European Road Safety Observatory

Road Safety Thematic Report – Post-impact care

This document is part of a series of 20 thematic reports on road safety. The purpose is to give road safety practitioners an overview of the most important research questions and results on the topic in question. The level of detail is intermediate, with more detailed papers or reports suggested for further reading. Each report has a 1-page summary.

Disclaimer

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Summary

Post-impact care and road safety

Road traffic fatalities and injuries can have substantial and long-term negative impacts on the lives of the casualties and their surroundings. Although it has received less attention in terms of research and policy, post-impact care is an important contributing factor in reducing the number of traffic fatalities and limiting the consequences of injuries.

Post-impact care is defined as the chain of help provided to casualties following a road crash. It starts with dialling an emergency number and providing those taking the call with as much information as possible on the accident, in particular the location of the accident – information which is often transmitted automatically once the call is connected. Based on the information received, the organisation taking the call dispatches the appropriate emergency services who travel to the scene as rapidly as possible. Upon arrival, a first general assessment of the situation and the state of the casualties is made. After the scene is made safe, fire and rescue services secure entry to the vehicle to extricate the casualties safely and quickly. Emergency medical services then administer pre-hospital care. In most cases, casualties will have sustained injuries and require further medical treatment. Upon arrival at the hospital, the patient is first stabilised and, if needed, prepared for transfer to a higher-level trauma centre. Once the patient has received definitive care, they can start their rehabilitation. Despite progress in recent years, more research and further improvements can be expected in view of technological advances so that access to emergency services can be ensured for all phone-users, including phone-users with disabilities, regardless of their location in the European Union.

Countermeasures

The *eCall* vehicle system automatically dials the European emergency number '112' when a serious road accident is detected and automatically provides the Public Safety Answering Point (PSAP) with the most essential information about the crash. This system is intended to help reduce the response times of emergency services.

Advanced Mobile Location (AML) can provide more precise information about the caller's location to the PSAP by means of satellite navigation systems and Wi-Fi location information derived from the handset.

First aid training is compulsory for all new drivers in some EU countries, although no evidence exists yet which demonstrates an effect on traffic mortality.

Some EU countries have introduced *emergency corridors* which grant priority to emergency vehicles so that they can reach the crash scene as quickly and safely as possible.

Rescue sheets contain information about the structure, design, and components of a vehicle in order to aid fire and rescue services in safely extricating casualties trapped in vehicles.

1   Highlights

- Post-impact care can improve the chances of survival and reduce the conse-quences of road traffic injury but it is imperative that the care is provided as rap-idly as possible.
- The European KPI on post-impact care, which is available for 11 Member States, shows that in most cases, the response time of emergency medical services is below 30 minutes.
- Many more road traffic deaths could be prevented by further improvements in post-impact care. For example, the implementation of automatic accident notifi-cation systems is estimated to reduce the number of people killed by 2% to 4%.
- New technological developments have improved and accelerated access to emergency services.

2   What is the problem?

2.1   What are the consequences of road traffic injury?

Over the past decade, the EU27 collectively have reduced the number of road fatalities by 37% and the number of people seriously injured by 14% (ETSC, 2021). However, the number of casualties remains high: it is estimated that for every life lost, five more people suffer serious injuries with life-changing consequences (European Commission, 2020b). Road traffic injuries can have substantial and long-term negative impacts on the life of the casualties and additionally cause a substantial cost to society (Weijermars et al., 2016). For more information on serious road traffic injuries, see *Thematic Report Serious Injuries, EC, 2021*.

2.2   What is post-impact care?

Road safety policy is often aimed at preventing road crashes entirely or mitigating the consequences if a collision was unavoidable. However, improvements in emergency and medical care post-crash are important contributing factors in both reducing traffic fatali-ties and improving the outcomes of injuries sustained, although this is often overlooked in research, exchange of best practices, and policy measures (ETSC, 2018a; Høye, 2009).

The majority of road traffic deaths occur at the site of the crash, during transportation to a health facility, or within the first hour following the crash (Alharbi et al., 2022). The num-ber of preventable pre-hospital deaths remains high despite major advances in trauma care (Oliver et al., 2017). Post-impact care is defined as the chain of care following a road collision – receipt of the emergency call, emergency rescue, pre-hospital medical care, trauma care, and rehabilitation – aiming to limit the consequences of the injuries sus-tained by the casualties. The more rapidly and effectively a seriously injured person is treated, the greater the chance of surviving and making a full recovery. The care may be

provided by lay bystanders, trained volunteers, or professional emergency services (ETSC, 2018a; Høye, 2009).

