility? (only respondents answering b) to the previous question will get this question)
    a. [Dropdown menu with numbers 1-30]

26) How many days did you receive rehabilitation treatment at your overnight stay in the hospital/treatment facility? (only respondents answering c) to question 23 will get this question)
    a. [Dropdown menu with numbers 1-90]

27) How many rehabilitation meetings or treatments have you received so far? (only respondents answering d) to question 23 will get this question)
    a. 1-5 treatments
    b. 5-10 treatments
    c. 10-15 treatments
    d. More than 15 treatments

28) Did you have to skip at least one day of work, university or school due to your accident?
    a. No
    b. Yes, I was absent for some days
    c. Yes, I am still absent from work/studies/school and do not know for how long.
    d. No, those days I would have been absent in, were in my holiday.

29) How many days were you absent? (Only respondents who answered b) to the previous question will get this question)
    a. [Dropdown menu with numbers 1-90]

30) How many days have you been absent so far? (Only respondents who answered c) to question 28 will get this question)
    a. Dropdownmenu with numbers 1-90

31) Was your property damaged due to your accident? This could be your clothes, cell phone, vehicle or any other of your own personal items. (Value adjusted to meaningful intervals in the specific country and local currency)
    a. No
    b. Yes, I estimate my property damage to be 1-49 EUR
    c. Yes, I estimate my property damage to be 50-199 EUR
    d. Yes, I estimate my property damage to be 200-499 EUR
    e. Yes, I estimate my property damage to be 500-999 EUR

f. Yes, I estimate my property damage to be 1000-1999 EUR
g. Yes, I estimate my property damage to be 2000-2999 EUR
h. Yes, I estimate my property damage to be 3000-3999 EUR
i. Yes, I estimate my property damage to be 4000-4999 EUR
j. Yes, I estimate my property damage to be 5000-9999 EUR
k. I estimate my property damage to be more than 10,000 EUR

32) Was there any damage to the road or its surroundings? [Multiple answers can be chosen]
    a. No
    b. Yes, one or more signs were damaged
    c. Yes, a lamp post /street light was damaged
    d. Yes, one or more trees, bushes or flowers were damaged
    e. Yes, a guardrail was bent
    f. Yes, a traffic signal was damaged
    g. Yes, a nearby building was damaged
    h. Yes, the road itself, the sidewalk, kerbstones or alike were damaged
    i. Yes, something other than mentioned above was damaged
    j. I do not know

Respondents that previously answered that they have had more than one accident, get the following text and a repetition of the previous questions: *"You previously stated that you have experienced multiple accidents. It is now time for you to think of your second accident and answer the questions based on this accident alone."*

"You previously stated that you have experienced multiple accidents. It is now time for you to think of your third accident and answer the questions based on this accident alone."

"You previously stated that you have experienced multiple accidents. It is now time for you to think of your fourth accident and answer the questions based on this accident alone."

"You previously stated that you have experienced more than four accidents, and you have answered questions related to the first four accidents. We will not take any more of your time by asking you to give details on any more of your accidents.

OUTFASING DEMOGRAPHIC QUESTIONS

33) How have you been employed the previous three months? *If your employment status has changed over the period, please choose the category that fits the largest proportion of the three months.*
    a. Employed
    b. Self-employed
    c. Unemployed/seeking job/jobless
    d. Pensioner
    e. Student (highschool, university, business education, apprenticeship etc.)
    f. Stay at home / housewife / househusband

g. Other

34) What is your average monthly income after tax (net income) or benefit in lack of income (e.g. unemployment benefits, pension, sickness benefits...)? *If your monthly income has changed over the period, please choose the category that fits the largest proportion of the three months* (Value adjusted to meaningful intervals in the specific country and local currency)

h. Below 1,000 EUR
i. 1,000 – 1,500 EUR
j. 1,500 – 2,000 EUR
k. 2,000 – 3,000 EUR
l. 3,000– 5,000 EUR
m. More than 5,000 EUR
n. I do not know or will not share this information

35) Is there anything else you would like to tell about your accident or add about your given information? [Optional]

a. Text field

Final text: Your answers have been saved and you can close the browser window. Thank you very much for your time and participation in the research project! Your answers are very helpful for us; you help us improve and understand traffic safety by giving detailed information on your traffic accident. We will send you a new questionnaire in 3 months and kindly remind you that it is very important for the usefulness of the research that you answer the questionnaires we send you this year (four in total). Please also remember to open the questionnaire if you have had no accidents; thus you will only be asked a single question – it might seem simple, but it will help us a lot in our research.

Text when screen out: Your answers have been saved and you can close the browser window. Thank you very much for your time and participation in the research project! Your answers are very helpful for us; you help us understand and improve traffic safety by taking your time to fill out the questionnaire. We will send you a new questionnaire in 3 months and remind you that it is very important for the usefulness of the research that you answer the questionnaires we send you this year (four in total). Please also remember to open the questionnaire if you have had no accidents; thus you will only be asked a single question – it might seem simple, but it will help us a lot in our research.

Screen-out text: Thank you for your answers. We do not need any further information from you.

12. APPENDIX 4: Results

12.1. Employment

Table 32: Employment of the respondents involved in an accident.

