D5.1 POTENTIAL IMPACTS FOR IMPROVING URBAN PTW SAFETY

Evi Germeni, Eleni Petridou (CE.RE.PR.I.)

Report documentation

Title:	Estimation of population preventable fractions linked to modifiable risk factors for PTW injuries
Authors:	Evi Germeni, Nick Dessypris & Sakis Ntinapogias (Center for Research and Prevention of Injuries, Department of Hygiene, Epidemiology and Medical Statistics, Athens University Medical School), Simon Hayes (Altran España)
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Evi Germeni, Eleni Petridou
Center for Research and Prevention of Injuries (CE.RE.PR.I.)
Department of Hygiene, Epidemiology and Medical Statistics
Athens University Medical School
75, Mikras Asias Str.
115 27 Athens,
Greece

Foreword

Most EU countries enjoy stable fatality reduction trends for most road users. Powered Two-Wheelers (PTWs), however, are the sole road users for whom the respective trends are not declining systematically. Consequently, a growing EU and national attention is currently being given to this area, taking into account the increasing popularity of this mode of transport, apart from the increased casualty levels. In this context, the "European Safer Urban Motorcycling" (eSUM) project, a European Commission co-funded initiative, constitutes, for the first time, a collaborative venture involving four of Europe's principal motorcycling cities, industry and academic organizations. ESUM aims to demonstrate that a constant reduction in PTW accidents is feasible by addressing PTW safety through an interdisciplinary approach.

Epidemiological estimates denoting the number of deaths caused by specific risk factors is a prerequisite for both health policy development and priority setting. The document "POTENTIAL IMPACTS FOR IMPROVING URBAN PTW SAFETY" sought to provide the necessary knowledge by focusing on three major modifiable risk factors for PTW injuries, namely helmet non-use, driving under the influence of alcohol and unlicensed riding. An attempt has been made to derive a theoretical estimation of the proportion of potentially avoidable PTW fatalities in eSUM cities in order to show the high potential for prevention of this type of injuries. The investigation goes a step forward by including the preventable fraction also for Athens, a European capital availing one of the more numerous PTW wheelers fleet and a potential "transfer" city, that is, a city which could benefit if the eSUM proposal for safety improvements were to be adopted.

PTW safety is a complex undertaking, as improvements in the field require an integrated, 'safe system' approach and rely on adoption of measures by all participating disciplines and behavioural modifications by the public at large. In leading this work in the context of eSUM, the Center for Research and Prevention of Injuries (CEREPRI), headed by Dr Petridou, Professor of Preventive Medicine and Epidemiology in our Medical School invites Municipalities across Europe to use the eSUM findings and proposals for change if they opt to play an active role in the development of a safer urban environment. On my behalf, I would like to express my gratitude to all those who have contributed to the development of this report as well as to colleagues who provided data and expertise. Let me close with a wish that PTW casualties follow the same steady decline in the years to come and minimize in our societies a major cause of premature death and lifelong disability among young population groups.

Christodoulos Stefanadis M.D., PhD
Professor of Cardiology and
President,
Medical School,
National and Kapodistrian University of Athens

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Executive summary

The “European Safer Urban Motorcycling” (eSUM) project is a collaborative initiative among industry, academic organizations, and local authorities of Europe’s principal motorcycle cities, to identify, develop, demonstrate and promote measures designed to deliver safer urban motorcycling in the short, medium and longer term. Although a consistent downward trend has been noted over the last decade in the number of road traffic fatalities, the same does not apply for Powered Two-Wheelers (PTWs). The general aim of eSUM is to demonstrate that a constant reduction in PTW accidents is feasible by addressing PTW safety through an integrated approach.

As one of the project’s deliverables, this report seeks to identify PTW ‘problem areas’ in major European urban cities and, at the same time, heighten the ‘quick wins’ of PTW casualty reduction, by presenting the proportion of PTW fatalities that could be averted every year if all PTW riders complied with existing regulations about: (a) helmet use; (b) drink driving; and (c) licenced driving. City-wide enforcement measures were chosen as an area that had not been quantified by eSUM cities participating in the WP2 benchmarking and WP4 demonstrations.

Chapter 1 gives an overview of the current PTW situation in Europe, while detailing how “impact assessment” has been conceptualized within the eSUM context. Chapter 2 gives the background rationale for the selection of measures investigated; in addition, it provides the reader with comprehensive information regarding participating cities’ typology and legal context, and describes the methodology used for this investigation. Chapter 3 presents the potential impacts for improving urban PTW safety in Paris, Barcelona, London, and Athens, whereas, in the last chapter, the main findings are summarized and recommendations are made for the participating cities.

Although estimations described herein are based on a theoretical model, there is increasing evidence on the array of existing effective interventions that could in practice improve urban PTW safety in the EU. The eSUM Good Practice Guide, being established as a “one-stop shop” to centralize knowledge regarding good practice cases, is strongly related to this document, since it provides guidance on successful PTW casualty reduction projects that have been implemented across Europe. Moreover, the eSUM Action Pack is intended to provide an easy-to-use template to help municipalities better understand their own PTW road safety problems, as well as to develop and implement remedial measures in a practical way.

1. Introduction

1.1. PTW collisions in Europe: Basic facts

Although often preventable, road crashes involving motorcycles and mopeds (together referred to as Powered Two Wheelers - PTWs) pose a significant public health problem in many countries around the world. In the industrialized European Union (EU) Region, where PTW use rates are considerably lower than those in developing countries, more than 6,500 citizens die each year as a result of a PTW crash, whereas the risk of dying for motorcyclists is estimated to be 20 times higher than for car occupants.

Notwithstanding the risk, for many EU citizens PTWs offer affordable personal mobility and an alternative to cars for many urban trips. Figures provided by the Association des Constructeurs Europeens de Motocycles (ACEM) show an increase in the number of motorcycles on the roads over the last decade and indicate the potential for greater PTW use in the future: the PTW vehicle stock is estimated to comprise 33M vehicles, and is expected to reach 37M in 2020. Motorcycles are expected to grow by 29%, while mopeds will decline by 14% reaching 11 million units.

It is important to take account of growth in numbers and use when examining road accident trends. Compared to other modes of transport, PTWs have shown a slower progress with a -14% fatalities reduction (for all types of PTWs) in a context of a +17% fleet increase over the period 2001-2008 (IRTAD – EU-20 data). Indeed, it is the share of PTW fatalities that has increased in overall transport due to the better results achieved by cars. In 2006, motorcycle and moped riders comprised 21% of the fatalities on urban roads.

For EU-20, up to 2008, Figure 1.1 compares the consistent downward trend for all road users with the trends for PTW riders and for its component parts: motorcyclists and moped riders. Moped fatalities have been reduced – both in urban and rural areas - while motorcycle fatalities do not show the downward trend of the other road users. Considering the PTW situation in more detail, it is seen that there is a significant increase in the motorcycle fleet (see Figure 1.2), whereas the moped fleet shows little change from 2001. When the fleet evolution is taken into account, a relative improvement in motorcycle safety can be seen over the last decade.

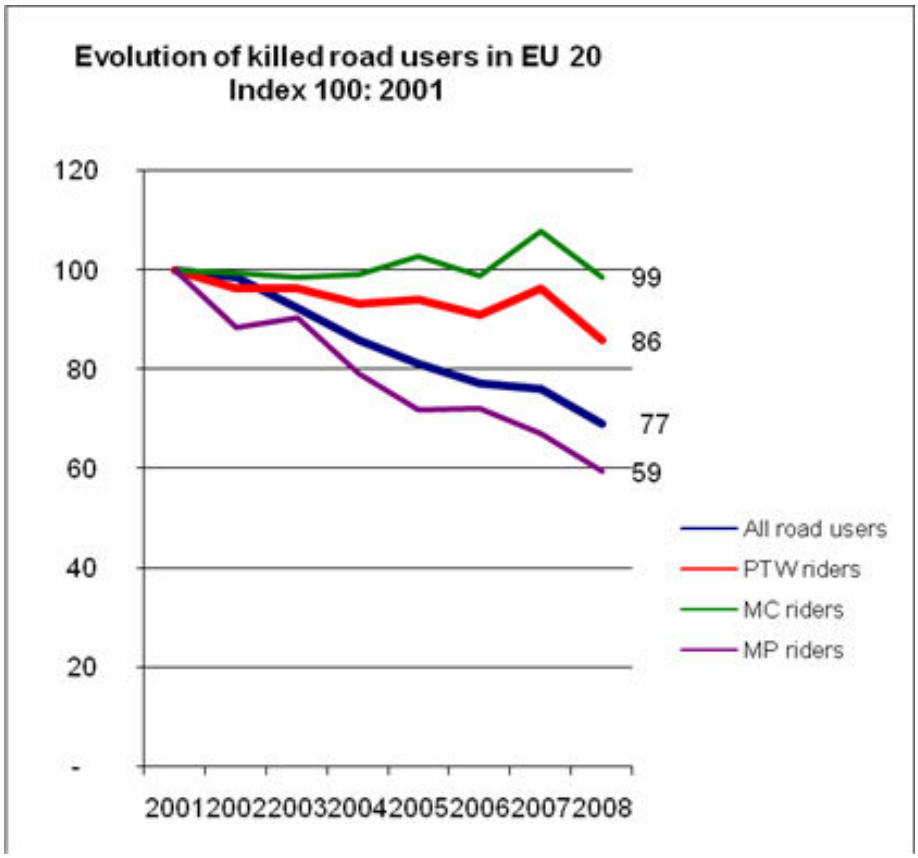

Figure 1.1 Evolution of total fatalities and of motorcycle fatalities in EU20, 2001-2008 (Source: IRTAD).

