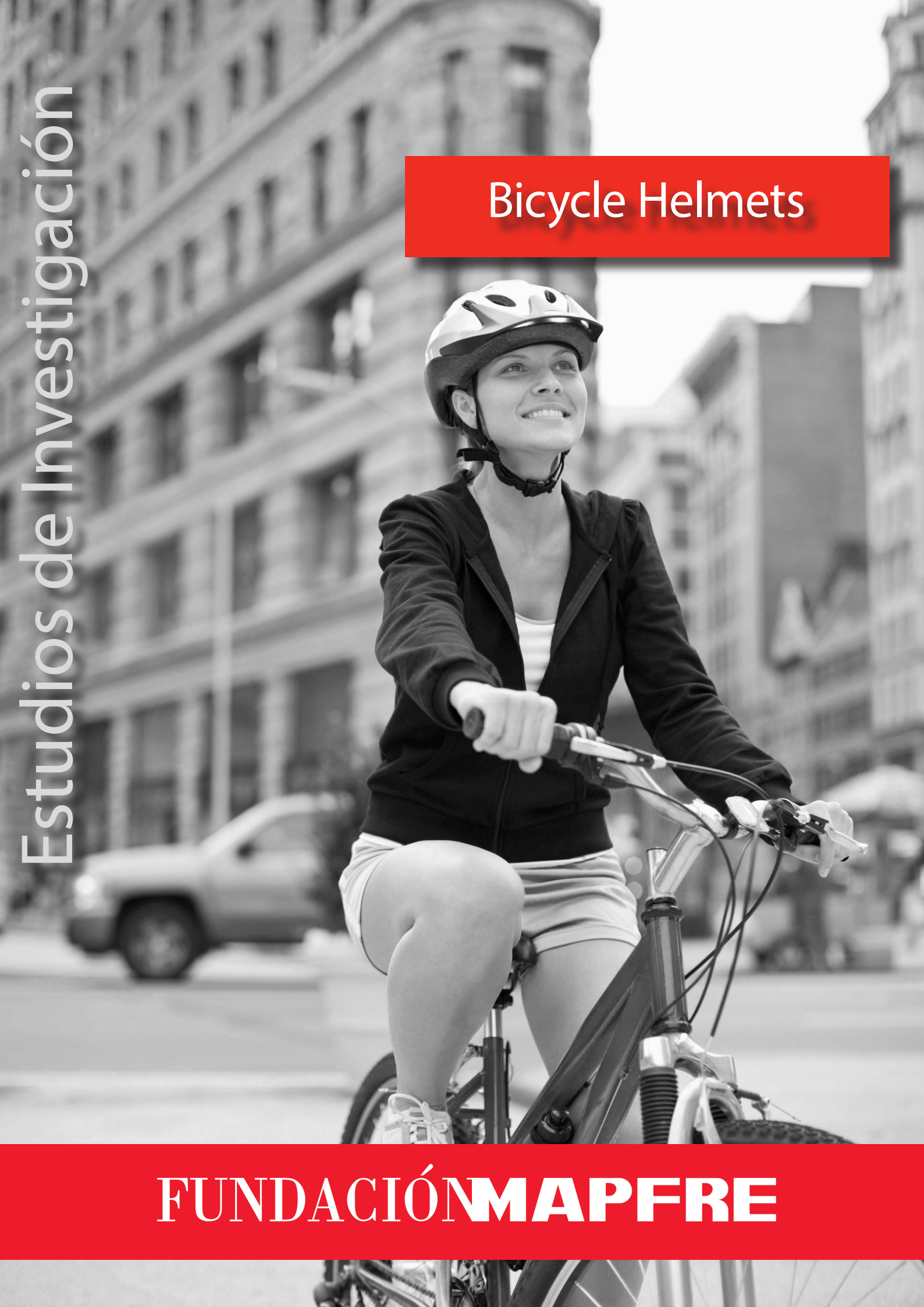
Estudios de Investigación

Bicycle Helmets



FUNDACIÓNMAPFRE

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1. The question: Does the bicycle helmet protect?

In recent months the debate on whether or not to make the bicycle helmet compulsory was reopened. This review of findings and recommendations provides an update on the effectiveness of bicycle helmets. A basic question arises: Does the bicycle helmet protect?