	Employed	Self-employed	Un-employed	Pensioner	Student	Stay at home	Other	Total
Belgium	117	12	0	5	36	0	2	172
Denmark	323	20	13	86	66	10	14	532
Germany	75	5	3	10	5	1	1	100
Poland	25	2	1	0	2	0	0	30
Spain	29	6	2	1	2	0	0	40
Sweden	66	7	2	14	8	3	0	100

12.2. Road element

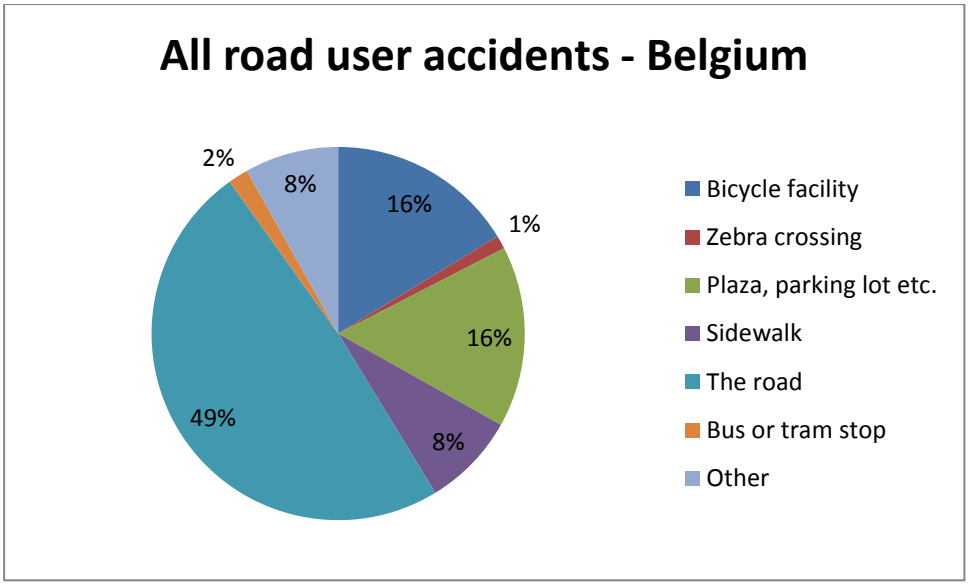


Figure 7: Distribution of all the accident locations in Belgium.

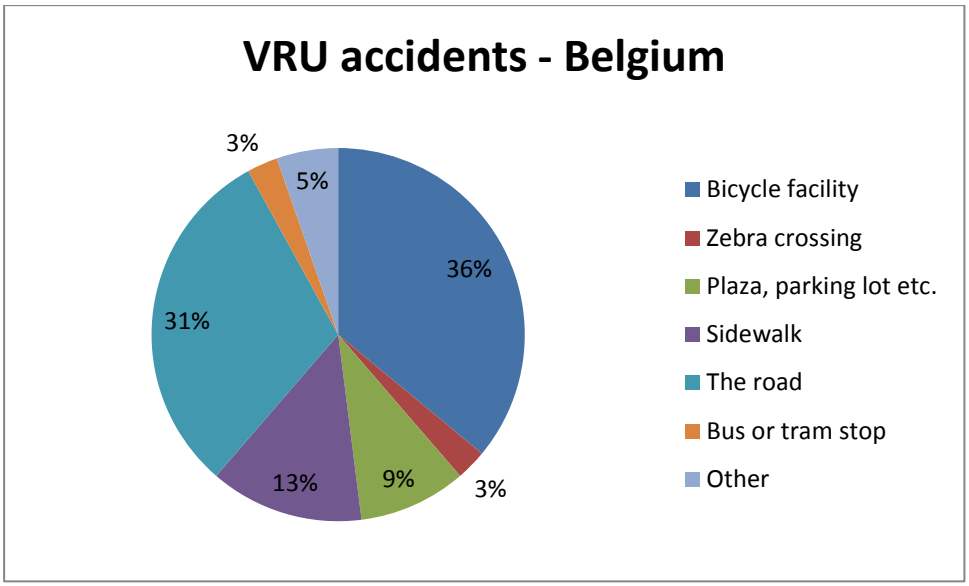


Figure 8: Distribution of the accident locations with VRUs in Belgium.

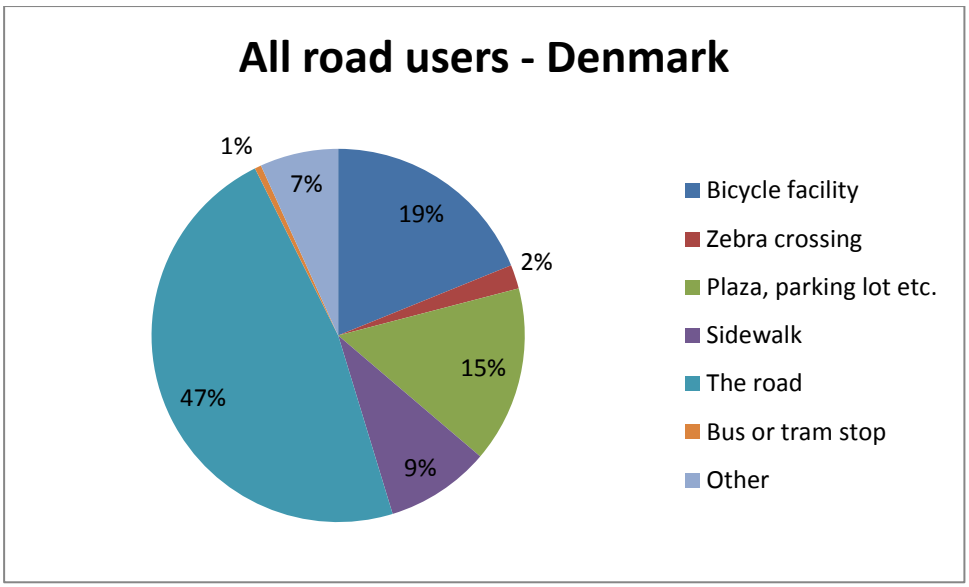


Figure 9: Distribution of all the accident locations in Denmark.