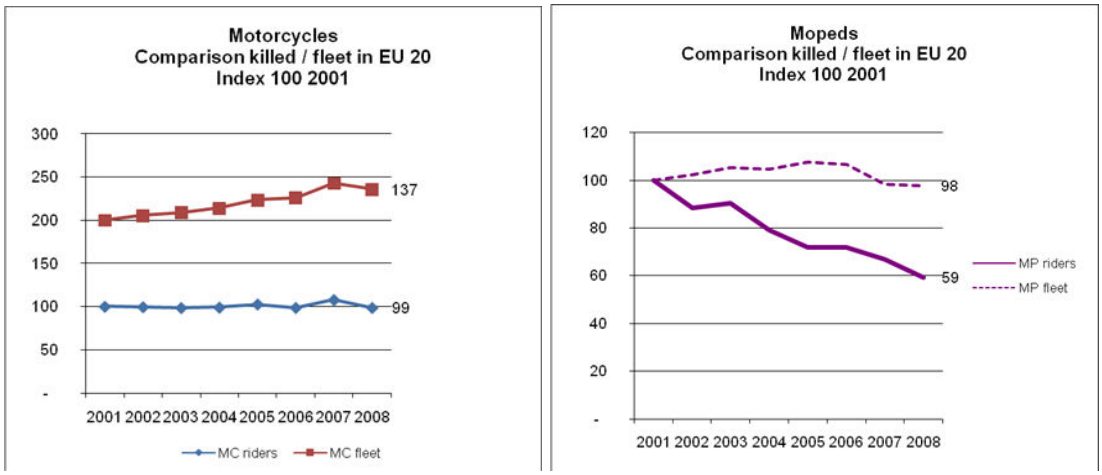

Figure 1.2 Comparative trends in killed riders against fleet size for motorcyclist and moped riders (Source: IRTAD).

The absolute figures, however, show that there is still room for improvement. PTW safety is a complex matter and improvements in this field require an integrated, 'safe system' approach from all participants. It is a fundamental requirement that PTWs have a place in the overall transport policy and sustainable urban development. As such, the European Commission co-funded project eSUM ("European Safer Urban Motorcycling") constitutes a collaborative venture involving four of Europe's principal motorcycling cities, industry and academic organizations, while aiming to identify, develop, demonstrate and promote the wider uptake of measures that are effective in improving the safety of urban motorcycling.

As one of the project's deliverables, this report seeks to provide a useful tool for policy-making purposes, by presenting the proportion of human lives that could have been saved in Europe's major motorcycling cities, should all PTW users complied with existing regulations about: (a) helmet use; (b) alcohol consumption; and (c) licenced driving. Although estimations described herein are based on a theoretical model, there is increasing evidence on the array of existing effective interventions that could in practice improve urban PTW safety in the EU.

1.2. Impact assessment in the eSUM context

The eSUM Good Practice Guide (GPG) (www.esum.eu), developed within the Work Package 3, has been established as a "one-stop shop" to centralize knowledge regarding good practice cases based on the appraisal of hundreds of case studies. The initial assessment provides a first guidance on potentially successful PTW casualty reduction projects. It has a search facility which can be used to help in the selection of appropriate measures, divided into six main categories:

- Rider Training and Awareness;
- Highway Features and Policy;
- Targeted Enforcement;
- Highway Remedial Measures;
- PTW Design and Protective Equipment Design; and
- 'Softening' the Highway Infrastructure.

Further work to establish and promote good practice comes from WP 4 where the eSUM partners collaborate to demonstrate over 20 measures using a common reporting structure covering the following four action areas:

- Infrastructure;
- Enforcement;

- Vehicles & Protective Equipment; and
- Rider Training and Driver Awareness;

As described in the D4 report (Barcelona Municipality, 2010), the WP4 demonstrations were developed taking into account the commitments as far as they were described in the work plan (based on city authority partners' local plans at the time of making the proposal), adapting them with respect to the ongoing identification of good practice (in WP3) and also to taking account of opportunities arising from the evolving local conditions (changes in political control, etc. – see D4).

Figure 1.3 The eSUM Good Practice Guide.

The work presented in this report has been developed in parallel to the WP3 activity that has consolidated and updated the GPG, and to the execution and evaluation of the (WP4) demonstration actions. The actions to remedy risks of PTW injury that are studied in this report take account of a review of published literature. An approach is developed that provides quantified estimates of savings in fatalities that could accrue were actions – mainly enforcement and behavioural change campaigns - to be

undertaken to eliminate these risk factors. There are some overlaps between the measures studied in this report and the case work of the other Work Packages. What this report seeks to illustrate is how the potential impacts (of fatality reduction) associated with selected actions can be quantified. It thus addresses one of the weaknesses identified in the WP3 report (TfL, 2009) which found that only a fraction of the cases assessed had been able to adequately quantify the potential of the actions for reducing collisions.

2. Methodological approach

2.1. Risk factors investigated

Many factors are associated with the risks of the incidence and/or severity of PTW injuries, even though determinants of the injury incidence are rarely differentiated from those of injury severity. Lin and Kraus (Lin and Kraus, 2009) recently provided a thorough review of the published literature regarding patterns and protective/risk factors of motorcycle injuries. Identified risk factors were classified according to the Haddon matrix (Figure 2.1). The Haddon matrix is composed of three time phases of a crash event (pre-crash, crash, and post-crash), along with the three areas influencing each of the crash phases (human, vehicle, and environment).

As shown in Figure 2.1, many risk factors (e.g. young age, male gender, low socioeconomic status, nighttime, summer period) cannot be directly modified to prevent the occurrence of PTW injuries and reduce their severity. Yet, many factors that are - to a great extent - modifiable do exist (e.g. helmet wearing, alcohol use, inexperience and driver training, riding at excessive speed, risk-taking behaviors) and, thus, have more relevance for developing and designing prevention programmes. The aim of this investigation was to provide a theoretical understanding of the impact that well-known modifiable risk factors for PTW injuries may have in the potential for saving of humans' lives, by calculating the population attributable fractions linked to: (a) helmet non-use; (b) alcohol consumption; and (c) unlicenced riding.

	Human	Vehicle	Environment
Pre-event	Young age, male, low socioeconomic status, inexperience, crash history, unlicenced riding, traffic violation history, high risk-taking behavior, alcohol consumption, drug use, speeding, rider's inconspicuity (e.g. without high-visibility clothing)	Motorcycle inconspicuity (e.g. without daytime headlight use)	Nighttime, poor light condition, poor road condition, summer period, rural area
Event	Large amount of riding distance and time, excessive speed, no safety devices (e.g. safety helmet, leg protector, airbag jacket)	Motorcycle make	Collision with a heavy object (e.g. moving car)
Post-event	Elderly person, pre-existing medical condition		Slow emergency response, poor rehabilitation programs

Figure 2.1 Risk factors for PTW injuries using Haddon's matrix (Source: Lin and Krauss, 2009).

The selection of these three risk factors (i.e. helmet non-use, alcohol consumption, and unlicenced riding) was based, in part, on feedback gained in the course of meetings held with local authorities participating in the eSUM project, as well as on data provided by previous benchmarking work realized in the context of WP2 (ATAC, 2009). Although an effort was made to include "speeding" among the investigated risk factors, it was eventually agreed that the required data for assessing controls of excessive speeding was not readily available for more than one of the cities (Paris, London, Rome and Barcelona) and that the work should therefore concentrate on the aforementioned three factors.

Further reasoning for this focus is that:

- The results from some of the demonstration actions have only become available during the final months of the project such that a framework for relating these to the road network was not previously available (in time to influence the study decision).
- The WP4 results are – in many cases – preliminary results that require further assessment (once additional time facilitates more After accident data).
- The eSUM Consortium believes that city-wide enforcement is a fundamental element of any city's PTW strategy. Since this was not fully addressed by the WP4 demonstration actions (apart from the Southern Spain helmet enforcement, the actions are site-focused), it was considered appropriate to study the transfer potential of city-wide enforcement actions within task 5.2.

2.1.1. Helmet non-use

Helmets have been the principal countermeasure for preventing or reducing PTW-related head injuries, currently contributing in the EU countries to about 75% of deaths among motorcycle and moped users. Based on police reports, during the period 1972-1987, helmets were found to reduce the risk of PTW fatalities by 29% (Evans and Frick, 1988). Nonetheless, their effectiveness increased to 37% during 1993-2002, possibly due to improvements in helmet design and materials. A recent review of observational studies demonstrated that helmets are effective in reducing head injuries in PTW users who crash by 69% and death by 42% (Liu et al., 2008).

After adjusting for age and crash characteristics, non-helmeted riders were found to be 2.4 times more likely to sustain brain injuries or skull fractures than those wearing a helmet (Gabella et al., 1995). After adjusting for collision type, posted speed limits and environmental factors, non-helmeted riders had a 3.1-fold increased risk of head injuries or death compared with helmeted riders (Rowland et al., 1996). Moreover, after stratification by crash severity measured by the Injury Severity Score (ISS) for other than head injuries or repair costs of motorcycle damage, the protective effect of helmets on head injuries remained significant (Lin et al., 2001).

Considering that, although lower-extremity injuries most commonly occur in PTW crashes, head injuries are most frequent in fatal crashes (Lin and Kraus, 2009), interventions aiming to decrease mortality resulting from PTW-related collisions have, to a large degree, relied on increasing helmet wearing rates, mainly through enactment of mandatory legislation. For instance, in the Romagna region, north-eastern Italy, a 66% decrease in admissions of traumatic brain injury for PTW crashes was observed after the introduction of a revised mandatory helmet law (Servadei et al., 2003). In addition, traumatic brain injury admissions to neurosurgical hospital units decreased by 31%, whereas a fall to almost zero was noted in the number of blunt impact head injuries among injured moped users admitted to hospital. Moreover, the enactment of a federal road safety law in Spain led to a decrease of 25% in the motorcycle crash mortality and a reduction of 9% to the proportion of deaths with severe head injuries (Ferrando et al., 2000).

Notwithstanding the great impact of helmet use in terms of lives saved, financial gains should also be considered. Thus, a study conducted in Michigan, United States, found out that helmet use decreased mean cost of hospitalization by more than 20%, namely more than US$ 6,000 per patient (Brandt et al., 2002). Helmet laws also had the least cost per year of lives saved among all major traffic safety programmes (Graham, 1993), whereas their benefit-cost ratios range from 2.3 to 5.07 (Hyder et al., 2007).

