



(E. Rodrigues)

MOTORCYCLE USE IN THE AMERICAS

Measures to improve the safety of motorcycle riders

In 2013, nearly 516 million vehicles around the world—29% of all registered vehicles—were powered two- and three-wheelers. Given the fact that many countries lack a registration system, there are probably even more. These figures go hand-in-hand with a steeply rising trend of the use of motorcycles. In low-income countries the number of motorcycles increased more than six-fold between 1993 and 2014, twice the rate of GDP growth in those countries for that period.

In some developing countries, the affordability of motorcycles, together with other socioeconomic factors, is contributing to the growth of the motorcycle fleet. Other factors include unmet transportation needs, increasing traffic congestion in urban areas, the increased cost of other forms of transportation, easy access to financing for motorcycle purchases, convenience of use and parking, and ease of maintenance.

A motorcyclist is 26 times more likely to die in a road crash than the occupant of a car.

Although the availability of motorcycles has afforded many segments of the population a mobility they had not experienced before, the relatively rapid increase in the number of these vehicles on the roads has brought several negative consequences, including a significant increase in injuries and deaths related to their circulation. In fact, a motorcyclist is 26 times more likely to die in a road crash than the occupant of a car. Given the inherent vulnerability of this mode of transportation, there has been a noticeable increase in not only the number, but also the severity of injuries.

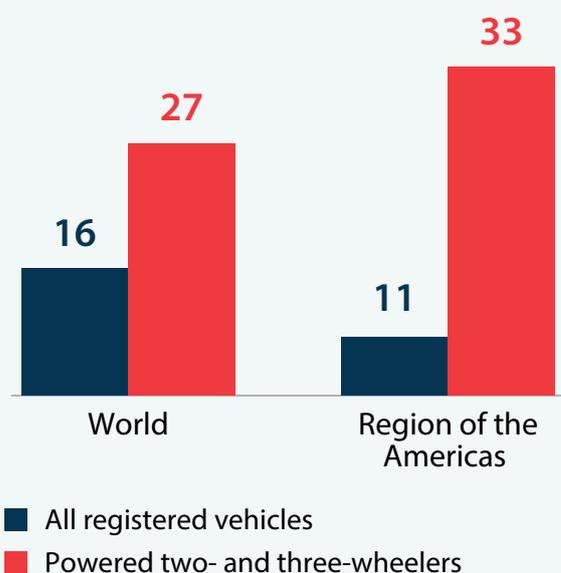
With a view to mitigating the negative consequences of this phenomenon, and given the complexity of the problem, broad measures must be adopted that take into account the social and economic circumstances related to the use of motorcycles, as described in the following sections of this document. However, promotion of the proper use of helmets—a proven and effective way to protect motorcycle riders—should also be a central part of the set of actions aimed at reducing the risk of injury. This will also be covered in the following pages.

» The increase in motorcycle crashes is a public health issue

Worldwide more than 286,000 motorcycle riders died in road crashes in 2013, accounting for almost one quarter of all road traffic deaths. In addition to the human cost, road crashes and their consequences have a major impact on the economies of countries: they cause material damages, add to the demand for care in already overloaded health systems, cause suffering, and break up families.

According to data from the 2015 WHO Global Status Report on Road Safety, while the total number of road traffic deaths has stabilized, deaths among motorcycle riders have increased, which is closely related to the growth in the number of motorcycles in low- and middle-income countries. As can be seen in figure 1, while the total number of vehicles registered throughout the world increased by 16% between 2010 and 2013, the number of registered motorcycles increased by 27%. This phenomenon is much more pronounced in the Region of the Americas, where the growth in the number of motorcycles was three times greater than for all vehicles combined

Figure 1. Percent growth in the total number of vehicles and of powered two- and three-wheelers registered worldwide and in the Region of the Americas (2010-2013).



Source: Global status report on road safety (WHO, 2015).

» The problem in the Region of the Americas

Traffic and related statistics, including road safety, are frequently among the most illustrative indicators of levels of development, inequities, and the priorities in a nation's policies. In the Region of the Americas, the lack of an adequate response to the growing demand for transportation has given rise to one of the Region's greatest challenges in road safety: the exponential increase in the circulation of motorcycles and the collisions associated with this increase.