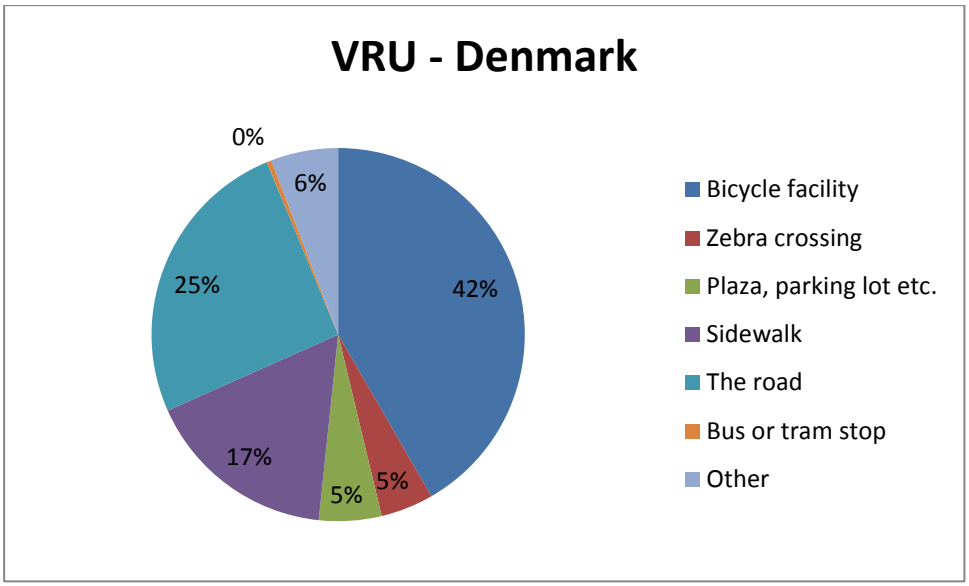


Figure 10: Distribution of the accident locations with VRUs in Denmark.

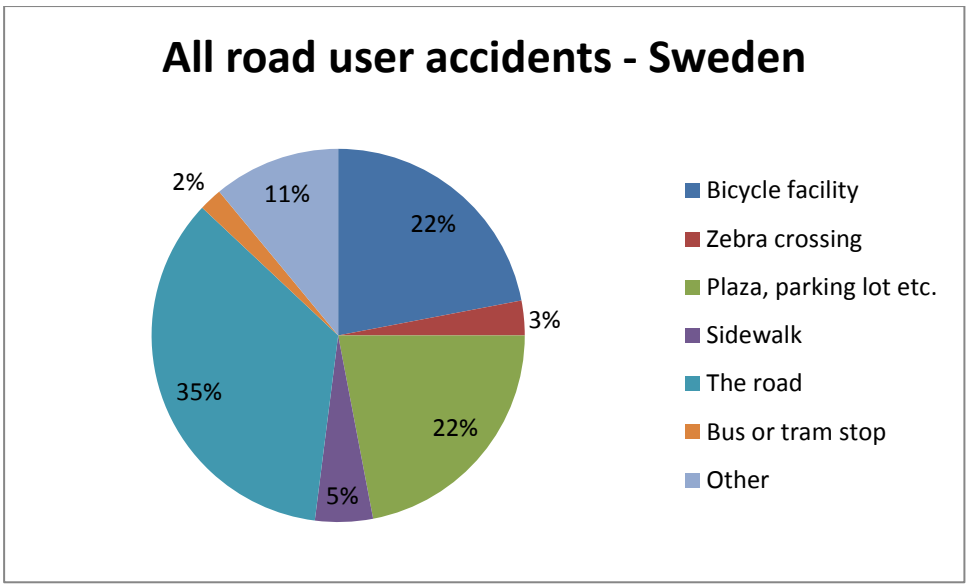


Figure 11: Distribution of all the accident locations in Sweden.

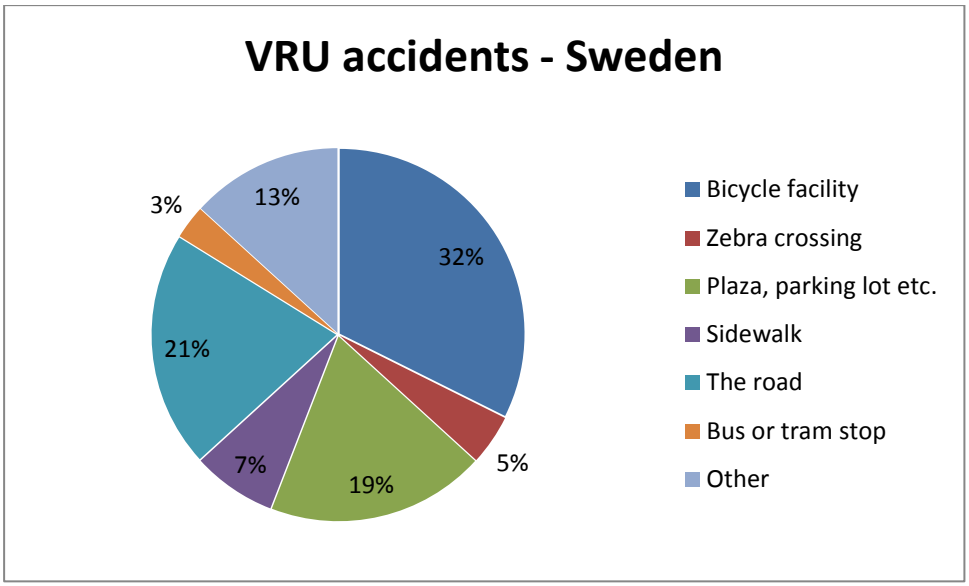


Figure 12: Distribution of the accident locations with VRUs in Sweden.

Table 33: Accident locations (all accidents and VRU accidents only) in Germany, Poland and Spain.