3 What are the main features of post-impact care?

The post-collision response chain consists of multiple sequential steps performed by emergency or rescue teams. All of the steps in the post-collision response prior to arrival at a medical facility should be carried out as rapidly as possible, since this is crucial for a person's survival and for limiting the effects of the injuries (ETSC, 2018a).

3.1 Receipt of the emergency call

The first step in the post-collision response chain is the receipt of the emergency call. The European emergency number 112, introduced in 1991[1], is a unique number that functions all over Europe and combines police, fire, and medical emergency services answering points. Some countries have fully transitioned to the European emergency number while others have maintained national emergency numbers alongside 112, whether for health, police or fire brigade (ETSC, 2018a). Of all emergency calls made in the EU in 2021, just over half were made to the European emergency number. The prevalence of calls to 112 depends on people's awareness of the availability of the 112 number as well as on the co-existence of national numbers (European Commission, 2022b). According to the 2021 Eurobarometer, nearly three quarters of Europeans would use the 112 number for contacting emergency services in their own country while just over four in ten would do so while in another EU country. Nearly as many do not know which number to call in case of an emergency in another country (European Commission, 2021).

Calls to an emergency telephone number are answered by a Public Safety Answering Point (PSAP) with each PSAP covering a specific geographic area. Each call to the 112 emergency number is always routed to the most appropriate PSAP, regardless of the nationality of the caller's phone (ETSC, 2018a). According to the European Commission's data on answering times, less than 10 seconds on average is needed in most Member States to get in contact with the emergency services (European Commission, 2022b).

3.2 Dispatching

The organisation taking the call – when it is not made with eCall – normally follows a certain protocol to obtain all the necessary information, such as the caller's name, estimated location, description of the road collision, number of people injured, and the caller's phone number. Though the caller location information should be transmitted automatically to the organisation taking the call as soon as the call is connected, it is not always possible or legal to pinpoint the precise location of a call. The caller may therefore still be asked to provide an estimate of their location. More and more, advanced mobile

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[1] 91/396/EEC: Council Decision of 29 July 1991 on the introduction of a single European emergency call number, OJ L 217, 6.8.1991.

location technology is being used automatically to provide the caller's location to emergency services (ETSC, 2018a). (For more information on advanced mobile location, see 4.1.)

For the organisation taking the call, it is important to know where approximately the accident occurred, in which travelling direction, and on what kind of road (i.e. urban, rural or highway) so as to ensure that the emergency vehicle(s) will be able to access the scene. The organisation taking the call also has a duty to instruct the caller on how to provide immediate care to the victim. Lay bystanders can play a key role in post-impact care as they are usually the first to arrive at the scene. They can already significantly improve the injury outcome, for example by providing first aid and clearing the victim's airway. However, help should only be provided if it is safe to do so. The bystanders' primary concern should always be their own safety (ETSC, 2018a).

Based on the information received, the organisation taking the call identifies the nature of the problem and in some cases immediately decides which emergency services need to be dispatched to the site and with what level of urgency. In other cases, the first person taking the call may filter the calls (triages) and then pass them to a specialised dispatcher (ETSC, 2018a; European Bank for Reconstruction and Development, 2021).

The process of dispatching is facilitated by a computer-aided dispatch system (CAD), software that allows the person taking the call or dispatcher to collect information and react according to pre-programmed scenarios. (ETSC, 2018a).

3.3 Travelling to the scene

Once dispatched, emergency crews have to reach the crash scene in the shortest possible time without endangering other road users. They may receive training on how to avoid collisions, but it is also important for other road users in proximity not to obstruct emergency services' passage. Flashing lights and sirens are used to alert all road users of an emergency and to warn them to be extra cautious. One measure used to facilitate the prompt arrival of emergency services are emergency corridors (see 4.4).