2.1.2. Alcohol consumption

While alcohol is a major contributing factor to all kinds of motor vehicle crashes, PTW riders are more likely than other motor-vehicle drivers to have consumed alcohol in both fatal and non-fatal collisions (Williams, 2006). As shown in Figure 2.2, in the United States, about 1 in 3 motorcycle rider fatalities in 2005 were alcohol-related, while approximately 1 in 4 automobile driver fatalities were related to alcohol (NHTSA, 2006). Drinking motorcycle riders involved in a crash are more likely than non-drinking riders to have lower rates of helmet use, more severe head injuries, and higher Injury Severity Score (ISS) levels (Hundley et al., 2004; Zambon and Hasselberg, 2006). Moreover, loss of control is significantly more common among drinking than non-drinking riders, usually involving running off the roadway (Kasantikul et al., 2005). Compared with multiple-vehicle crashes, single-vehicle crashes account for a greater proportion of motorcycle deaths with a blood alcohol concentration (BAC) of ≥0.1 g/dl, particularly at night (Preusser et al., 1995; Kasantikul et al., 2005).

Since PTW riders are more vulnerable than other motor-vehicle drivers to alcohol's effects on balance, motor coordination, and judgment, and given that additional basic skills are needed to operate the less stable two-wheeled vehicle, a lower legal limit of BAC for PTW drivers has been suggested (Watson and Garriott, 1992; Sun et al., 1998). In addition, considering that although the risk of being involved in a fatal crash

appears to increase with increased BAC levels for all age groups, the association between BAC and crash risk is significantly higher in young drivers than older drivers, the enactment/enforcement of zero-tolerance BAC laws for minors has also been proposed (Peck et al., 2008).

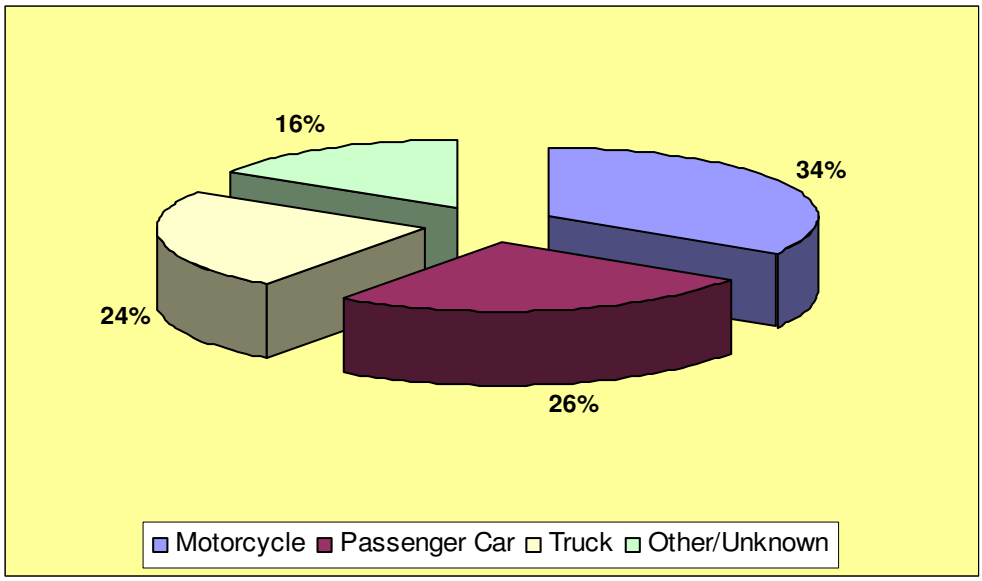

Figure 2.2 Percentage of US vehicle operators killed in fatal road crashes with alcohol involvement (BAC≥.01) in 2005 (Source: NHTSA, 2006).

2.1.3. Unlicenced riding

Riding a PTW without a valid driving licence has been associated with both higher risk of crash involvement and higher risk of serious PTW injuries (Kraus et al., 1991; Lardelli-Claret et al., 2005; Dandona et al., 2006). In a study assessing the interrelationships among motorcycle licensure, ownership and injury crash involvement, Kraus et al. (Kraus et al., 1991) found that motorcycle drivers who crashed and who did not own the motorcycle were more likely to be unlicenced than those owning the motorcycle, and owners involved in a crash were less likely to have a licence than those not in a crash. Moreover, compared with licenced operators, unlicenced ones were less likely to report using the low-beam headlight in daytime, wearing body protection, or driving without drinking alcohol (Peek-Asa and Kraus, 1996; Reeder et al., 1996).

Lack of a driving licence is also correlated with age. In a study of 4,183 PTW drivers, Dandona et al. (Dandona et al., 2006) found that 11% of participating drivers had not obtained a driving licence, whereas almost 22% had obtained a licence without taking the mandatory driving test. The odds of not having a driving licence were found to be significantly higher for drivers aged 16-25 years, with schooling up to class XII or less, those driving moped or borrowed vehicle, and those not having vehicle registration or insurance documents.

2.2. Cities investigated

2.2.1. Basic characteristics

This investigation sought to include the areas of jurisdiction of the authorities participating in the eSUM project, notably Barcelona, Rome, Paris, and London. While the two former are characterized by two of the largest concentrations of PTW usage in Europe, the two latter have demonstrated a remarkable experience in improving PTW road safety. Figure 2.3 provides an overview of each study area. The areas correspond to the central city areas of Barcelona and Paris (both of the order of 100 sq.km.) and the larger urban areas of Rome and London (approximately 1,300 and 1,600 sq.km., respectively) – more than 10 times the areas of Barcelona and Paris (Table 2.1). Consequently, the population densities of the two central city areas are much higher than the average values of the more extended areas of London and Rome, whereas the population density of London is more than twice than that of Rome (similar areas). A more detailed description of the eSUM cities' structure, mobility trends and road safety levels is available in the D2.1 report "eSUM Diagnosis of Urban Motorcycling Safety".

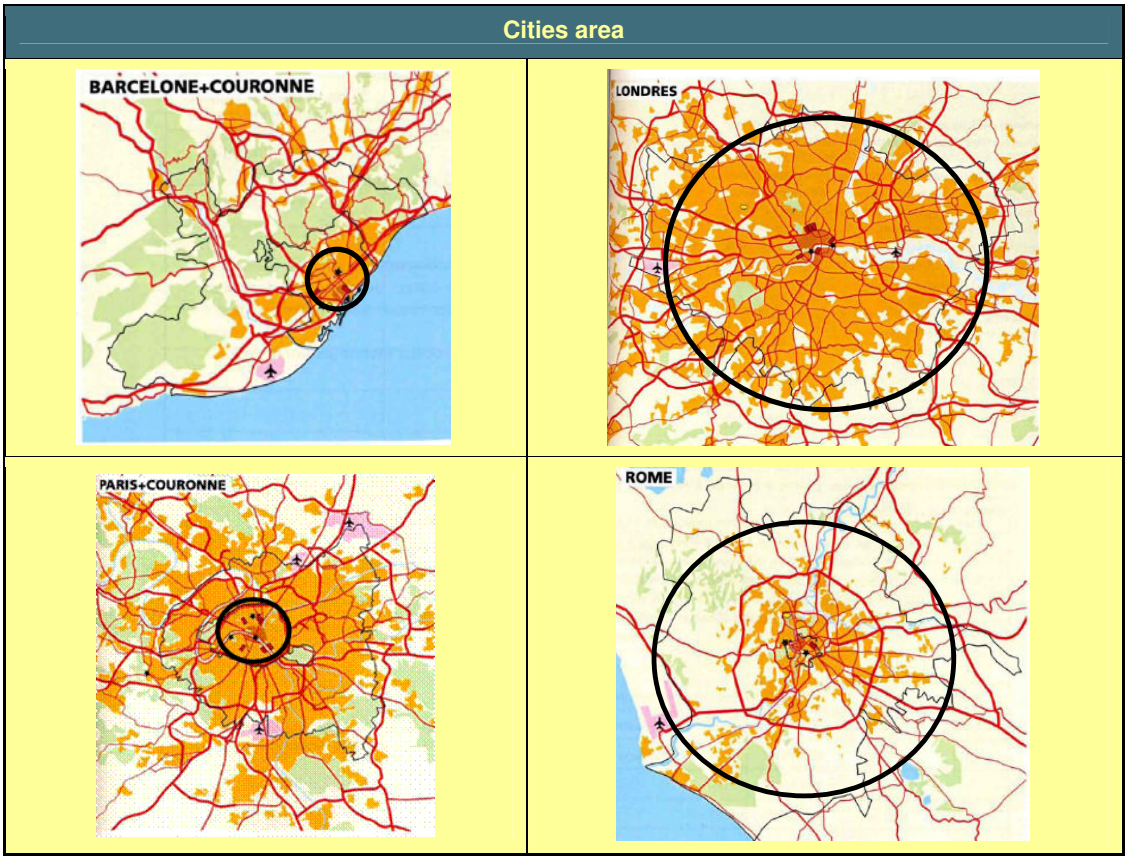

Figure 2.3 Study areas (Barcelona, London, Paris and Rome).