Mortality among motorcyclists increased in all subregions of the Americas between 1998 and 2010; in 2013, of the 154,089 people who died in road crashes throughout the Region, 20% were motorcycle users. In the Latin Caribbean, 47% of traffic fatalities were among motorcyclists, and subregions such as the Andean area and the Southern Cone also saw a high percentage of deaths

The death rate among motorcyclists increased in all subregions of the Americas.



among motorcyclists (23% and 25%, respectively). In some countries, motorcycle riders account for more than half of all road deaths.



» The use of motorcycles in developing countries

Although the problem affects all countries, it should be noted that 88% of the worldwide fleet of powered two- and three-wheelers is found in low- and middle-income nations, and more than 90% of the deaths of motorcycle users occur in these countries.

In these countries, motorcycles have a dual purpose for users, who are typically between 15 and 34 years of age. First, they facilitate the movement of goods and people. Second, they are often part of a business or a source of income. In many cases they are used for commercial purposes, primarily as taxis or delivery vehicles. In poorer regions, entire families get around on motorbikes.



Motorcycles are particularly common in urban areas of large cities, making road crashes more common in these places. Considering that in low- and middle-

income countries these vehicles are often used in businesses as public transportation or as delivery vehicles, it should come as no surprise that most collisions occur in the daytime, during office hours.

In low- and middle-income countries, motorcycles are often used by businesses for public transportation services or as delivery vehicles, and most collisions occur in the daytime, during office hours.

» Most common victims

In developing countries most victims are young adults, while in high-income countries motorcycle fatalities occur among slightly older people. In Latin America, people between 15 and 44 years old account for more than 60% of all motorcycle deaths. This partially reflects the different uses of motorcycles in different places: for recreational use in high-income countries, and primarily as a

mode of transportation and employment in low- and middle-income countries.

The non-recreational use of motorcycles in developing countries also means that the victims are often self-employed and lack health insurance or social protection, making them part of a socially vulnerable group.



» Risks associated with motorcycle transportation

Motorcycles and their riders are less visible and less protected than those in other vehicles, and tend to share the space with larger, faster vehicles. This puts them at greater risk for crashes and injuries.

Many factors increase the risks for motorcyclists: the road environment (such as the presence of mixed traffic, road infrastructure design, the lack of police enforcement, the state of the roadways, and dangers all around); the motorcycles themselves (instability, lack of protection from crashes or in the brake systems); and the behavior of road users (drivers and other people in and around the roadways). Some of the most prominent risk behaviors of motorcyclists include not using helmets, speeding, driving under the influence

of alcohol, zig-zagging or unskilled driving, and aggressive behavior.

Numerous situations heighten the dangers. For example, some workers use their motorcycles to make deliveries within an agreed time frame, with the risk of losing their jobs if delivery is late. Despite being aware of the risk, they choose to drive at high speeds. Increased motorcycle use also increases pressure on the urban infrastructure with competition for space, which constitutes an additional source of risk for injury and death.

Table 1 summarizes the risks related to the behavior of motorcyclists according to their characteristics and the reasons for using a motorcycle.

Table 1. Relationship between main purpose of motorcycling and type of risky behavior