ROAD ELEMENT	Germany		Poland		Spain	
	All	VRU	All	VRU	All	VRU
Bicycle facility	9	9	5	5	2	2
Zebra crossing	4	2	0	0	7	7
Plaza, parking lot etc.	15	5	3	1	5	3
Sidewalk	7	5	3	1	5	5
The road	59	23	17	8	12	3
Bus or tram stop	0	0	0	0	0	0
Other	6	2	2	0	9	4
Total	100	46	30	15	40	24

12.3. Road geometry

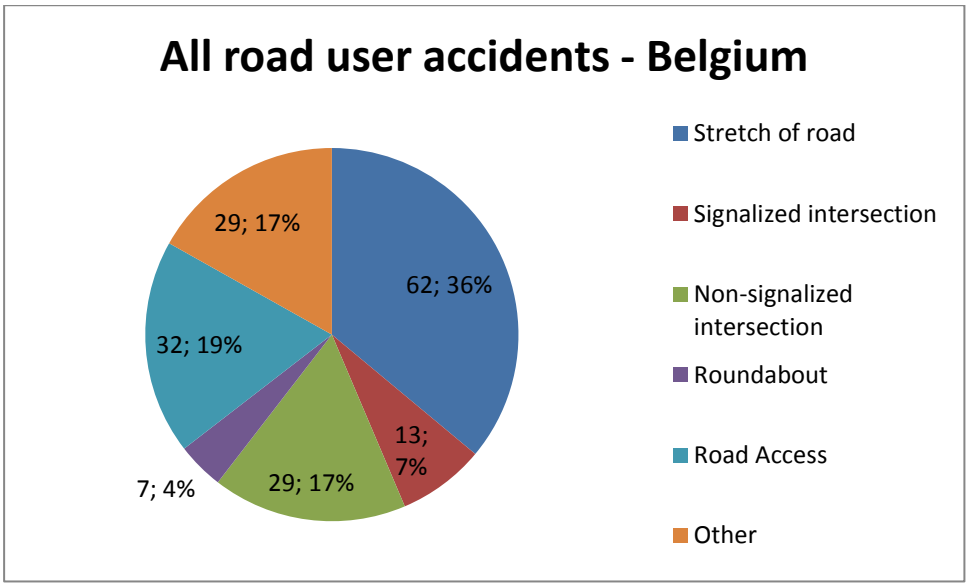


Figure 13: Distribution of road geometry at all the accident locations in Belgium.

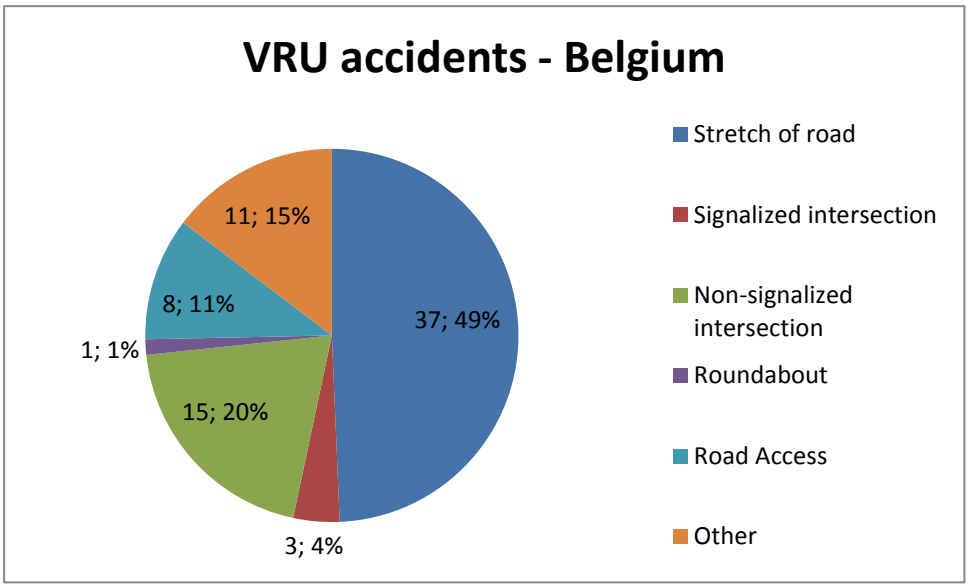


Figure 14: Distribution of road geometry at the VRU accident locations in Belgium.

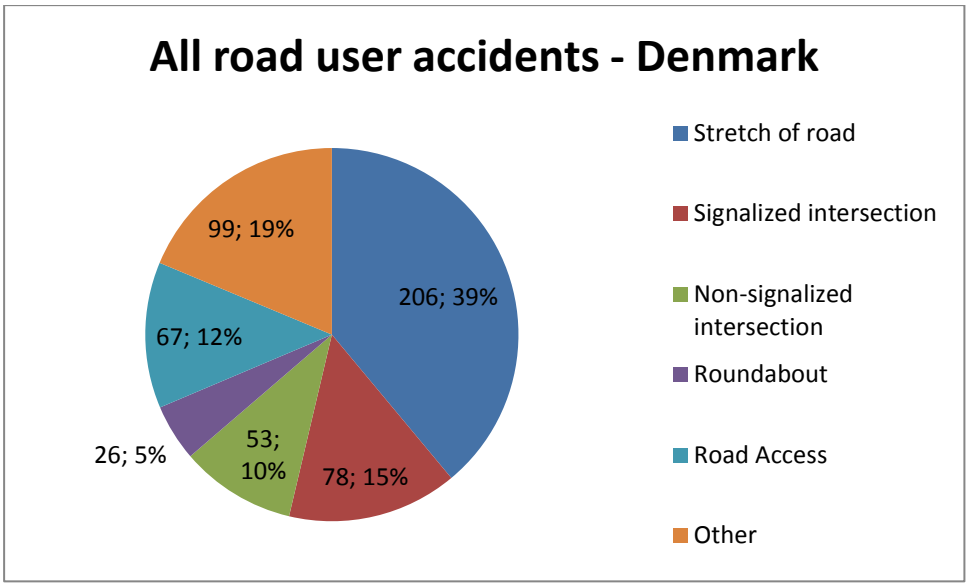


Figure 15: Distribution of road geometry at all the accident locations in Denmark.