Background Year	Barcelona 2008	London 2007	Paris 2007	Rome 2007	Note
Population	1,628,090	7,557,000	2,153,600	2,718,768	
Area (SqKm)	101.0	1,579	105,4	1,285	
Density	20,433	4,813	20,433	2,115	
Road network length (Km)	1,328	14,926	1,644	6,100	
Primary roads (Km)	357.19	1,720		1,700	
Secondary roads (Km)	923.8	13,146		4,400	
Bus lanes (Km)	113.5	292	189.0	110	
Bicycle lanes (Km)	140.2	1,343	399.3	150	4
Zone 30 (Km) or 20mph Zones	53.4	2,000	302	19	
Number of motor vehicles	990,166	3,010,000	893,300	2,660,202	
Lorry / Van	69,099	265,000	117,700	182,397	
Cars	608,830	2,497,000	673,600	1,897,672	
Motorcycles	193,902	116,000	102,000	379,997	
Mopeds	93,382			155,842	3
Other vehicles	24,953	132,000		44,294	
Number of collisions with casualties	8,942	23,210	7,463	19,960	2
Number of fatalities	31	222	50	201	2
Number of injured	11,551	27,949	8,546	26,299	2
Motor vehicle km (million)	13.2	334.52		143.70	
Travels (internal+external) (million)	7.85	27.6		6.14	1
PTW travels (internal+external) (million)	0.36	0.2		0.49	
Population density per area (persons/SqKm)	16,119.70	4,813.38	20,432,64	2,115.26	
Kilometre road length per area (Km/SqKm)	13.15	9.51	15.60	3.89	
Kilometre bus lane per area (Km/SqKm)	1.12	0.19	1.79	0.08	
Motor vehicles per inhabitant ('000)	608.18	398.31	414,79	978.46	
Car per inhabitant (*1,000)	373.9	330.4	312.8	698.0	
Motor vehicle km per inhabitant (Km/person)	8.13	44.27		52.85	
Motor vehicle km per motor vehicle (veh-km/vehicle)	13.37	111.14		54.02	
Daily Trips per inhabitant (trips/person)	4.82	3.65			

Table 2.1 Basic data of the cities of Barcelona, London, Paris and Rome.

1. Barcelona: Working day, London: 2006
2. Paris, London: 2008
3. Rome: Estimated data
4. Paris: 138.6 km of bicycle lanes coupled with bus lanes

The eSUM work is intended to be applicable to a range of European cities. Therefore, the decision to look for and include data from other cities was motivated by proposals made within the project work plan that seek to promote a wider uptake of the work. The inclusion of data for the city of Athens was, thus, an intention from the proposal stage – but which occurred in part thanks to data and contacts established by the Work Task leader, as well as the actions carried out to involve various cities (including Athens) in the eSUM transfer seminar activity realized in May of 2010.

Although constituting the second smallest prefecture in Greece (after Lefkada prefecture), the Athens prefecture is the most populous and most densely populated. With a density of 7,383 people per sq.km., it covers a land area of 361 sq.km. and has an official population of 2,664,776 inhabitants (as of 2001). It is part of the periphery of Attica and the Athens-Piraeus super-prefecture, whereas it is made up by 48 municipalities, each one of which has an elected district council and a directed elected mayor. In 2006, a total of 6,346 road traffic collisions occurred in the prefecture of Athens, resulting in 218 fatalities, 307 serious injuries, and 7,539 slight injuries. More than half of the fatal road collisions involved PTW users. As shown in Figure 2.4, over the five-year period 2002-2006, PTW-related fatalities have doubled in the prefecture of Athens.

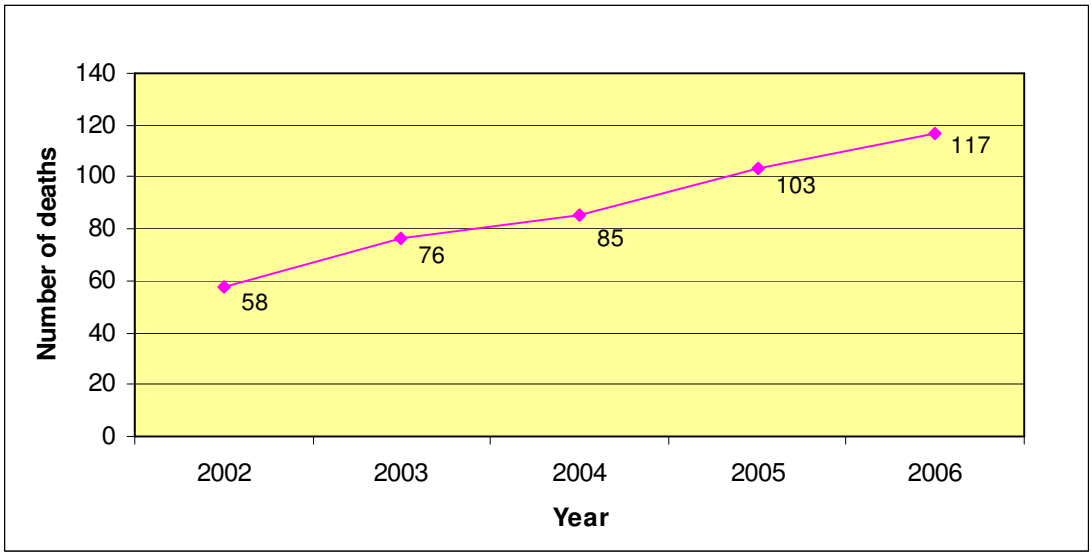

Figure 2.4 Evolution of PTW-related fatalities in the prefecture of Athens.

2.2.2. Legal context

2.2.2.1. Legislation regarding PTW helmet use

Helmet use is mandatory for all PTW users (i.e. both drivers and passengers) in all eSUM cities, including Athens. Yet, although compliance rates seem to have reached almost 100% in Barcelona, London, Paris, and Rome, this is not the case for Athens, where nearly half of the PTW users killed in 2008 were not wearing a helmet at the time of the event. In Greece, measures related to PTW safety are mostly coming from revisions of the Hellenic Road Traffic Code. The recently (2007) revised Code sets considerable fines for helmet non use (see Table 2.2); yet, the level of police enforcement still remains far from satisfactory.

	Compulsory helmet use	Introduction of legislation	Minimum sanction (for riders)	Minimum sanction (for passengers)
Athens	Yes	1986	Fine of 350 € + suspension of driver's licence for 10 days + 5 points on the driver's licence	Fine of 100 €
Barcelona	Yes	1980 – interurban 1992 – urban roads	Fine* of 91-300 € + 3 points on the driver's licence	N/A
London	Yes	1973	Fixed fine of £30, rising to a maximum of £500	Fixed fine of £30, rising to a maximum of £500
Paris	Yes	1973	Fine of 135 € + 3 points on the driver's licence	Fine of 135 €
Rome	Yes	1986	Fine of 74 € + suspension of driver's licence for 60 days	Fine of 74 €

Table 2.2 PTW helmet legislation in Athens, Barcelona, London, Paris and Rome.

* In Spain, since 25 May 2010, infractions are classified as minor, serious and very serious; minor are fined up to 100€, serious 200€, and very serious up to 500€.

2.2.2.2. Drink driving regulations

All eSUM cities, including Athens, have legal blood alcohol limits and their limit values are the same, with the exception of London. Thus, while Athens, Barcelona, Paris, and Rome apply a general BAC (Blood Alcohol Content) limit of 0.05%,

London applies a BAC limit of 0.08% (see Table 2.3). In addition, Athens, Barcelona, and Paris apply lower limits for novice drivers, while Athens also applies intermediate and higher limits. As a result, the type and severity of sanctions imposed to drinking drivers in Athens correspond to the ranges defined by these limits, notably: Category A (BAC 0.5-0.8 g/l): fine of 200 € and vehicle immobilization; Category B (BAC 0.8-1.1 g/l): fine of 700 €, suspension of the driver's licence for 90 days, and vehicle immobilization; and Category C (BAC above 1.1 g/l): fine of 1200 €, suspension of the driver's licence for 180 days, imprisonment of at least 2 months, plus vehicle immobilization. If a driver is found to have a BAC exceeding 1.1 g/l within two years from a previous offence for drinking and driving, an immediate five-year disqualification is imposed, in addition to fine and imprisonment.

	Unit	Method of test
Athens	0.5 gr/1000cm^3	Breath test
Barcelona	0.5 gr/1000cm^3	Breath test
London	0.8 gr/1000cm^3	Screening test: breath; Evidence test: blood (or urine)
Paris	0.5 gr/1000cm^3	Detection by ethyl test; Control by ethylometer or blood test
Rome	0.5 gr/1000cm^3	Breath test

Table 2.3 Permissible level of alcohol in the blood and methods of control in Athens, Barcelona, London, Paris and Rome.

In Barcelona, the law establishing a lower authorized blood alcohol limit of 0.5 g/l of blood (or 0.25 mg/l of air in breath) and reducing the limit from the previous level of 0.8 g/l in blood, was introduced in 1998. Although there is no specific intermediate or higher limit applied in Catalonia and Spain, "drunkenness" is a judicial concept that, whilst not being strictly defined, in practice is typically set above 1.0 g/l. The judge interprets the degree of drunkenness of each case and it is customary to apply the limit of 1.0 g/l to prioritize those cases that are taken to court (and those that are processed administratively).

In London, the BAC limit of 0.08% was introduced in 1967. Evidential breath testing followed in 1983, together with a definition of a high risk offender: drivers who are convicted twice within a period of ten years with a blood alcohol level of over 0.2%, or who refused to supply an evidential sample. This definition was revised in 1990. Criteria are now: driving with a level of over 0.2%, or drinking and driving (over 0.08%) again within ten years after disqualification for drinking and driving, or refusal to supply an evidential sample. Random stopping of drivers by the police is allowed by the law, but random testing is not. A screening breath test can only be applied after suspicion of drinking and driving, or when the driver is suspected of committing a moving traffic violation, or was involved in an accident. The minimum sanction for drinking and driving in London is a twelve month disqualification, while high risk offenders have to pass a medical test to obtain a new driving licence.

In Paris, breath tests are taken at random, during large-scale awareness police operations and on suspicion, following a collision or a traffic offense. Violating the legal BAC limit of 0.5 g/l carries a fine of approximately 135 € and six points on the driver's licence. Nevertheless, if a driver is involved in a road traffic accident while having a blood alcohol level over the legal limit, the fine could be raised up to 30,000 €. Moreover, if the blood alcohol level of the driver is greater than 0.8 g/l, imprisonment of up to two years, as well as suspension of the driver's license, are imposed.