2. Methodology: How we have arrived to the answer to the previous question

In order to respond to this question we have turned to two types of primary sources. First, the latest and most comprehensive international studies on the effectiveness of bicycle helmets have been analyzed. Second, we reviewed the recommendations and considerations of fifteen national and international prescribers. This document summarizes the key findings and recommendations and it also proposes actions for the future to provide a more complete --and particularized to the Spanish context-- answer to that question. The document also includes --in a much more limited way-- information and tips on the effectiveness of visible and retro-reflective cyclists´ colored garments in order to supplement the central information about helmets.

3. The answer: Yes, helmets prevent two out of three serious head and brain injuries

Internationally, it can be stated that bicycle helmets prevent around 40 to 90 percent of all serious head (skull and scalp) and brain injuries. The protection in the case of children is greater than in the case of adults. Although in Spain is not known the exact number of cyclists who have died from head injuries, several sources suggest that it may be very significant. The bicycle helmet, therefore, constitutes an effective personal protection measure that should be promoted. It is recommended to conduct a study to determine the real potential of injury prevention in Spain by using cycling helmets.

CYCLIST ACCIDENTS

According to a study conducted by the Fundación MAPFRE, in 2010 bicycles were involved in 3,606 accidents with victims in which 67 cyclists were killed and 3,429 others were injured.

Between 2001 and 2010 the number of cyclists killed dropped by 33%, while between 2009 and 2010 there was an increase of 20% (going from 56 deaths in 2009 to 67 in 2010). However, in the case of the injured there was a notable increase in the last ten years, going from 2,037 in 2001 to 3,429 in 2010 (up 68%).

Although accidents occur mostly in urban areas (in 69% of cases), the deaths occur mainly on roads (73% of total). Over 90% of cyclists killed were males.

Between 2008 and 2010 19% of cyclists killed in Spain resulted from accidents in which there were no other vehicles involved; 50% of fatalities occurred in crashes between bicycles and cars or taxis; about 2% happened in collisions with motorcycles; 25% occurred in accidents involving heavy vehicles and 8% resulted from collisions with other vehicles. According to the European Road Safety Observatory (ERSO), the lack of visibility is an important factor in bicycle accidents. Sometimes, even in broad daylight, vulnerable road users (pedestrians and cyclists, mainly) are not detected by other drivers. The situation worsens at dawn, dusk, and night especially where there is no artificial lighting. The limited "physical" visibility of cyclists related to the small size of their vehicles (as drivers of other vehicles tend to look for same sized vehicles as theirs) is reduced further, at least in countries where cycling is not very common, due to lack of "social" visibility, in other words, car drivers do not see bicyclists because they simply do not expect to see any.

Sources:
1. www.fundacionmapfre.org/fundacion/es_es/images/El-colectivo-ciclista-y-los-accidentes-de-trafico_tcm164-12977.pdf
2. http://ec.europa.eu/transport/road_safety/specialist/knowledge/pdf/pedestrians.pdf
(Note: all the sites mentioned in this document have been consulted between January 4th and 6th, 2013)

HEAD INJURIES

SThere are very few in-depth studies carried out in Spain on bicycle injuries and even less of those reporting the use of helmets, or high visibility or reflective items, by this group of road users.

A recent study carried out by the Road Safety Public Prosecutor on 67 fatal accidents involving children under the age of 15 between 2008 and 2010, of which five cyclists aged between 5 and 12 years old died, concluded that all victims suffered head injuries. In three out of the five cases head injuries were the most serious (in the other two cases the area of the body most severely injured couldn't be determined). None of the five children used a helmet. All accidents happened during daytime, three of them in urban areas and the remaining two on roads. Although it is a small number of cases and, as a result their representativeness cannot be guaranteed the information is considered relevant for this review.

Furthermore, there is frequent news in the press that report cyclists seriously injured in the head. For example, according to a news piece reported by the newspaper el Periódico Mediterráneo in October 2012, "a cyclist was seriously injured when struck in the head on a path of Morella and was rushed by helicopter to La Fe with a head trauma. The wounded man, aged 42, from Barcelona but closely linked to Cinctorres, rode in a group. According to sources close to the attendees of the tour, the man was "very unlucky, as he lost control of the bike and what could have been a scratch ended in a strong hit in the head." La Voz de Galicia, additionally, reported that in the month of December 2012 "a cyclist was injured after being hit in Oia. The cyclist rode on the PO 552 and according to eyewitnesses was not wearing a helmet. The victim rode on a stretch that has no bike lane and received a blow on the head". That same month the newspaper La Opinión de Tenerife reported that a cyclist was hospitalized after falling and hitting his head at El Hierro. "An 18-year-old suffered a serious head injury after falling off his bike yesterday, the accident occurred in the path from La Maceta to Las Puntas, in the municipality of Frontera ".