MOTIVATION FOR USE	CHARACTERISTICS	RATIONALE FOR USE	TYPE OF RISKY BEHAVIORS
Convenient vehicle for commuting	Young and older riders	<ul style="list-style-type: none"> ▶ Economical ▶ Easier to park ▶ Only means of transportation for self and family 	<ul style="list-style-type: none"> ▶ Most do not use a helmet ▶ Disobeying traffic rules ▶ Illegally giving rides to family/ children without use of a helmet
Occupational transportation needs	Young and older experienced drivers	<ul style="list-style-type: none"> ▶ Economical ▶ Easier to park ▶ Mandated by employers 	<ul style="list-style-type: none"> ▶ Illegally transporting cargo and passengers ▶ Not using a helmet when employers do not require one ▶ Disobeying traffic rules
Recreation and thrill-seeking	Youth unlicensed riders	<ul style="list-style-type: none"> ▶ Challenge, push limits (aggressive competition, racing), recreation (hobby) 	<ul style="list-style-type: none"> ▶ Engaging in aggressive competition, speeding, and performing stunts ▶ Driving while under the influence of drugs/alcohol
Criminal activity	Young unemployed and unlicensed riders	<ul style="list-style-type: none"> ▶ Organized and individual-based crime 	<ul style="list-style-type: none"> ▶ Unlikely to use a helmet ▶ Riding with peers ▶ Riding in high school and areas where young people gather ▶ Disobeying traffic rules ▶ Driving while under the influence of drugs/alcohol ▶ Hit and run

Source: Powered two- and three-wheeler safety: A road safety manual for decision-makers and practitioners (WHO, 2017)

All these data show that the massive use of motorcycles is occurring in a specific context of social development. Therefore, intersectoral interventions are required, such as wide-ranging policies on education, public transportation, road engineering, and urban and workforce development. Particularly noteworthy are measures to minimize exposure to high-risk scenarios, such as efforts to improve public transportation, and actions targeting the behavior of motorcyclists and improving care for accident victims, such as introducing a uniform treatment protocol, rapid emergency response, and early rehabilitation services.

A systematic, worldwide review has evaluated the effectiveness of several specific motorcycle safety interventions. These actions include road engineering to minimize exposure to high-risk scenarios and interventions to improve protection

of the vehicle and its users. They also include the introduction or enforcement of key road safety legislation combined with social marketing to promote the adoption of regulations and compliance with them.

Massive use of motorcycles is occurring in a specific context of social development. Therefore intersectoral interventions are required, such as wide-ranging policies on education, public transportation, road engineering, and urban and workforce development.

Table 2 summarizes this set of interventions. An intervention's effectiveness is measured by reduced death and injury, as well as other measurable changes in the road user's behavior. An intervention with **proven effectiveness** is one for which studies exist (systematic reviews, experimental trials, case-control studies) that demonstrate its effectiveness in reducing deaths and injuries related to motorcycle use, or in achieving changes in the desired behavior, in combination with the likely viability or cost-effectiveness of the measure. An intervention is promising if the available data show some benefits are derived from the intervention, but

additional evaluations must still be conducted, which warrants cautious implementation. Finally, an intervention with **insufficient evidence** is one in which evaluations did not yield firm conclusions regarding effectiveness in reducing deaths or injuries or inducing the desired change. This group includes strategies that apparently do not work; however, it must be kept in mind that the available data only apply to the contexts that have been evaluated.

This document will now shift its focus to the use of helmets, one of the most effective means of reducing injuries among motorcycle users.



Table 2. Key measures and specific interventions for improved motorcycle safety

KEY MEASURES	SPECIFIC INTERVENTIONS	EFFECTIVENESS		
		Proven	Promising	Insufficient evidence
Safer roads and mobility	Exclusive motorcycle lanes	Proven		
	Protected turn lanes and widened shoulders or lanes		Promising	
	Removal of roadside hazards		Promising	
	Speed-limiting and traffic-calming structures		Promising	
	Improved road surface conditions		Promising	
	Modified composition of roadside barriers			Insufficient evidence
Safer vehicles	Antilock brake systems (ABS)	Proven		
	Headlights at night		Promising	
	Daytime running headlights		Promising	
	Configuration to enhance stability			Insufficient evidence
	Airbags for motorcycles			Insufficient evidence
	Intelligent transport systems			Insufficient evidence
	Brake lights			Insufficient evidence
Safer road users	Setting and enforcing legislation			
	Mandatory helmets	Proven		
	Helmet standards	Proven		
	Strengthening penalties	Proven		
	Demerit point system		Promising	
	Wearing reflective and protective clothing			
	Reflective clothing use		Promising	
	Protective clothing use		Promising	
	Thermal resistant shields			Insufficient evidence
	Regulating and licensing motorcycles			
	Mandatory registration of vehicles and licensing of motorcycle operators	Proven		
	Graduated licensing system		Promising	
	Age restrictions for children riding motorcycles or travelling as passengers			Insufficient evidence
	Restrictions on multiple passengers			Insufficient evidence
	Periodic inspection for mechanical defects			Insufficient evidence
	Minimum height for passengers			Insufficient evidence
	Smaller engine size for learner riders			Insufficient evidence
	Training			
	Compulsory skill test for motorcycle permit	Proven		
	Post-license training			Insufficient evidence
Post-crash response	On-site removal of helmet / collar brace		Promising	