In Rome, drink driving is enforced both randomly and on an evidential basis, whereas random breath testing was introduced in 2003. The introduction, however, of a new penalty point system attributed the highest sanction possible to a drink driving offence. In addition, the driving licence can be suspended for between 15 days and three months, while this offence is also dealt with as a penal sanction (and not an administrative one) and re-testing is necessary to retrieve the driving licence. In order to tackle alcohol-related road traffic collisions in Italy, lowering the BAC limit to 0.2 g/l or even to 0.0 g/l has also been discussed.

2.2.2.3. Legislation regarding PTW licence acquisition

Table 2.4 summarizes the legislation regarding PTW licence acquisition in the five eSUM cities. In Athens, it is not allowed to obtain a driving licence for a moped before a person becomes 16, whereas the legal driving age for a motorcycle is 18 years old. In both cases, learner riders are required to pass both theory and practical tests, in order to prove their efficiency in riding. Failure to show a valid driving licence, in case of a police inspection, could bring a fine of up to 200 € and, in some cases, imprisonment of up to twelve months.

In Barcelona, the minimum age for driving a moped is 14 years old; however, drivers under 18 cannot carry a passenger. There are two types of motorcycle licences: A1 and A. Type A1 allows a person to drive motorcycles of less than 125cc and less than 11KW. The minimum age is 16 years. Type A allows to drive any type of motorcycle and the minimum age is 18. For engines over 250cc, the driver needs to have at least two years of experience driving motorcycles of over 125cc. The compulsory test is the same one for A1 and A. Since October 2004, it is possible to drive motorcycles of less than 125cc if the person holds a car driving licence for more than 3 years.

In London, compulsory basic training (CBT) must be completed before a learner moped or motorcycle rider is allowed to ride on the road with L-plates. Once the CBT course is successfully undertaken, a completion of CBT Certificate (DL 196) is issued. This allows the rider to hold a provisional moped licence, if he/she is at least 16 years old. A CBT certificate obtained on a moped is also valid for motorcycles, once the rider has reached the age of 17 years and has the necessary licence. Two

types of full motorcycle licence exist – A1 and A. The light motorcycle licence (A1) restricts riders to any bike up to 125 cc and a power output of 11 kW. The practical test must be taken on a bike of between 75 cc and 125 cc and riders must be a minimum of 17 years old. The standard motorcycle licence (A) is obtained if the practical test is taken on a bike of over 120 cc but not more than 125 cc and capable of at least 100 km/h per hour. After passing the standard motorcycle practical test, there is a restriction of two years to riding a bike of up to 25 kW and a power/weight ratio not exceeding 0.16 kW/kg. After this period, any size of bike may be ridden.

Similarly, in Paris, there are two types of motorcycle licences (A1 and A) and one moped education (BSR). The BSR includes theoretical and practical training that allows learner riders to get acquainted with the general rules of movement and security in real traffic conditions. Type A1 licence allows to drive motorcycles of less than 125cc and less than 11KW, whereas the minimum age is 16 years. Type A licence allows to drive any type of motorcycle under 100CV and the minimum age is 18 years. For engines over 34CV, the drivers need to have at least two years of experience driving motorcycles of over 15CV. These limitations don't apply to drivers who are more than 21 years old or those holding a driving licence for more than two years.

In Rome, 14-year-old teenagers are eligible to ride a PTW (up to 50 cc and 45 km/h speed) if they have the relevant certificate called: “Certificato di idoneità per la guida del ciclomotore”. Furthermore, A1 Licence allows riders of at least 16 years to drive any “light” PTW (i.e. up to 125 cc and a power output of 11 kW), whereas A Licence includes two different typologies depending on the rider’s age and the PTW used during the practical test: a) “gradual access” (A2 licence or limited A), which allows riders of at least 18 years old to ride PTWs with a power output up to 25kW and a power/weight ratio up to 0,16 kW/kg - after two years of experience, riders holding the A2 licence are allowed to ride any kind of PTW (no restriction); and b) “directed access” (A3 licence or A licence without any limits), allowing to ride any kind of PTW without any restrictions. In the latter case, drivers have to be at least 21 years old and the PTW used for the test must have a power output of at least 35 kW.

PTW type		Engine size	Min Age	Compulsory test		Compulsory documents
				Theoretical	Practical	
Athens						
Moped		<50cc	16	Yes	Yes	Licence
Motorcycle		>50cc	18	Yes	Yes	Licence
Barcelona						
Moped		<50cc	14	Yes	Yes	Licence
Motorcycle	A1	50 -125 cc	16	Yes	Yes	Licence
	A	125+cc	18	Yes	Yes	Licence
London						
Moped		<50cc	16	Yes	Yes	Licence (full or provisional)
Scooter		<50cc	17	Yes	Yes	Licence (full or provisional)
Motorcycle	A1	50 -125 cc	17	Yes	Yes	Licence
	A	125+cc	17	Yes	Yes	Licence
Paris						
Moped/scooter		<50cc	14	Yes	Yes	Certificate
Scooter	B	50 -125 cc	20	Yes	Yes	Car Licence + 2 years
Motorcycle	A1	50 -125 cc	16	Yes	Yes	Licence
	A	125+cc	18	Yes	Yes	Licence
Rome						
Moped		<50cc	14	Yes	Yes	Certificate
Motorcycle	A1	50 -125 cc	16	Yes	Yes	Licence
	A2	125+cc	18	Yes	Yes	Licence
	A3	No restriction	21	Yes	Yes	Licence

Table 2.4 Legislation regarding PTW licence acquisition in Athens, Barcelona, London, Paris and Rome.

2.3. Methods

In March 2010, a request was sent by the Work Task leader to all participating cities asking them to provide road traffic police data on number of PTW drivers involved in a traffic accident during 2005-2007, by: (a) age group (i.e. 0-24 years, 25-44 years, or 45+ years); (b) outcome (i.e. death, injury, or non-injury); and (c) presence/absence of risk factor investigated. As of July 1st, 2010 (i.e. extended deadline for sending contributions), Paris had provided all data requested, whereas Barcelona and London provided mostly casualty data, given that information regarding non-injured riders involved in collisions was not readily available (see Tables 2.5-2.7).

	BARCELONA			LONDON			PARIS			ROME		
	2007	2006	2005	2007	2006	2005	2007	2006	2005	2007	2006	2005
Killed with helmet	x	x	x	x	x	x	x	x	x			
Riders, -24 years	x	x	x	x	x	x	x	x	x			
Riders, 25-44 years	x	x	x	x	x	x	x	x	x			
Riders, 45+ years	x	x	x	x	x	x	x	x	x			
Killed without helmet	x	x	x	x	x	x	x	x	x			
Riders, -24 years	x	x	x	x	x	x	x	x	x			
Riders, 25-44 years	x	x	x	x	x	x	x	x	x			
Riders, 45+ years	x	x	x	x	x	x	x	x	x			
Injured with helmet*	x	x	x				x	x	x			
Riders, -24 years	x	x	x				x	x	x			
Riders, 25-44 years	x	x	x				x	x	x			
Riders, 45+ years	x	x	x				x	x	x			
Injured without helmet*	x	x	x				x	x	x			
Riders, -24 years	x	x	x				x	x	x			
Riders, 25-44 years	x	x	x				x	x	x			
Riders, 45+ years	x	x	x				x	x	x			
Non-injured with helmet							x	x	x			
Riders, -24 years							x	x	x			
Riders, 25-44 years							x	x	x			
Riders, 45+ years							x	x	x			
Non-injured without helmet							x	x	x			
Riders, -24 years							x	x	x			
Riders, 25-44 years							x	x	x			
Riders, 45+ years							x	x	x			

Table 2.5 Availability of data regarding helmet use.

	BARCELONA			LONDON			PARIS			ROME		
	2007	2006	2005	2007	2006	2005	2007	2006	2005	2007	2006	2005
Licensed killed	x	x	x				x	x	x			
Riders, -24 years	x	x	x				x	x	x			
Riders, 25-44 years	x	x	x				x	x	x			
Riders, 45+ years	x	x	x				x	x	x			
Unlicensed killed	x	x	x				x	x	x			
Riders, -24 years	x	x	x				x	x	x			
Riders, 25-44 years	x	x	x				x	x	x			
Riders, 45+ years	x	x	x				x	x	x			
Licensed injured*	x	x	x				x	x	x			
Riders, -24 years	x	x	x				x	x	x			
Riders, 25-44 years	x	x	x				x	x	x			
Riders, 45+ years	x	x	x				x	x	x			
Unlicensed injured*	x	x	x				x	x	x			
Riders, -24 years	x	x	x				x	x	x			
Riders, 25-44 years	x	x	x				x	x	x			
Riders, 45+ years	x	x	x				x	x	x			
Licensed non-injured							x	x	x			
Riders, -24 years							x	x	x			
Riders, 25-44 years							x	x	x			
Riders, 45+ years							x	x	x			
Unlicensed non-injured							x	x	x			
Riders, -24 years							x	x	x			
Riders, 25-44 years							x	x	x			
Riders, 45+ years							x	x	x			

Table 2.6 Availability of data regarding licensed driving.

	BARCELONA			LONDON			PARIS			ROME		
	2007	2006	2005	2007	2006	2005	2007	2006	2005	2007	2006	2005
Drinking killed							x	x	x			
Riders, -24 years							x	x	x			
Riders, 25-44 years							x	x	x			
Riders, 45+ years							x	x	x			
Non-drinking killed							x	x	x			
Riders, -24 years							x	x	x			
Riders, 25-44 years							x	x	x			
Riders, 45+ years							x	x	x			
Drinking injured*	x	x					x	x	x			
Riders, -24 years	x	x					x	x	x			
Riders, 25-44 years	x	x					x	x	x			
Riders, 45+ years	x	x					x	x	x			
Non-drinking injured*	x	x					x	x	x			
Riders, -24 years	x	x					x	x	x			
Riders, 25-44 years	x	x					x	x	x			
Riders, 45+ years	x	x					x	x	x			
Drinking non-injured							x	x	x			
Riders, -24 years							x	x	x			
Riders, 25-44 years							x	x	x			
Riders, 45+ years							x	x	x			
Non-drinking non-injured							x	x	x			
Riders, -24 years							x	x	x			
Riders, 25-44 years							x	x	x			
Riders, 45+ years							x	x	x			

Table 2.7 Availability of data regarding drink driving.