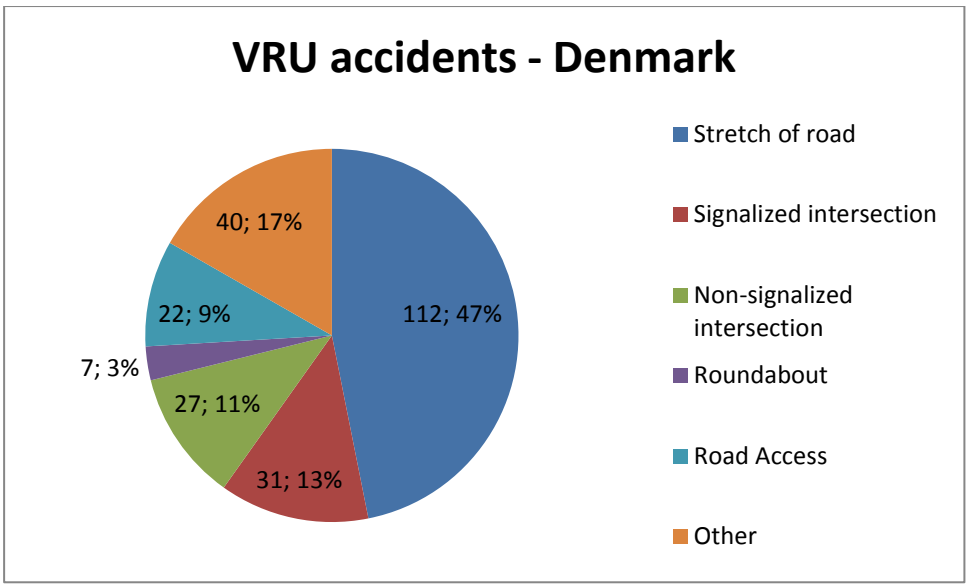


Figure 16: Distribution of road geometry at the VRU accident locations in Denmark.

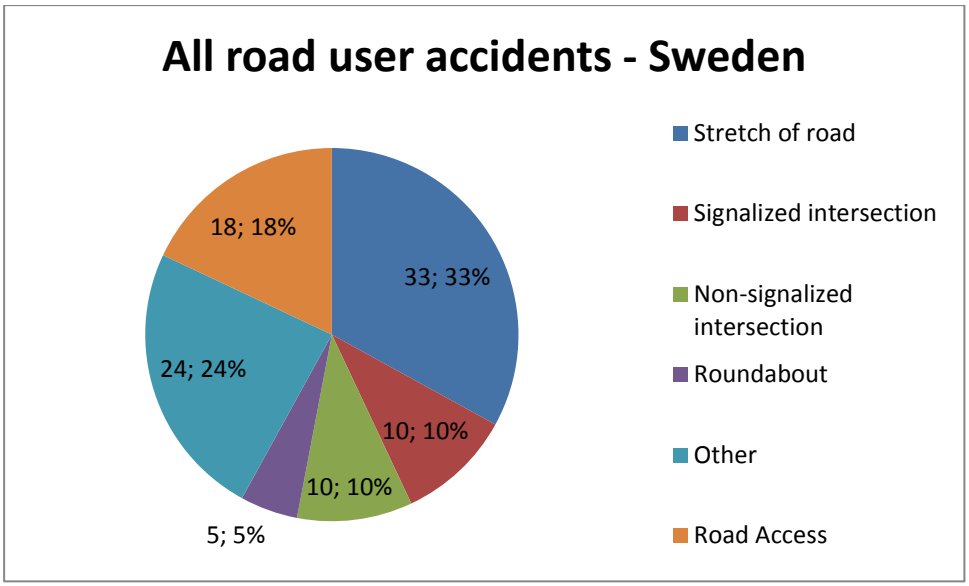


Figure 17: Distribution of road geometry at all the accident locations in Sweden.