Source: Powered two- and three-wheeler safety: A road safety manual for decision-makers and practitioners (WHO, 2017)

» Helmets

The lack of physical protection for motorcycle riders makes them particularly vulnerable to injury in a collision. Head and neck injuries are the main cause of death, severe injury, and disabilities, with costs not only for the injured person, but also for the family (or caretaker) and all of society.

In some low- and middle-income countries it is estimated that head injuries cause up to 88% of deaths in motorcycle crashes. The social costs of head injuries for survivors, families, and

In some countries head injuries are estimated to cause up to 88% of deaths in motorcycle crashes.

communities are high, partly because those injuries usually require specialized or long-term care. Head injuries also lead to much higher medical costs than any other type of injury and represent a heavy burden for health care systems and the country's economy.

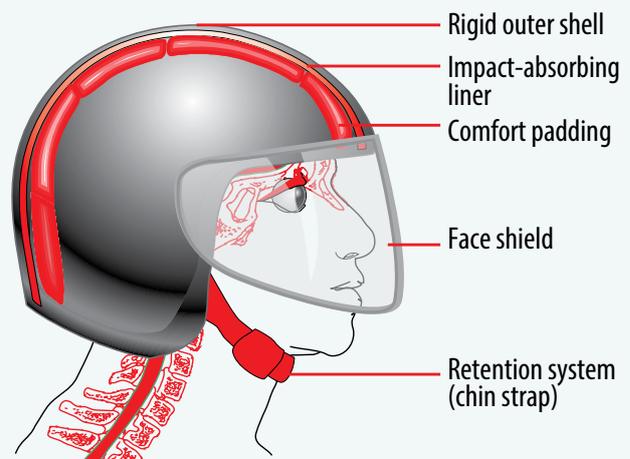
» ***The role of helmets***

Helmets are used to reduce the risk of major head injury by reducing the impact of a blow to the head. They basically serve three functions:

- ▶ Helmets reduce the deceleration of the skull and, as a result, the movement of the brain upon absorbing the impact. This is because part of the shift is alleviated by the soft material inside the helmet, which means that the head stops more slowly. Thus, the brain does not collide against the skull so forcefully.
- ▶ Helmets disperse the force of impact over a larger surface, so that impact is not concentrated on specific areas of the skull.
- ▶ Helmets prevent direct contact between the skull and the object being hit, acting as a mechanical barrier.

These three functions are served by combining the properties of the four basic components of a helmet, as described below (figure 4).

Figure 4. The components of a helmet



Source: Cascos: Manual de seguridad vial para decisores y profesionales (PAHO, 2008 (Spanish only)).

Multiple studies have demonstrated the protective value of helmets. A summary of these analyses conducted by WHO found that:

HELMET USE

- ▶ Reduces the risk of severe injury by about 72%.
- ▶ Reduces the likelihood of death by about 39%, depending on the speed of the motorcycle.
- ▶ Reduces the costs of collision-associated health care.

NO HELMET

- ▶ Increases the risk of head injury.
- ▶ Prolongs hospitalization time.
- ▶ Increases the likelihood of death from head injury.

NOTE: WHAT HELMETS DO NOT DO

Helmets are designed to reduce the likelihood of head, brain, and facial injuries, but not to prevent injuries elsewhere in the body. Other strategies can be used to reduce the likelihood of other injuries:

- ▶ Wear proper clothing such as jackets and trousers made of certain materials completely covering the arms, legs, shoes or resistant boots, and wear gloves that give a better grip and protect the hands during a collision.
- ▶ Obey traffic laws such as speed limits and drunk driving regulations to reduce the risk of a collision and, as a result, the likelihood a motorcyclist will suffer any type of injury.