Given that the calculation of effect measures in this investigation is constrained by the nature of the available data, it was not possible to calculate rate ratios or risk ratios for death or non-injury according to adoption of safety measures or behaviors. It was possible, however, to calculate the odds for being killed rather than non-injured, given that a PTW crash occurs, depending on the utilization or not of the indicated safety measures, and subsequently to estimate the odds ratio (OR), a widely used effects measure (Petridou et al., 1998). Population attributable fractions (PAF) were then calculated, by using a simple formula proposed by Miettinen (Miettinen, 1974). According to this formula, PAF equals the percentage of exposed cases -in this instance, deaths- multiplied by (OR-1) and then divided by the OR.

3. Results

3.1. Potential impacts for improving PTW safety in Paris

3.1.1. Helmet use

As shown in Table 3.1, no PTW rider was killed in the city of Paris during 2005-2007 without wearing a safety helmet. Given the 100% helmet use compliance in Paris, population attributable fractions linked to helmet non-use could not be estimated.

2007		
	Total killed (n)[(a)]	Helmet non users killed (n)
Riders, -24 years	2	0
Riders, 25-44 years	10	0
Riders, 45+ years	2	0
Total	14	0
2006		
	Total killed (n)[(b)]	Helmet non users killed (n)
Riders, -24 years	4	0
Riders, 25-44 years	12	0
Riders, 45+ years	6	0
Total	22	0
2005		
	Total killed (n)	Helmet non users killed (n)
Riders, -24 years	2	0
Riders, 25-44 years	6	0
Riders, 45+ years	7	0
Total	15	0

Table 3.1 PTW riders killed in Paris in 2005, 2006 and 2007 by age and helmet use.

[(a)] The total number of PTW fatalities in 2007 was 15. One case was excluded due to missing information regarding helmet use.
[(b)] The total number of PTW fatalities in 2006 was 23. One case was excluded due to missing information regarding helmet use.

3.1.2. Drink driving

Table 3.2 shows PTW riders killed in Paris in 2005, 2006 and 2007 by age and alcohol use. In 2005, 11 PTW riders were killed in the city of Paris, among whom 3 (27.3%) had consumed alcohol before the fatal road traffic accident. In 2006, 19 individuals were killed due to a PTW crash, among whom 7 (36.8%) had drunk alcohol before the accident, whereas in 2007, a total of 13 PTW riders were killed, more than half of whom (53.8%) had consumed alcohol before the event.

2007			
	Total killed[(a)]	Drinking killed (n)	Drinking killed (%)
Riders, -24 years	2	0	0.0
Riders, 25-44 years	8	5	62.5
Riders, 45+ years	3	2	66.7
Total	13	7	53.8
2006			
	Total killed[(b)]	Drinking killed (n)	Drinking killed (%)
Riders, -24 years	4	0	0.0
Riders, 25-44 years	9	5	55.6
Riders, 45+ years	6	2	33.3
Total	19	7	36.8
2005			
	Total killed[(c)]	Drinking killed (n)	Drinking killed (%)
Riders, -24 years	2	1	50.0
Riders, 25-44 years	4	2	50.0
Riders, 45+ years	5	0	0.0
Total	11	3	27.3

Table 3.2 PTW riders killed in Paris in 2005, 2006 and 2007 by age and alcohol use.

[(a)] The total number of PTW fatalities in 2007 was 15. Two cases were excluded due to missing information regarding alcohol consumption prior the accident.
[(b)] The total number of PTW fatalities in 2006 was 23. Four cases were excluded due to missing information regarding alcohol consumption prior the accident.
[(c)] The total number of PTW fatalities in 2005 was 15. Four cases were excluded due to missing information regarding alcohol consumption prior the accident.

When estimating the average of these three years (2005-2007), the percentage of drinking PTW riders in fatal crashes was 39.9%. In the age group 0-24 years, drinking PTW riders comprised 11.1% of the total number of PTW fatalities. In the age group 25-44 years, the percentage of drinking PTW riders killed in a fatal road accident reached 57.1%, whereas, in the age group 45+ years, the same percentage was 27.7% (Figure 3.1).

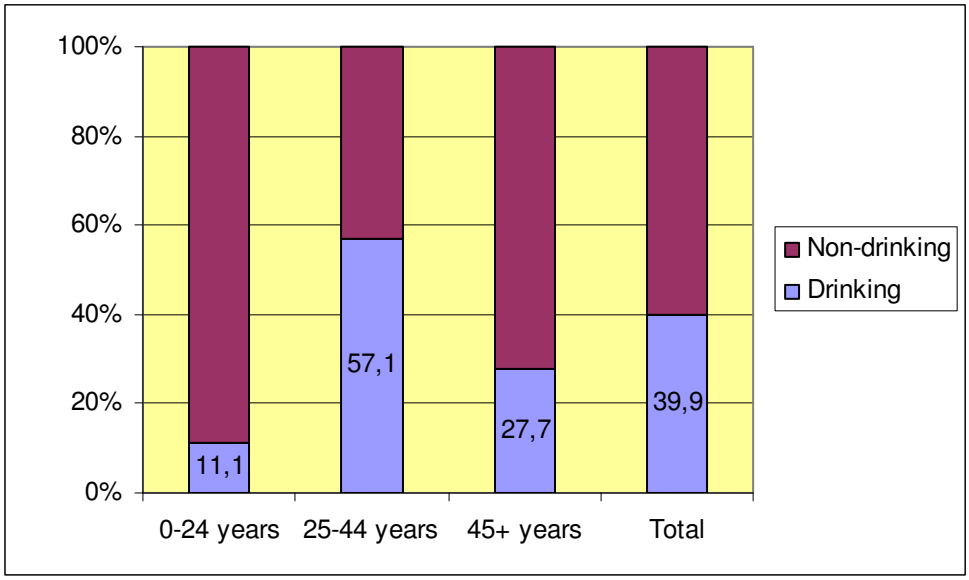

Figure 3.1 Drinking PTW riders killed in Paris as percentage of the total number of PTW fatalities (average of years 2005-2007).

Thus, among an average of 15 PTW riders killed in the city of Paris, almost 40% had consumed alcohol before riding and their odds ratio for death in comparison to non-drinking riders was 16.2. The population attributable fraction, namely the proportion of all deaths that could have been avoided in Paris if all PTW riders were sober while riding, was estimated to be 37% (Figure 3.2). In absolute numbers, this percentage is translated to about 6 human lives saved.

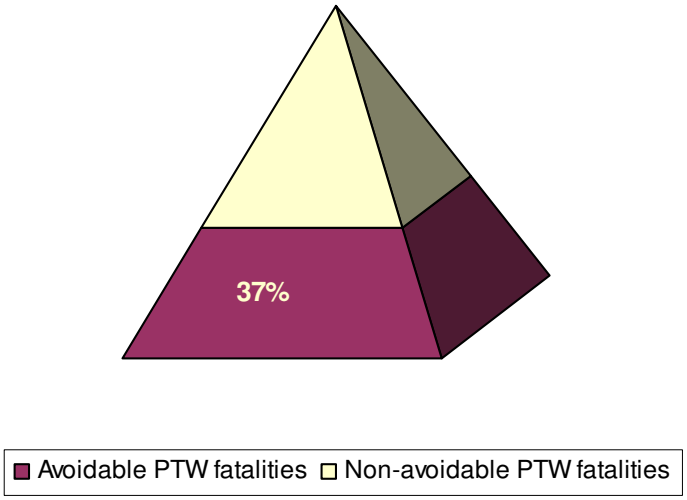

Figure 3.2 Proportion of potentially avoidable PTW fatalities in Paris attributable to alcohol.

3.1.3. Unlicenced riding

Table 3.3 presents PTW riders killed in Paris in 2005, 2006 and 2007 by age and possession of a driving licence. In 2005, 14 PTW riders were killed in the city of Paris, among whom 3 (21.4%) had been driving without a licence at the time of the event. In 2006, 17 individuals were killed due to a PTW crash, among whom 1 (5.9%) had been driving without a licence, whereas in 2007, a total of 13 PTW riders were killed, among whom 2 (15.4%) had been driving without a licence.

2007			
	Total killed[a]	Unlicenced[d] killed (n)	Unlicenced killed (%)
Riders, -24 years	2	1	50.0
Riders, 25-44 years	8	1	12.5
Riders, 45+ years	3	0	0.0
Total	13	2	15.4
2006			
	Total killed[b]	Unlicenced killed (n)	Unlicenced killed (%)
Riders, -24 years	3	0	0.0
Riders, 25-44 years	9	1	11.1
Riders, 45+ years	5	0	0.0
Total	17	1	5.9
2005			
	Total killed[c]	Unlicenced killed (n)	Unlicenced killed (%)
Riders, -24 years	2	2	100.0
Riders, 25-44 years	7	0	0.0
Riders, 45+ years	5	1	20.0
Total	14	3	21.4

Table 3.3 PTW riders killed in Paris in 2005, 2006 and 2007 by age and possession of driving licence.

[a] The total number of PTW fatalities in 2007 was 15. Two cases were excluded due to missing information regarding possession of a driving licence.
[b] The total number of PTW fatalities in 2006 was 23. Six cases were excluded due to missing information regarding possession of a driving licence.
[c] The total number of PTW fatalities in 2005 was 15. One case was excluded due to missing information regarding possession of a driving licence.
[d] Unlicenced group includes: (a) individuals not having obtained a driving licence; (b) individuals driving with inappropriate (i.e. false category) or invalid (i.e. licence expired or abolished) driving licence; (c) individuals holding a valid driving licence, but not carrying it with them at the time of the event.

When estimating the average of these three years (2005-2007), the percentage of unlicenced drivers in fatal PTW crashes was 13.6%. As expected, the percentage of unlicenced drivers killed in fatal PTW crashes was highest in the age group 0-24 years; 43.5% of young PTW riders killed in the city of Paris were driving without a licence. In the age group 25-44 years, the percentage of unlicenced drivers was 8.8%, whereas, in the age group 45+ years, the same percentage was 7% (Figure 3.3).