On a global level, in its manual on motorcycle and cyclists helmets, the World Health Organization (WHO) indicates that approximately two thirds of serious cyclist injuries that require hospitalization and three quarters of cyclist deaths are caused by cranial trauma. These injuries can be caused by a loss of control of the bicycle, a pothole in the road or a collision with another bicycle or automobile. In all countries, head injuries constitute a significant cause of disabilities and create an enormous burden for the victim´s families and the community. Therefore, the prevention of traumatic head injuries is an important objective according to the WHO.

Sources: 1. www.fiscal.es/cs/Satellite?c=FG_Actualidad_FA&cid=1247140676781&language=es&pageid=1242052738415&pagename=PFiscal%2FFG_Actualidad_FA%2FFGE_pintarActualidad&site=PFiscal
2. www.elperiodicomediterraneo.com/noticias/sucesos/un-ciclista-grave-golpearse-en-cabeza-en-una-senda-de-morella_771608.html
3. www.lavozdegalicia.es/noticia/vigo/2012/12/28/ciclista-herido-atropellado-oia/00031356727133825792825.htm
http://whqlibdoc.who.int/publications/2006/9241562994_eng.pdf

HELMETS EFFECTIVENESS

It is beyond the scope of this paper to conduct a thorough review of the evidence on the effectiveness of cycle helmets as several comprehensive reviews are already available on this topic. The following are internationally considered the most relevant reviews on cycle effectiveness:

The first one is an international review conducted in the framework of The Cochrane Collaboration. The Cochrane Collaboration is officially recognized by the UN and is set around a network of more than 28,000 experts from 100 countries working to provide reviews on the effectiveness of different aspects of health and injury prevention (so far it has produced more than 5,000 works on reviewing evidence of effectiveness). In 2009 it published a review of the effectiveness of bicycle helmets, which reached the following conclusions:

- No randomized controlled trials were found, but five well conducted case-control studies met The Cochrane Collaboration inclusion criteria.
- Head injuries are responsible for about three-quarters of all deaths of cyclists involved in collisions.
- Helmets provide a 63% to 88% reduction in the risk of head, brain and severe brain injury for all ages of bicyclists.
- Helmets provide equal levels of protection for crashes involving motor vehicles (69%) and crashes from all other causes (68%).
- Facial injuries are also common. Injuries to the upper and mid-facial areas are reduced 65%.
- Helmets do not prevent lower facial injuries.

Moreover, the Norwegian researcher Rune Elvik, expert on the realization of summaries of road safety measures evaluation studies (by using the special technique called meta-analysis), concluded in 2011 that:

1. A re-analysis of an earlier meta-analysis on the protection afforded by bicycle helmets was published in 2001 in the journal Accident Analysis and Prevention (Attewell et al., 2001), reaching the conclusion that the original analysis was influenced by publication bias and time trends that were not properly taken into account.
2. When these sources of bias are properly considered the effectiveness attributed to bicycle helmets drops with respect to the original estimates.
3. When the analysis was updated with the addition of four new studies the effectiveness attributed to bicycle helmets was further reduced.
4. In any case, after the correction with the new data to the estimates above, it was concluded that the risk of head injury remained 1.72 times greater in the case of not using the bicycle helmet as compared to using it (with a confidence interval of 95%, from 1.33 to 2.22).

5. In the case of brain injuries the risk seems to be 2.13 times higher (with a confidence interval from 1.33 to 2.45).

6. If all head and neck injuries are considered together the increased risk appears to be lower, although still present (a factor of 1.18, with a confidence coefficient of 95% from 1.02 to 1.35).

7. According to new studies reviewed, when observed together, head, face and neck injuries show there is no overall effect attributable to bicycle helmets.