Emergency services' response times are an important determinant in the quality of pre-hospital care. Some countries have set response time targets. Response time is usually defined as the elapsed time from the emergency call until the arrival of the emergency medical services at the scene of the accident. Research shows that road traffic deaths increase with increasing ambulance response time. One study from Spain found that a 10 minute reduction in response time from 25 to 15 minutes could reduce the probability of death by one third (Sánchez-Mangas et al., 2010). Response times depend among other things on the distance from the ambulance station to the crash scene, the availability of ambulances and ambulance personnel, road and traffic conditions, and the accuracy of the location description (Høye, 2009).

Recently, the EC has introduced a new Key Performance Indicator (KPI) on response times. The KPI is available for eleven countries. Response times vary broadly between 18 minutes and 54 minutes and are longest on rural roads and shortest at daytime during weekdays. The average 95th percentile of EMS response times is 27 minutes and 57 seconds (Nuyttens, 2022).

Figure 1 Post-crash care KPI estimates, P95 of EMS response times, 2019.
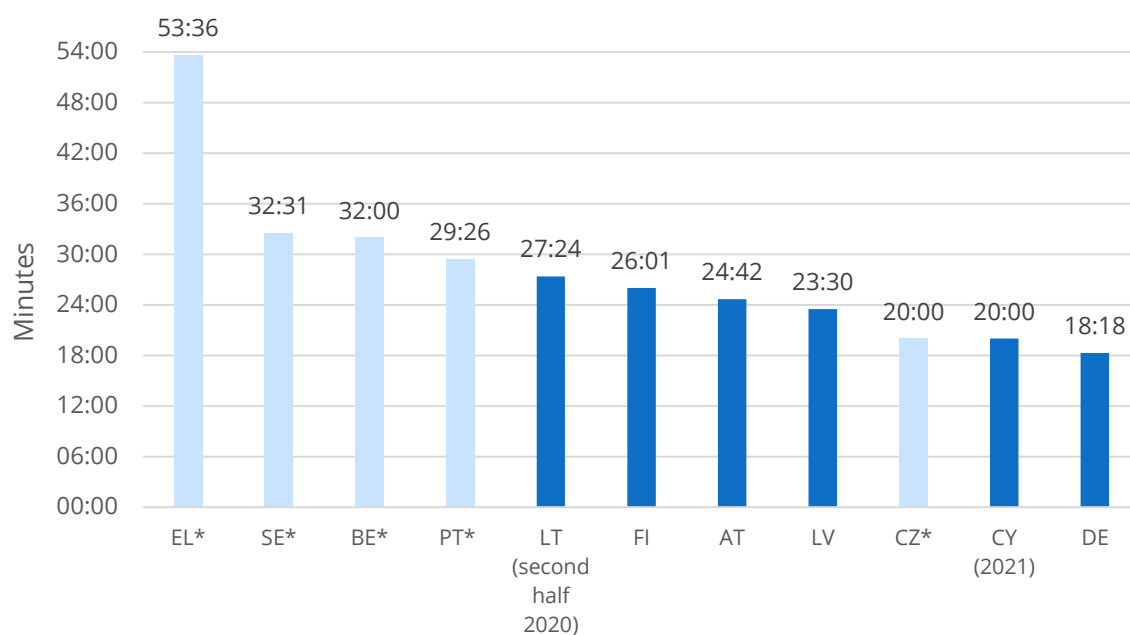
* Representativeness of data and/or comparability with other countries not guaranteed due to deviations from methodological requirements.

Source: Nuyttens (2022)

3.4 Arrival and care at the scene

Upon arrival at the scene of the accident, the emergency services first perform a general assessment of the situation and the state of the casualties. An assessment of the situation includes determining the exact number of people involved in the collision and creating a safe working area at the scene by blocking the site from oncoming traffic and securing it from bystanders. At the same time, fire and rescue services or emergency medical services provide the first necessary medical care.

Where the accident involves multiple casualties, the general assessment is followed by field triage. The purpose of field triage is to categorise and prioritise casualties according to the severity of symptoms and the availability of aid at the site. This is in order to provide timely and appropriate treatment to as many casualties as possible while at the same time ensuring priority treatment for those whose condition is likely to deteriorate quickly.

After the first assessment and triage, and after the vehicle has been stabilised, the emergency services secure entry to the vehicle to remove the casualties safely and quickly (ETSC, 2018a). Shorter extrication times mean a significantly reduced risk of being admitted to hospital with a major injury (Reed, 2017). Extrication is normally handled by the fire and rescue services but with the guidance of medical personnel to avoid causing further injuries to the casualties. To be able to safely extricate the casualty, fire and rescue services personnel need to be familiar with different types and models of vehicle. This can be challenging as vehicle structures and safety features vary widely from year to year and between models (ETSC, 2018a). In order to make the extrication easier, the fire and rescue services may use rescue sheets (see 4.5).