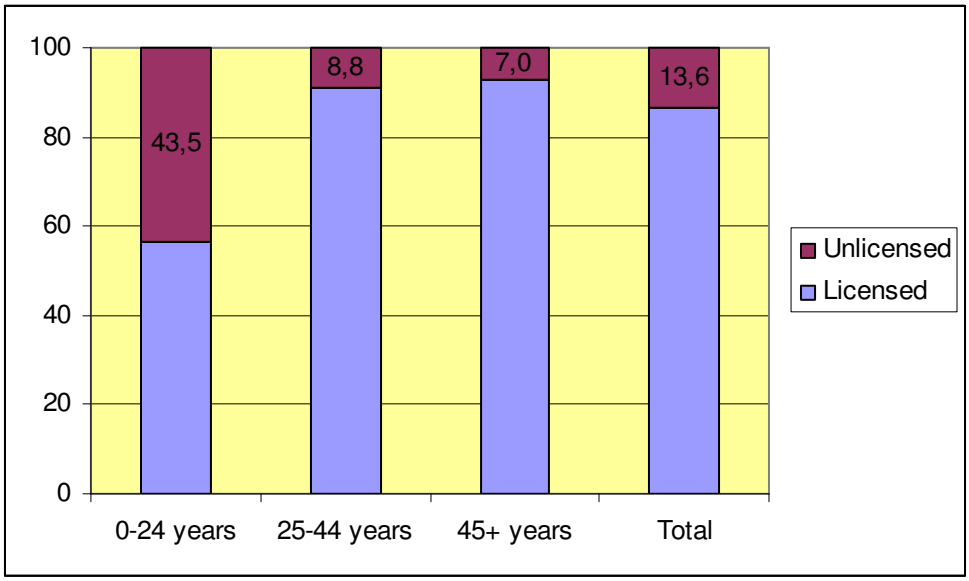

Figure 3.3 Unlicenced PTW riders killed in Paris as percentage of the total number of PTW fatalities (average of years 2005-2007).

Thus, among an average of 15 PTW riders killed in the city of Paris, 13.6% drove without a licence and their odds ratio for death in comparison to those holding a driving licence was 10.9. The population attributable fraction, that is, the proportion of all fatalities that could have been avoided in Paris if all PTW riders drove with a valid driving licence, was estimated to be 12% (Figure 3.4). In absolute numbers, this percentage is translated to about 2 human lives saved.

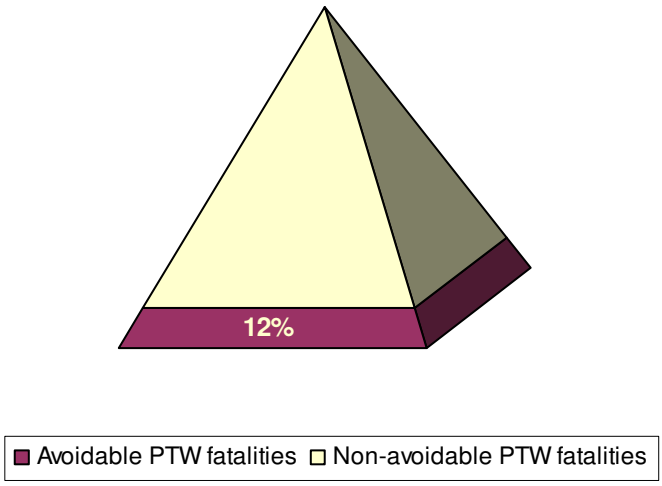

Figure 3.4 Proportion of potentially avoidable PTW fatalities in Paris attributable to unlicenced riding.

3.2. Potential impacts for improving PTW safety in Barcelona

3.2.1. Helmet use

As shown in Table 3.4, no PTW rider was killed in the city of Barcelona during 2005-2007 without wearing a safety helmet. Given the 100% compliance towards helmet wearing laws, it was not applicable to calculate population attributable fractions linked to helmet non-use for the city of Barcelona.

2007		
	Total killed (n)	Helmet non users killed (n)
Riders, -24 years	3	0
Riders, 25-44 years	11	0
Riders, 45+ years	0	0
Total	14	0
2006		
	Total killed (n)	Helmet non users killed (n)
Riders, -24 years	2	0
Riders, 25-44 years	15	0
Riders, 45+ years	3	0
Total	20	0
2005		
	Total killed (n)	Helmet non users killed (n)
Riders, -24 years	5	0
Riders, 25-44 years	11	0
Riders, 45+ years	1	0
Total	17	0

Table 3.4 PTW riders killed in Barcelona in 2005, 2006 and 2007 by age and helmet use.

3.2.2. Drink driving

Although data on PTW alcohol-related fatalities during 2005-2007 were not available for the city of Barcelona, we sought to calculate the proportion of potentially avoidable deaths attributable to alcohol based on figures provided by the previous SUNflower plus project. The SUNflower+6 report, comparing the road safety situation of the Southern countries of Greece, Portugal and Spain (and including a separate analysis for the Spanish autonomous region of Catalonia), concluded that in Catalonia the participation of drinking drivers in fatal collisions should be close to 30%. This estimation was further supported by EuroCare findings, according to which in Europe "between 1% and 5% of drivers have blood alcohol levels above their country's maximum limits, accounting for up to 20% of fatal and serious injuries, and up to 25% of driver fatalities". Given that Southern countries are at the bottom of EC rankings in this context, the slightly higher proportion of 30% in Catalonia seems to

be justified. In addition, this proportion was also supported by eSUM experts residing in Barcelona.

2007			
	Total injured	Drinking injured (n)	Drinking injured (%)
Riders, -24 years	141	3	2.1
Riders, 25-44 years	643	36	5.6
Riders, 45+ years	180	9	5.0
Total	964	48	5.0
2006			
	Total injured	Drinking injured (n)	Drinking injured (%)
Riders, -24 years	120	4	3.3
Riders, 25-44 years	523	27	5.2
Riders, 45+ years	111	6	5.4
Total	754	37	4.9

Table 3.5 PTW drivers injured in the city of Barcelona in 2006 and 2007 by age and alcohol use.

Furthermore, given that Barcelona provided data only on PTW alcohol-related injuries occurring in 2006 and 2007 (see Table 3.5), and information regarding PTW riders involved in a collision but not sustaining an injury, was not readily available, we sought to calculate the odds for being killed rather than injured, depending on having consumed alcohol prior the crash or not. Thus, among an average of 17 PTW drivers killed in the city of Barcelona, it was assumed that 5 (30%) had consumed alcohol before riding and their odds ratio for death rather than injury was 8.09. The population attributable fraction, that is, the proportion of all fatalities that could have been avoided in Barcelona if all PTW riders were sober while driving, was estimated to be 26% (Figure 3.5). In absolute numbers, this percentage is translated to about 4 human lives saved.

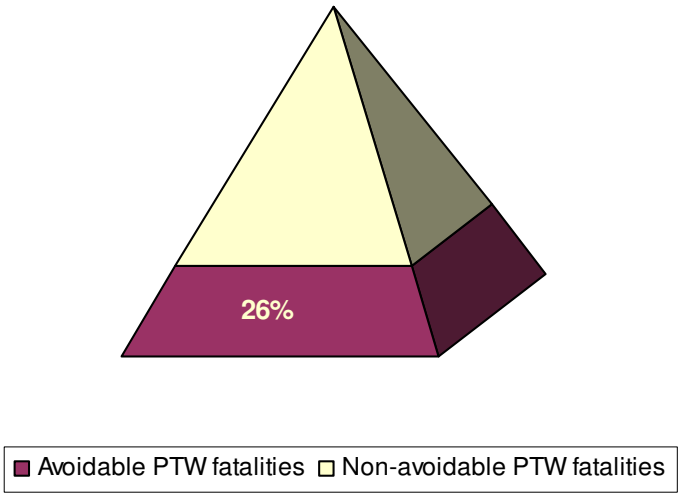

Figure 3.5 Proportion of potentially avoidable PTW fatalities in Barcelona attributable to alcohol.

3.2.3. Unlicenced riding

Table 3.6 presents PTW drivers killed in Barcelona in 2005, 2006 and 2007 by age group and possession of a driving licence. During the three-year study period, an average of 1 PTW rider was killed in the city of Barcelona without holding a valid driving licence. Given the small numbers of fatalities and the nearly 95% compliance, it was not applicable to calculate population attributable fractions linked to unlicenced driving.

2007		
	Total killed (n)	Unlicenced killed (n)
Riders, -24 years	3	0
Riders, 25-44 years	11	0
Riders, 45+ years	0	0
Total	14	0
2006		
	Total killed (n)	Unlicenced killed (n)
Riders, -24 years	2	0
Riders, 25-44 years	15	1
Riders, 45+ years	3	0
Total	20	1
2005		
	Total killed (n)	Unlicenced killed (n)
Riders, -24 years	5	1
Riders, 25-44 years	11	1
Riders, 45+ years	1	0
Total	17	2

Table 3.6 PTW riders killed in Barcelona in 2005, 2006 and 2007 by age and possession of a driving licence.

3.3. Potential impacts for improving PTW safety in London

3.3.1. Helmet use

Table 3.7 shows PTW drivers killed in London in 2005, 2006 and 2007 by age and helmet use. As evident, during the three-year study period, only 1 PTW driver was killed in London without wearing a safety helmet. Thus, given the nearly 100% compliance, it was not applicable to calculate population attributable fractions linked to helmet non-use for the city of London.

2007		
	Total killed (n)	Helmet non users killed (n)
Riders, -24 years	11	0
Riders, 25-44 years	23	1
Riders, 45+ years	6	0
Total	40	1
2006		
	Total killed (n)	Helmet non users killed (n)
Riders, -24 years	15	0
Riders, 25-44 years	22	0
Riders, 45+ years	5	0
Total	42	0
2005		
	Total killed (n)	Helmet non users killed (n)
Riders, -24 years	13	0
Riders, 25-44 years	22	0
Riders, 45+ years	6	0
Total	41	0

Table 3.7 PTW riders killed in London in 2005, 2006 and 2007 by age and helmet use.