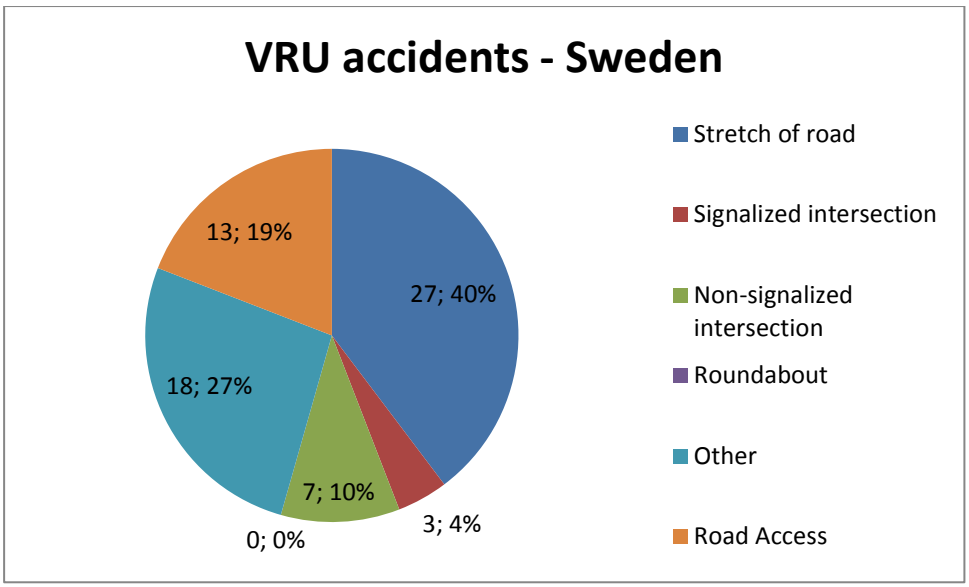
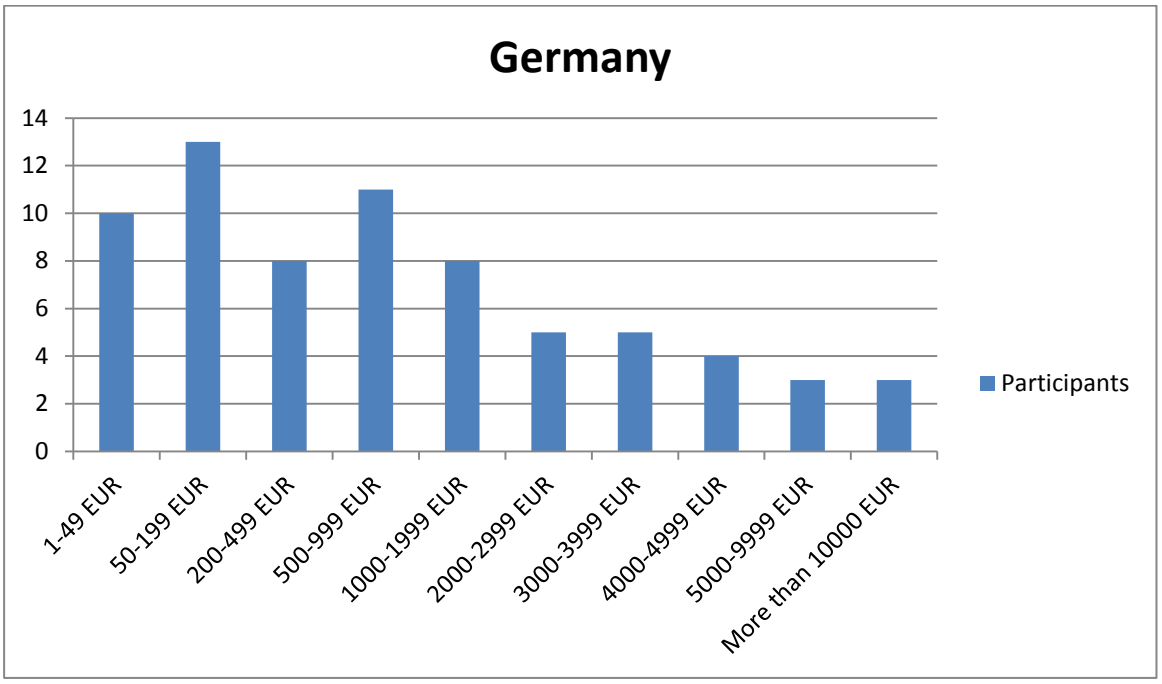


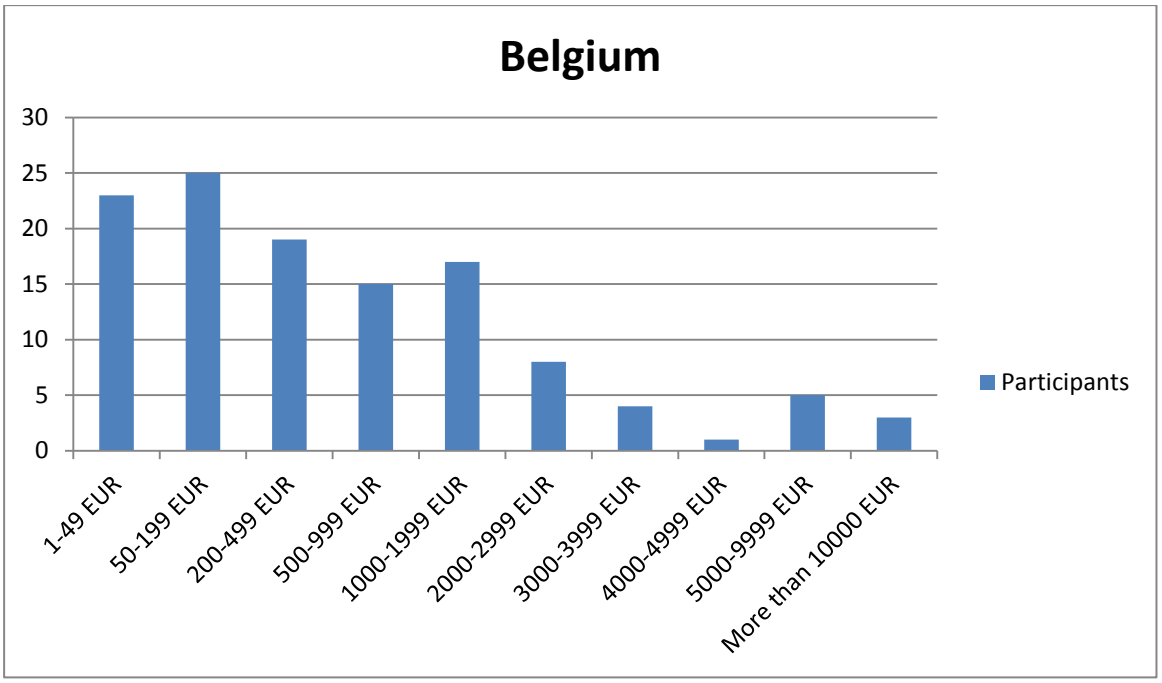
Figure 18: Distribution of road geometry at the VRU accident locations in Sweden.

Table 34: Road geometry at the accident location (all accidents and VRU accidents only) in Germany, Poland and Spain.