» So why are helmets not used?

Evidence on the effectiveness of helmet use is overwhelming. But according to a United Nations study (UNECE, 2016), a large number of motorcyclists continue to ride without helmets or without fastening their chinstraps. This behavior is often due to ignorance, but certain myths and misconceptions about helmets also play a role. Experience has shown that a combination of educational and legislative measures yields good results: persuasive arguments provide knowledge and facilitate acceptance, while legislation introduces the coercion necessary to force compliance where it is not voluntarily.

The UN study identified some of the reasons people do not use helmets:

- ▶ Peer pressure among young drivers, e.g. teasing helmet wearers.
- ▶ Many believe that a helmet is only needed for long trips (even though most crashes occur close to home).
- ▶ Helmets are considered uncomfortable and hot, especially in tropical climates.

Persuasive arguments provide knowledge and facilitate acceptance, while legislation introduces the coercion necessary to oblige compliance from those who are not doing so voluntarily.

- ▶ They ruin women's hairstyles.
- ▶ There is a practical problem of what to do with the helmet when it is not being used: e.g. it can be stolen or damaged, or may be inconvenient to carry when shopping.
- ▶ Hygiene can be a problem if the helmet does not belong to the user.

Possible countermeasures include:

- ▶ Improve the image of helmet wearing (make it "cool").
- ▶ Change helmet design to make them more attractive.

- ▶ Find solutions to the problem of “now what do I do with my helmet?” such as under-the-seat storage, top boxes, and helmet parks.
- ▶ Educate motorcycle riders through awareness raising campaigns.

Educational strategies should include correcting misconceptions about helmet use. Below are some of the myths and facts (a longer list can be found in the aforementioned United Nations study, UNECE, 2016):

▶ ***Myth: Helmets cause neck or spinal cord injuries.***

Fact: Research has proven that helmets conforming to international regulations and correctly worn do not cause neck or spinal cord injuries.

▶ ***Myth: Helmets impair hearing and sight.***

Fact: Helmets do not affect peripheral vision or contribute to crashes. Helmets may reduce the loudness of noises, but do not affect the ability of a rider to distinguish between sounds. Some studies have indicated that properly fitted helmets can actually improve the ability to hear by reducing noise from wind.

▶ ***Myth: Motorcycle helmet laws violate individual rights.***

Fact: All road safety laws require some action from individuals or impose limits—e.g. wearing seatbelts, not driving while impaired, or stopping at stop signs.

▶ ***Myth: Fatality rates are lower without helmet laws.***

Fact: Studies conducted in states of the United States that recently repealed their motorcycle helmet laws showed that deaths from head injuries actually increased following repeal of the law.

▶ ***Myth: Any helmet is better than no helmet.***

Fact: A low quality helmet might give the rider a false sense of protection. In case of a crash, a rider using a low quality helmet could get more severely injured or even killed, sending the false message that all helmets are useless.

▶ ***Myth: Motorcycle helmets in accordance with UN regulation No. 22 are too expensive for users in low-income countries.***

Fact: The relative costs of helmets go as low as one per cent and as high as 10 percent of the motorcycle price. Therefore, helmets should be affordable for buyers of new or second-hand motorcycles in low-income countries too.

» Motorcycle helmet legislation

Enforcement of comprehensive helmet laws effectively reduces the rate of fatal injuries, the seriousness of non-fatal injuries, and the length of hospital stays. In countries that have overturned or eased helmet use laws, helmet use has declined and the total number of deaths, head traumas, and brain injuries has increased. A systematic review of scientific literature indicates that mortality increased between 12% and 23% in states of the United States that repealed their helmet laws, compared to the mortality in states that did not do so.