Once the casualties have been safely removed from the vehicle, emergency medical services take over care of the casualties and provide pre-hospital care (ETSC, 2018a). In terms of pre-hospital treatment, two main care strategies are deployed: "*scoop and run*" and "*stay and play*". The first strategy aims at the quickest transfer to hospital while the latter involves treating and stabilising the patient before transport to hospital, meaning, where necessary, a longer time spent at the scene (Johannsen et al., 2017). It remains challenging to identify good practices regarding pre-hospital care as good evidence is lacking (ETSC, 2018a).

3.5   Patient transfer to a medical facility

In road traffic collisions with injuries, casualties often require further medical treatment at a hospital. Transporting the casualty from the scene of the crash to a medical facility is the next step in the chain of post-impact care.

The level of care given to a patient at this stage of post-impact care is much debated and varies around the world. Generally, two main protocols are in existence: "*International Trauma Life Support*" (ITLS) and "*Advanced Trauma Life Support*" (ATLS), although the details of their definition vary from country to country. Generally, ITLS (formerly known as "*Basic Trauma Life Support*") covers basic methods of trauma management, mostly consisting of non-invasive treatment carried out by less trained personnel. In the "*scoop and run*" strategy, often only ITLS is performed leaving more invasive and targeted treatment (ATLS) to the hospital (Johannsen et al., 2017).

The patient is then either transported to the nearest hospital for stabilisation and emergency first aid and then, if necessary, transferred to a specialised trauma centre, or directly transported to the appropriate and best equipped trauma centre that can provide definitive care of the highest level. The latter sometimes means bypassing the nearest medical facility. Practices between countries differ in this regard, although it is recommended to minimise the number of inter-hospital transfers to reduce mortality risk (ETSC, 2018a; Haddak et al., 2017).

3.6   Trauma care

The purpose of a trauma care system is to provide in a geographic region the most appropriate level of care that matches the needs of the injured. A trauma system consists of different components in the prevention of and response to an injury event: this includes not only in-hospital care but also the pre-hospital response, rehabilitation care, and injury prevention. There are differences in hospital trauma systems as between Member States. Evidence shows that the presence of a trauma system correlates with decreased pre-hospital time and effective patient triage (Alharbi et al., 2022). Furthermore, studies have indicated that treating severely injured patients at trauma centres is associated with a reduced mortality of 15% to 22%, with one Swedish study reporting a decrease in mortality of up to 70% for the most critically injury patients (Candefjord et al., 2022).

3.7   Rehabilitation

The last link in the chain of post-impact care is the rehabilitation of the patient which usually begins after stabilisation of the patient's injury. The aim of trauma care rehabilitation is to return an injured patient to their pre-injury health status. Rehabilitation care can include, among other things, physical therapy, pain control, and psychological support. The level and length of rehabilitation required by each patient differ and are determined by the number and type of injuries, the patient's age, pre-injury health status, and overall health (Alharbi et al., 2022).

4   Specific post-impact measures

4.1   eCall

eCall (Emergency Call) is a system used in vehicles in the EU which automatically dials the European emergency number 112 in the event of a serious road accident, and can also be triggered manually. The purpose of eCall is to reduce the notification time, i.e. the time between the occurrence of the accident and the notification of the emergency services, especially when those involved are unable to make the emergency call due to injury. Once activated, it connects to the most appropriate Public Safety Answering Point (PSAP) and automatically sends a minimum set of information needed to handle the emergency situation, such as the accident location, the direction of travel, vehicle identification, and other essential information. If any of the passengers is able to speak, they can also provide the PSAP with additional information. eCall can also be activated manually by pushing a button in the car, for example when a person witnesses a serious road accident or in case of security issue. Since 2018, the system has been mandatory in new models of passenger cars and light commercial vehicles in the EU. The implementation of automatic accident notification systems is estimated to reduce the number of people killed by 2% to 4% (Høye, 2020).