ROAD GEOMETRY	Germany		Poland		Spain	
	All	VRU	All	VRU	All	VRU
Stretch of road	27	12	10	5	14	9
Signalized intersection	19	10	7	4	6	3
Non-signalized intersection	20	9	3	1	8	6
Roundabout	0	0	2	2	3	1
Road access	14	8	4	1	2	1
Other	20	7	4	2	7	4
Total	100	46	30	15	40	24

12.4. Property damage




Belgium
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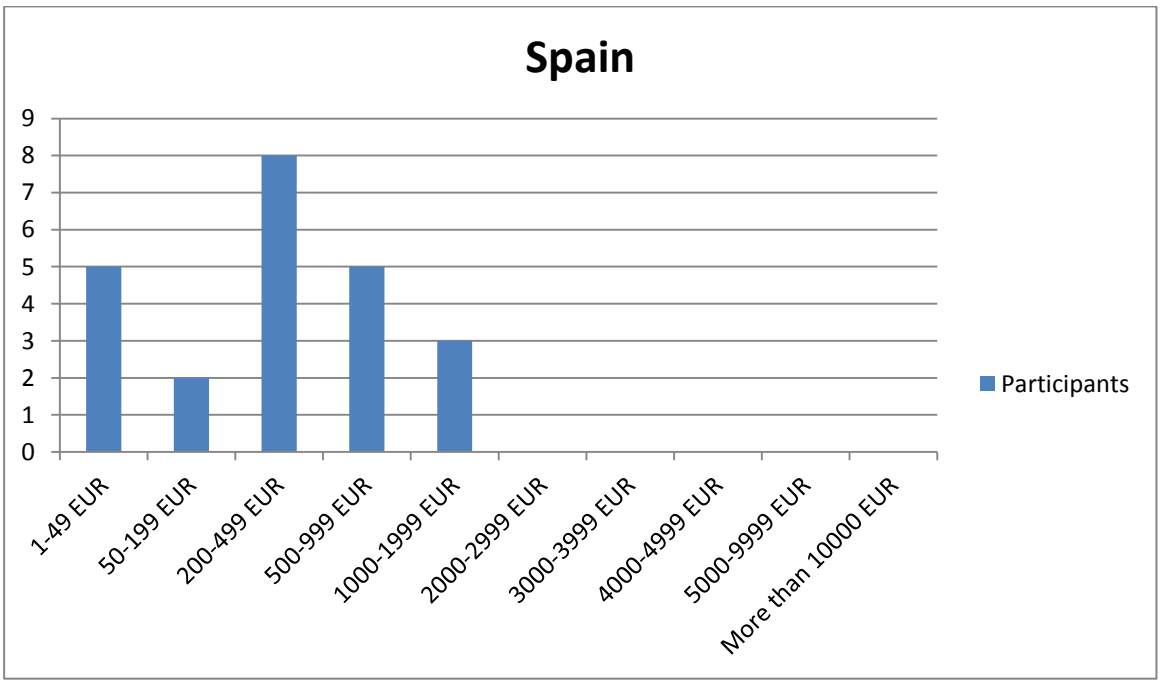
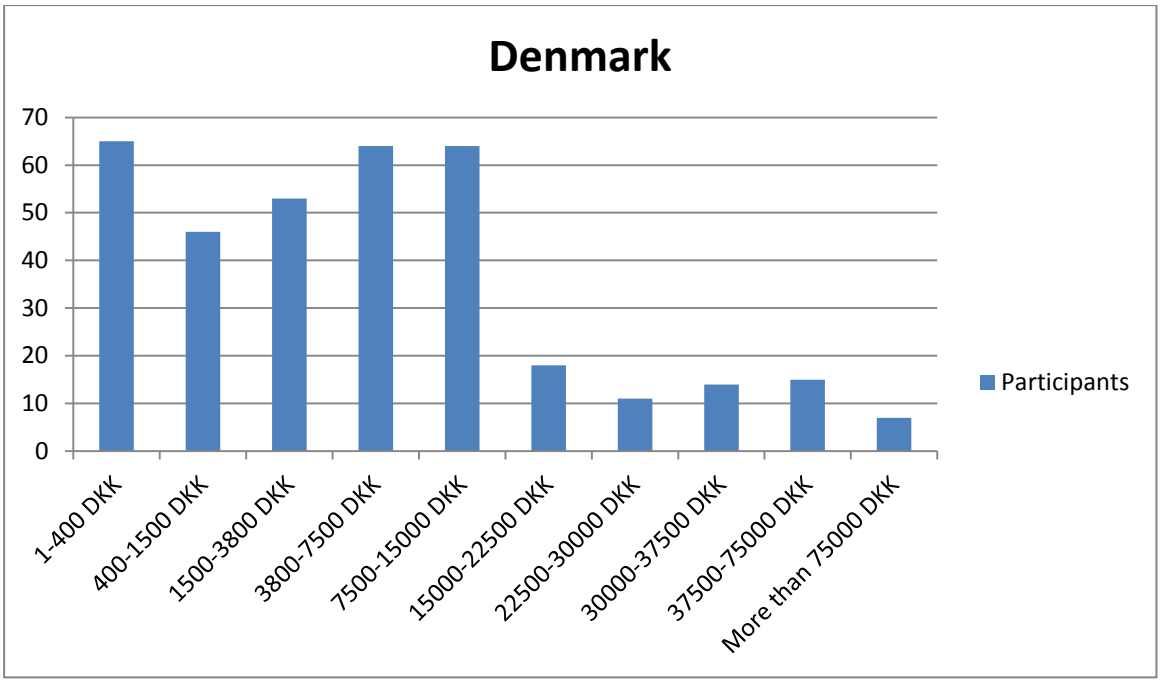
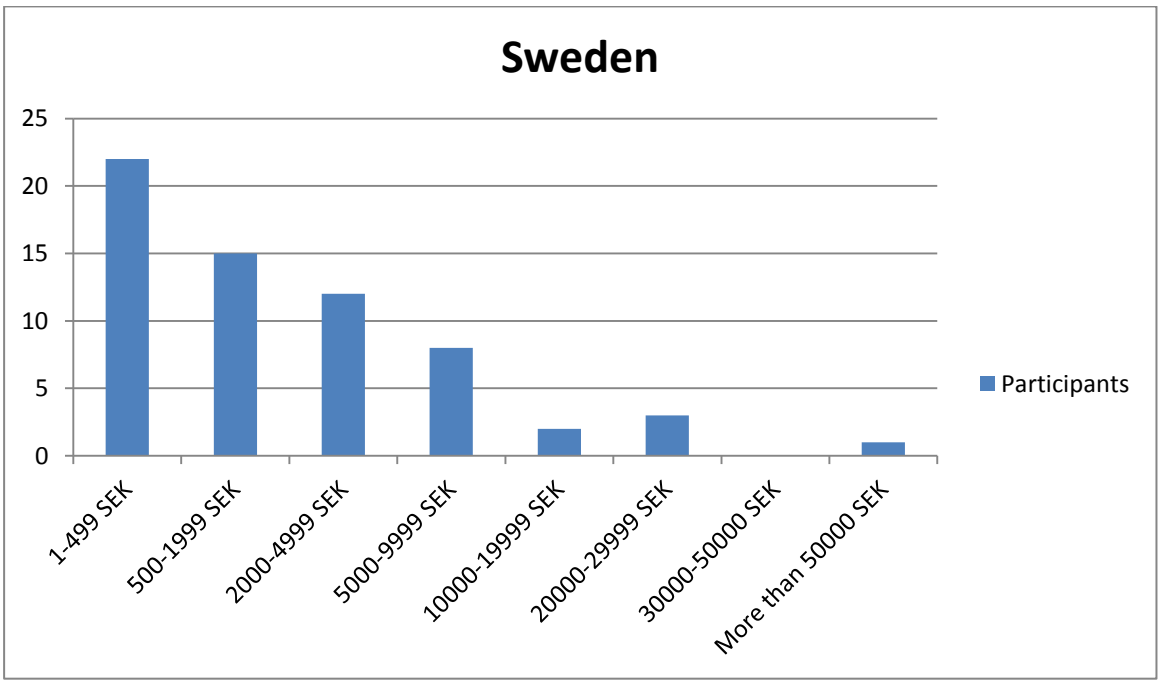
25
20
15
10
5
0
1-49 EUR
50-199 EUR
200-499 EUR
500-999 EUR
1000-1999 EUR
2000-2999 EUR
3000-3999 EUR
4000-4999 EUR
5000-9999 EUR
More than 10000 EUR
Participants