3.4. Potential impacts for improving PTW safety in Athens

3.4.1. Helmet use

Table 3.8 presents PTW drivers killed in Athens in 1998 and 2008 by age and helmet use. In 1998, approximately 80% of PTW drivers involved in a fatal road accident were not using a safety helmet. Eleven years on, that is, in 2008, the proportion of unhelmeted PTW riders in fatal road crashes has been reduced to nearly 47%.

2008			
	Total killed[(a)]	Helmet non users killed (n)	Helmet non users killed (%)
Riders, -24 years	15	8	53.3
Riders, 25-44 years	39	15	38.5
Riders, 45+ years	8	6	75.0
Total	62	29	46.8
1998			
	Total killed[(b)]	Helmet non users killed (n)	Helmet non users killed (%)
Riders, -24 years	12	11	91.7
Riders, 25-44 years	25	19	76.0
Riders, 45+ years	7	5	71.4
Total	44	35	79.5

Table 3.8 PTW riders killed in Athens in 1998 and 2008 by age and helmet use.

[(a)] The total number of PTW fatalities in 2008 was 74. Twelve cases were excluded due to missing information regarding use of safety helmet.
[(b)] The total number of PTW fatalities in 1998 was 74. Thirty cases were excluded due to missing information regarding use of safety helmet.

In 1998, among the 44 PTW riders killed in Athens, 79.5% were not wearing a helmet and their odds ratio for death in comparison to those wearing was 3.5. The population attributable fraction, that is, the proportion of all deaths that could have been avoided in Athens if all PTW riders were to wear a helmet, was estimated to be 57% (Figure 3.6). In absolute numbers, this percentage is translated to about 25 human lives saved.

Accordingly, in 2008, among the 62 PTW riders killed in Athens, 46.8% were not wearing a helmet and their odds ratio for death in comparison to those wearing was 10.4. The proportion of all fatalities that could have been avoided in Athens if all PTW riders were to wear a helmet was estimated to be 42% (Figure 3.6). This means that, in 2008, an estimated 26 deaths could have been avoided in Athens had a helmet have been used by all PTW riders.

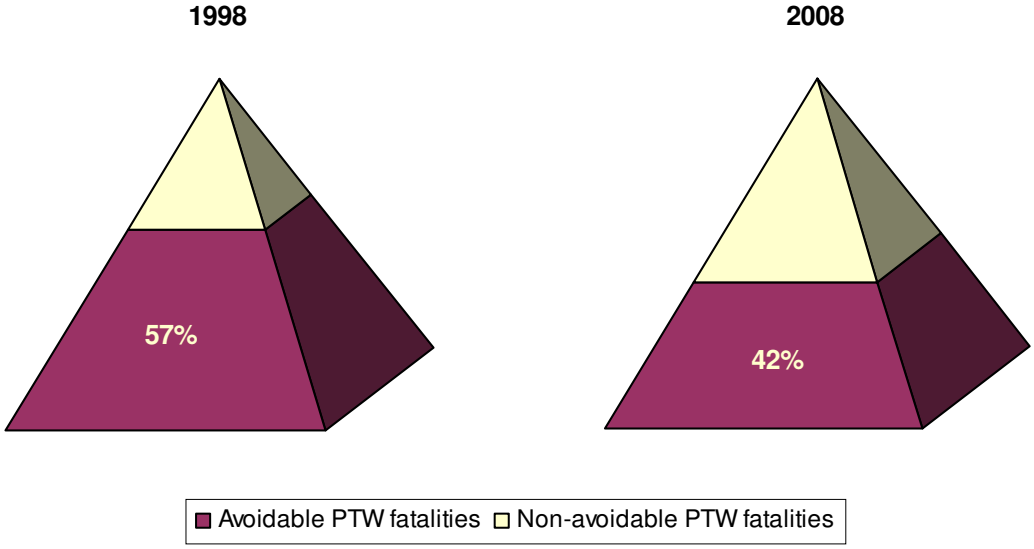

Figure 3.6 Proportion of potentially avoidable PTW fatalities in 1998 and 2008 in Athens attributable to helmet non use.

4. Conclusions

4.1. Main findings

The primary aim of this investigation was to identify PTW 'problem areas' in major European urban cities, while heightening the 'quick wins' of PTW casualty reduction. It was decided to focus on city-wide enforcement measures as an area that had not been quantified by the cities participating in the WP2 benchmarking and WP4 demonstrations. Findings are worth noting, both in terms of the potential impact of improved enforcement in the eSUM cities, and for those cities that might transfer the eSUM results.

Improving the city-wide enforcement could have benefit in Paris and Barcelona (figures suggest that London has less potential, and the data for Rome have not become available to make the assessment). A proportion of 37% PTW fatalities could be averted each year in Paris if all riders were sober while driving. Likewise, a proportion of 12% PTW deaths could be avoided in the same city were all riders to drive with a valid driving licence. Intriguingly, the pattern of savings from improved enforcement is quite similar for Barcelona, with an estimated proportion of 26% potentially avoidable PTW fatalities attributable to alcohol.

The data investigated would appear to confirm that the good levels of helmet use compliance in eSUM cities have accomplished a reasonable safety level. Yet, our results indicate that in Athens 42% of human lives could have been saved in 2008 if all PTW drivers had respected existing helmet use legislation. This finding is of great importance when the overall plan of actions is being devised (see Table 4.1), while indicating that Athens should be one transfer case.

The eSUM project is about improving the urban motorcycling safety and focuses on the city level. The results of this investigation, however, need to be interpreted and considered in a broader, country-specific context. Thus, since 2006, alcohol has become in France the number one contributor to road crashes; the proportion of fatal accidents involving alcohol was almost 30% in 2007 (ETSC, 2009). Moreover, the number of drink driving offences went up from 264,223 in 2006 to 276,452 in 2007. Results of a survey commissioned by the French Association Prevention Routiere and the French Insurers (FFSA) revealed that, although drink driving is evaluated by young French drivers (aged 18-25 years) as the most dangerous of driving behaviors, during the last evening out one in four drove after drinking and one in ten drove after having had more than two glasses. In addition, 30% considered more police enforcement as the most effective measure in combating the drink driving problem in France (ETSC, 2009).

% Reduction in persons injured	Local roads	Primary roads in general (with signalled junctions)	Primary roads with commercial activity ("High Streets")	Primary roads with bus lanes	
Measure	30 zones	Roundabouts (if space allows)	De-cluttered road design	Allow PTW use	Ban PTW use
All modes	-12%	-80%			
PTWs	-40%		- 20 to -40%		
Measure		Speed cameras		Enforcement & awareness campaigns focused on problematic conflicts	
All modes					
PTWs		-30%			
Measure		Exclusive ASLs			
All modes		-10%			
PTWs		-4%			
Measure					
	Rider training / Driver awareness				
Measure	**City-wide enforcement**				
PTWs	**Savings of up to 42% fatalities / year**				
Measure					
	safer PTWs				

Table 4.1 PTW accident reduction potential as estimated in the eSUM context (adapted from Barcelona Municipality, 2010).

More adequate police enforcement also seems to be the most effective route for increasing PTW helmet wearing rates in Greece. Although PTW helmet use has been compulsory since 1986, in 2003 two out of every three killed motorcyclists in Greece were not wearing a safety helmet, compared with approximately one out of every twenty-five in Catalonia (Hayes, 2005). Results from a qualitative study aiming to explore Greek adolescents' perceived benefits and barriers to helmet use indicated a sharp contrast with respect to the most important benefit of helmet use, expressed among current helmet users as "protection in the case of a road crash" and among helmet non-users as "avoiding tickets from Traffic Police" (Germeni et al., 2009). Although recent regulations of the Ministry of Transportation impose considerable fines on helmet non-users, the need for stricter enforcement of Greek legislation has been stressed quite a few times in the past, while substantial evidence from many countries has shown that helmet laws, when enforced, can result in large, immediate public health benefits.

4.2. Recommendations

Since 2001, France has proven itself as the frontrunner in reducing road deaths in the EU; among EU countries, it cut the most road traffic fatalities between 2001 and 2007, achieving a 43% reduction (ETSC, 2009). Its efforts, however, have mostly focused on combating speeding (e.g. policy of “zero tolerance” of speeding offences, introduction of a fully automated speed management system). This report, aiming to elucidate potential impacts for improving urban PTW safety, amplifies an already known need, that is, the need for advancing new initiatives to put an end to the high levels of drink driving. The estimated 37% proportion of potentially avoidable PTW fatalities due to drink driving in the city of Paris has both practical and policy significance, while indicating that there is still great potential scope for reducing PTW-related mortality, even in cities that have demonstrated a remarkable experience in improving road safety.

The problem of drink-driving is also obvious in the city of Barcelona, where it was estimated that about 26% of PTW fatalities could be avoided each year if all riders were sober while driving. Given that in most Mediterranean countries alcohol production and consumption have been interwoven with the economy and culture for a long period of time, authorities should actively try to modify the behavioral culture of drink-driving among PTW users. It is evident that this requires not only intensive police control supported by a severe penal system, but also large-scale awareness raising campaigns aiming to increase perceived susceptibility to drink-driving fatalities.

Another obvious recommendation is that the city of Athens should address the limited PTW helmet use compliance through massive publicity and more systematic police enforcement efforts. Although the results of this investigation suggest that Athens has made a considerable progress during the last couple of years (i.e. in 1998, the proportion of potentially avoidable fatalities due to helmet non-use was estimated to be 57%, as contrasted to 42% in 2008) – a progress which is most probably related to the increase in the number of penalty notices issued – it has not managed to reach yet the nearly 100% compliance noted in other eSUM cities. Thus, the enforcement effort needs to be sustained and implemented even more extensively, whereas it is critical that it is complemented with behavior-change campaigns tailored for the needs of specific population groups (e.g. young moped users).

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