The following table summarizes Elvik's findings in 2011, translated into a reduction of injury rates (a reduction with a negative sign equals an increase in the number of injuries):

Injury area	Estimated reduction of injuries due to helmet use	Confidence interval by 95%:	Number of estimates of the effect:
Head	42%	25% to 55%	23
Brain	53%	25% to 59%	9
Face	17%	-3% to +33%	13
Neck	-32%	-72% to -1%	4
Multiple injuries	15%	2% to 26%	40

In the UK a complete review of the effectiveness of bicycle helmets was carried out in 2003 for the Ministry of Transport. Its objectives were to provide a basis to make future decisions on policies and research needs in this field. The findings of this review, conducted by the University of Newcastle, were:

a) There is a substantial amount of scientific evidence indicating that bicycle helmets are effective in reducing the incidence and severity of head, brain and upper face injuries.

b) The bicycle helmets are effective in reducing injuries in all age groups, but especially in the case of children.

c) Although most studies indicate that helmets protect against head injuries, the relative risk of injury to cyclists wearing helmets and those who do not is different in different studies. In particular, there is disagreement as to the relationship between helmet use and neck injuries.

d) Most cyclists´ injuries occur among children, adolescents or young adults. Head injuries (scalp, skull and brain) and to the face constitute a significant proportion of all injuries to cyclists.

e) The legislation on bicycle helmet use has been associated with reductions in head injuries and, along with the support of educational activities, has shown to be an effective means to increase the practical use of helmets.

f) However, the mandatory use of helmets may discourage some cyclists, which can translate into a reduction in the use of bicycles.

g) In Australia, New Zealand and Canada, for example, such legislation was introduced until high rates of helmet use were achieved among the population.

h) After considering a wide range of views on bicycle helmets, the authors conclude that "the way the debate has occurred in the U.K. has been of little help to those who aspire to reach a balanced judgment on this issue." The pro-helmet group largely based their arguments on one main point: that there is scientific evidence that, in the case of a fall, helmets substantially reduce head injuries. The group against helmets based their arguments on various points, including: mandatory helmet use for cyclists causes a reduction in the use of bicycles; the theory of "risk compensation" nullifies gains in safety; scientific studies are defective, and the road environment needs to be improved globally.

In 2006, the WHO published a road safety manual for decision-makers and professionals on helmets. While the manual focuses on the use of motorcycle helmets, it also provides information concerning the bicycle helmet. The manual states that after reviewing the evaluations from the effectiveness of bicycle helmets in reducing head injuries, it was concluded that these were effective in cyclists of all ages:

- The WHO stated in 2006 that five case-control studies on the effectiveness of helmets were carried out in the U.S., Europe, Australia and New Zealand, which compared individuals who suffered head or brain injuries during a bicycle collision with others who suffered injuries not involving the head. Studies showed that the use of helmets reduced the risk of head injury by 69%. The term "head injury" is a broad term that includes injuries to the scalp, skull and brain.

- Considering only the traumatic brain injury –the most serious type of injury– it was found that helmets reduce the risk of brain injury also by 69% and severe brain trauma by 79%.

- Helmets appear to be effective in all age groups, including young children and the elderly. According to the global report on prevention of road traffic injuries developed in 2004 by the World Health Organization and the World Bank, the use of helmets among children suffering a cycling collision reduces the incidence of head injuries by 63% and loss of consciousness by 86%.

- Concern that helmets may not be effective for cyclists hit by motor vehicles has been expressed. However, WHO indicates that studies show that helmets are equally effective in collisions with motor vehicles and other types of crashes.

- Helmets are also effective in preventing injuries in the middle and upper parts of the face, i.e., above the upper lip. Helmets decrease the risk of injury in these parts of the face by about two-thirds, probably because there is a part of helmet that extends above and in front of the face.

HELMETS EFFECTIVENESS

Much less evidence exists regarding the effectiveness of high-visibility elements for pedestrians and cyclists, so it is not possible to provide conclusive evidence in this case. As part of another Cochrane review in 2009, a search was conducted for studies on the effectiveness of "visibility aids" (as these elements were termed in this review) to protect pedestrians and cyclists. The authors did not find any studies that compared the number of accidents in which visibility aids were used to those when they were not used; however, they found 42 studies that compared the ease with which drivers detected people using the visibility aids to those not using them. These studies demonstrated that fluorescent materials in yellow, red and orange enhance the detection capability of the drivers during the day. Similarly, the headlights, flashing lights and retro-reflective materials in red and yellow –particularly those in a bio-movement configuration (movement that leverages pedestrians or cyclists´ limb movement) – improve pedestrian´s recognition at night.