Spain
9
8
7
6
5
4
3
2
1
0
1-49 EUR
50-199 EUR
200-499 EUR
500-999 EUR
1000-1999 EUR
2000-2999 EUR
3000-3999 EUR
4000-4999 EUR
5000-9999 EUR
More than 10000 EUR
Participants


Denmark
70
60
50
40
30
20
10
0
1-400 DKK
400-1500 DKK
1500-3800 DKK
3800-7500 DKK
7500-15000 DKK
15000-22500 DKK
22500-30000 DKK
30000-37500 DKK
37500-75000 DKK
More than 75000 DKK
Participants


Sweden
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20
15
10
5
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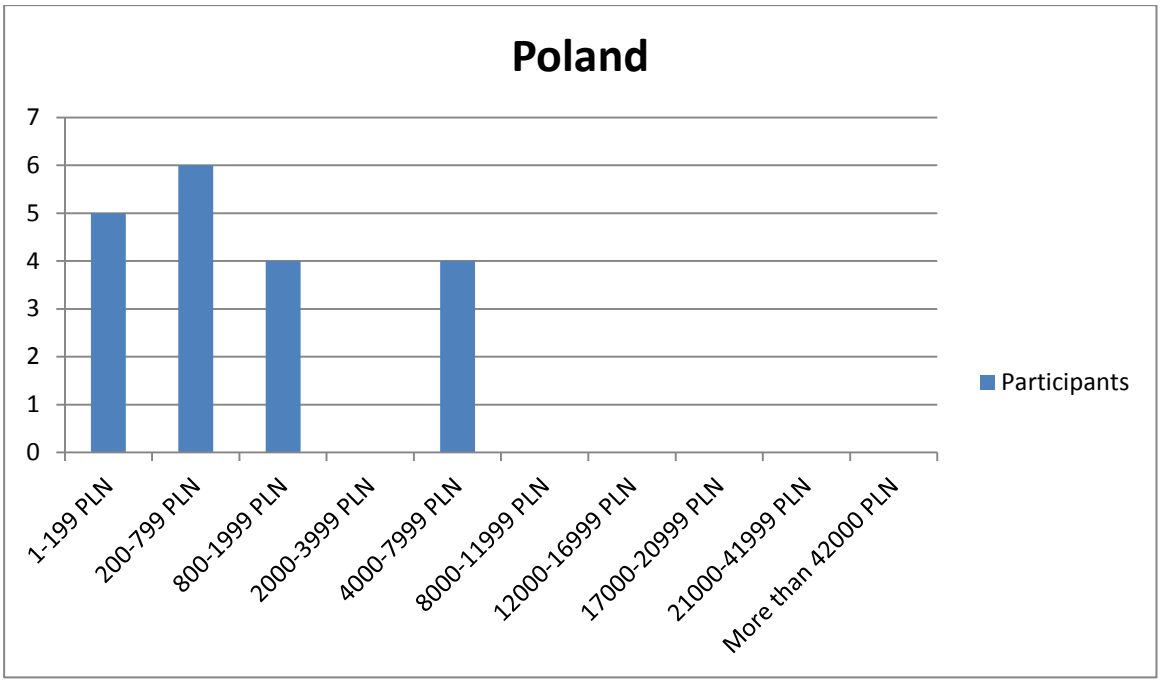
1-499 SEK
500-1999 SEK
2000-4999 SEK
5000-9999 SEK
10000-19999 SEK
20000-29999 SEK
30000-50000 SEK
More than 50000 SEK
Participants


Poland
7
6
5
4
3
2
1
0
1-199 PLN
200-799 PLN
800-1999 PLN
2000-3999 PLN
4000-7999 PLN
8000-11999 PLN
12000-16999 PLN
17000-20999 PLN
21000-41999 PLN
More than 42000 PLN
Participants