4.2   Advanced mobile location (AML)

In all Member States, when making an emergency call from a mobile network, the location is given by the Cell ID provided by the network. The reported accuracy of network-based location ranges from 500m to 40 km, depending on the density of the network (i.e. urban or rural area). Advanced Mobile Location (AML) can improve accuracy levels by up to 4,000 times, providing accuracy to under 100m. AML supplements the network-based Cell ID location information with Global Navigation Satellite Systems (GNSS) or Wi-Fi location information derived from the handset. To protect the caller's privacy, AML is only activated when an emergency number is dialled. In the majority of Member States, PSAP systems are guaranteed to be AML-enabled. Similarly, emergency mobile applications can also deliver more accurate caller location information based on GNSS or the Wi-Fi capability of the smartphone (European Commission, 2022b).

4.3   First aid training for drivers

In several European countries such as Austria, Estonia, Germany and Hungary, first aid training is a mandatory prerequisite for obtaining a driver's license, and all drivers who arrive at the scene of an accident are obliged to provide first aid (Goldenbeld & Weijermars, 2017; Høye, 2009). While a number of studies indicate that first aid training for drivers improves their first aid knowledge, skills, self-confidence, and willingness to provide first aid at the scene of an accident, no studies have so far proved this training's impact on mortality (Goldenbeld & Weijermars, 2017).

4.4   Emergency corridor

An emergency corridor grants priority to emergency vehicles and allows them to reach the scene of an accident quickly and safely and without unnecessary delay. Some EU countries, such as Poland, Belgium, Germany, and Lithuania, have adopted laws making it compulsory for drivers to clear one lane and form an emergency corridor, also known as a rescue lane. This emergency corridor has to be formed on motorways and highways with two or more lanes when the surrounding traffic slows down significantly before coming to a standstill and should be at least three metres wide (ETSC, 2018a, 2018b). This particular measure is only effective if all drivers comply. It is therefore important that the public is made aware of what an emergency corridor is, what purpose it serves, and how it should or should not be used (ETSC, 2018b).

4.5   Rescue sheets

After a serious collision, casualties can be trapped in their vehicle and it is clinically critical for them to be extricated as quickly and safely as possible. The extrication process depends on the type of collision and the type of vehicle involved. Improved vehicle safety, new vehicle types (i.e. electric/hybrid) and technologies, and the sheer number of vehicle models on European roads have complicated the extrication process. It is not self-evident that fire and rescue services at an accident site will be familiar with each and every vehicle model and be able to identify the manufacturer, model and year of manufacture. To help the extrication process, fire and rescue services can rely on *rescue sheets*, which are documents provided by vehicle manufacturers containing information about the structure, design, and components of a vehicle. They are available online or placed behind the driver's sun visor in the car. They are used to help fire and rescue services identify suitable cutting points and potential hazards so that they can extricate casualties as quickly and safely as possible. Tests have shown that rescue sheets can speed up extrication time by 30% (ETSC, 2019).

5   What new developments can be expected?

Further improvements in the accessibility of emergency services can still be expected as a result of technological developments and new European regulations (European Commission, 2020a, 2022a):

- The accuracy of caller location information has continued to improve over the years through the implementation of handset-derived caller location. In most Member States, PSAP systems are AML-enabled. However, fewer countries can ensure that handset-derived location is also available for roaming phone-users.
- Similarly, phone-users with disabilities – unlike other phone-users – do not yet benefit fully from equivalent means of access to emergency services, especially when roaming. When they are unable to make an emergency call to 112 from abroad, they have to rely on alternative solutions which are often nationally fragmented and about which information is not always readily available. Member States have to implement accessibility solutions to ensure that the European emergency number 112 is available to all phone-users. These solutions should enable two-way communication through text or video between the person alerting the emergency services and the PSAP. The technology that is most deployed by Member States is SMS.
- The European Commission is currently assessing the relevance of a possible extension of eCall to other vehicle categories, such as powered-two-wheelers, heavy goods vehicles, buses, etc.

While recent years have seen growing policy attention to post-impact care – with the introduction of a new road safety KPI on emergency response times and the gradual implementation of new measures in Member States – further research into post-crash response and emergency care is still needed. Furthermore, it would be advisable to develop additional indicators to monitor post-crash response and emergency care in order to identify the links in the post-crash chain that could be improved. To this end, systematic data collection and improvements in statistics provision are needed. (ETSC, 2018a).

6   Further reading

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