But it does not suffice to have good laws. There is evidence that in both high-income and low- and medium-income countries maximum compliance with mandatory helmet use laws (that is greater than 95% compliance) is only achieved when there is strict enforcement. In countries that have appropriate helmet laws but little enforcement, there is no evidence that the legislation is effective. Table 3 presents a checklist for a comprehensive evaluation of helmet use laws.

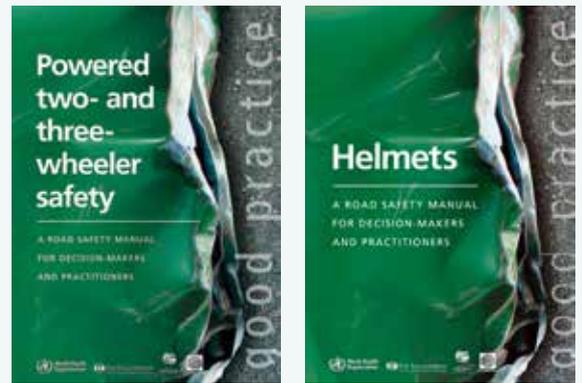
Table 3. Checklist for assessing comprehensiveness of helmet-wearing legislation

CURRENT LEGISLATION INCLUDES THE FOLLOWING ASPECTS:	YES	NO
1. Helmet use		
Includes the compulsory helmet wearing for all riders (i.e. drivers and passengers)		
Defines helmet wearing as including proper strapping and wearing of a helmet that meets national standards		
Requires all riders to wear a helmet on all roads		
Requires riders of all motorized two- or three-wheeled vehicles (all engine types) to wear a helmet		
Sets a minimum age for riding a motorcycle		
2. Helmet standards		
Specifies recognized helmet safety standards based on internationally recognized standards		
Includes product labeling requirements; addresses tampering with product labeling		
Specifies requirements for child helmets (e.g. age or height) depending on the age at which children are allowed to ride on motorcycles		
3. Enforcement		
Specifies who has authority for enforcement		
Allows primary enforcement: no other traffic offense is required to stop a violator and enforce helmet-wearing law		
4. Penalties		
Specifies financial penalties		
Includes provisions for motorcycle impoundment		
5. Other regulatory measures for helmet wearing		
Establishes penalties for sale of helmets that do not meet standards		
Establishes penalties for tampering with product labeling		
Sets requirements for passenger helmet-wearing for public service two- and three-wheeled motorized vehicles.		

Source: Powered two- and three-wheeler safety: a road safety manual for decision-makers and practitioners (WHO, 2017)

» For more information

PAHO/WHO publications *Helmets: A Road Safety Manual for Decision-Makers and Practitioners* and *Powered two- and three-wheeler safety: a road safety manual for decision-makers and practitioners* (has more detailed information on the issues discussed in this document).



» Related documents

- [Helmets: A Road Safety Manual for Decision-Makers and Practitioners](#) (PAHO, 2008).
- [Powered two-and three wheeler safety](#) (OMS, 2017).
- [Road safety in the Americas](#) (PAHO, 2016).
- [Global status report on road safety 2015](#) (WHO, 2015).
- [Plan of Action for Road Safety](#) (OPS, 2011).
- [The UN motorcycle helmet study](#) (UNECE, 2016).
- [Economic Survey of Latin America and the Caribbean 2013: three decades of unequal and unstable growth](#) (ECLAC, 2014)
- [Trends in fatal motorcycle injuries in the Americas, 1998–2010](#) (Rodrigues et al., 2014).
- [Effectiveness of interventions to prevent motorcycle injuries: systematic review of the literature](#) (Araujo M, Illanes E, Chapman E, Rodrigues E, 2016).

Motorcycle in the Americas.

PAHO/NHM/18-016

© Pan American Health Organization 2018

All rights reserved. Publications of the Pan American Health Organization are available on the PAHO website (www.paho.org). Requests for permission to reproduce or translate PAHO Publications should be addressed to the Communications Department through the PAHO website (www.paho.org/permissions).

All reasonable precautions have been taken by the Pan American Health Organization to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall the Pan American Health Organization be liable for damages arising from its use.

MOTORCYCLE USE IN THE AMERICAS

Measures to improve the safety of motorcycle riders