Sources:
1. http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD001855/pdf/abstract
2. www.sciencedirect.com/science/article/pii/S0001457512004253
3. www.dft.gov.uk/rmd/project.asp?intProjectID=10083
4. http://whqlibdoc.who.int/publications/2006/9241562994_eng.pdf
5. www.who.int/world-health-day/2004/infomaterials/world_report/en/summary_es.pdf
6. http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003438.pub2/abstract

DISADVANTAGES OF HELMETS

In the recent months opinions against the proposed mandatory use of bicycle helmets in towns were also expressed. The main arguments against this obligation are:

a) A significant number of head injuries was not detected as such serious a problem. Causes of accidents and their consequences were not analyzed[1].

b) Both independent and governmental investigations in several countries conclude that helmet law reduces the use of bicycles as a habitual vehicle or non-sportive leisure. Thus, many cyclo-tourists avoid Spain in their travels because of the mandatory use of helmet on interurban roads.

c) A reduction in cycling due to mandatory use of helmet would cause general harm to the health of the population. Cycling is good for health: the bicycle helmet can save a brain, but damages many hearts.

d) The biggest safety factor for cyclists is that many of them ride together in order to be made more visible: more cyclists riding without helmets is safer than less cyclists wearing helmets.

e) The helmet law in cities also poses a logistical problem for those cities with bike-sharing systems, since the subscriber card to such systems can be carried in a wallet but not the helmet. Nor would it be feasible to share helmets for hygienic reasons.

f) In general, cycling associations that oppose the enforcement of helmet laws, do not preclude helmet use.

The European Road Safety Observatory (ERSO) additionally, provides the following example from a study on the effects of cycling on cardiovascular risk prevention. This is a study from the early 1990s conducted among 9,400 people with sedentary jobs (executive grade civil servants), 70% of which used the bike at least one hour a week to go to work or used the bicycle at least 40 km (25 miles) a week for other reasons. The incidence of heart disease in this group stood at 2.5/1000 persons per year. For people who traveled fewer miles by bicycle, that incidence stood at 4.5/1000. This effect on health is considered to be between 5 and 10 times more important than the aspect of road safety during cycling.

Sources:
1. www.conbici.org;
2. http://ec.europa.eu/transport/road_safety/specialist/knowledge/pdf/pedestrians.pdf

1 This statement contradicts the information given in the previous section on international evidence concerning head injuries and bicycle helmet effectiveness.

SPANISH LEGISLATION

The rules on the use of helmets and reflective elements in Spain are included in Royal Decree 1428/2003 approving the General Traffic Regulations for the application and development of the Law on Traffic, Circulation of Motor Vehicles and Road Safety.

Accordingly, cyclists, and where appropriate the passengers, are required to use protective helmets approved or certified under the applicable law when driving in urban roads, except in prolonged ascending ramps, for medical reasons in accordance with the cited regulation, or in extreme heat conditions. Bicycle riders in competitions and professional cyclists, whether during practice or competition, shall be governed by their own rules.

Bicycles shall be fitted with reflective elements duly homologated as determined in the General Vehicle Regulation. When the use of lighting is required, bicycle riders shall additionally wear a reflective garment allowing drivers and other road users detect them from a distance of 150 meters on interurban roads.

Source:
www.boe.es/boe/dias/2003/12/23/pdfs/A45684-45772.pdf

INTERNATIONAL LEGISLATION

The sources consulted for this study, namely the German Council for Traffic Safety (Deutscher Verkehrssicherheitsrat, DVR) and the European Commission, offer the following compilation of countries where, for all or for certain age groups, the use of bicycle helmet is mandatory:

Country	Compulsory use of helmet for:
Austria	Children under 12
Australia	All cyclists
South Corea	Children under 13
Croacia	Children and youngsters under 16
U.S.A	In 38 States, in general, children and youngsters under 16
Slovakia	Children under 15 and all cyclists on interurban roads
Slovenia	Children under 15
Spain	All cyclists on interurban roads, except in prolonged ascending ramps, or with medical reasons where credited, or in extreme heat. The penalty for violating this rule is 90 euros.
Estonia	Children under 16. Recommended for the rest.
Finland	All cyclists. Helmets must meet the technical standard EN1078.
Iceland	Children under 15.
Israel	Children and youngsters under 18
Japan	Children under 13
Lithuania	Children and youngsters under 18. Recommended for the rest.
Malta	All cyclists
New Zealand	All cyclists. The penalty for violating this rule is 30 euros.
Czech Republic	Children and youngsters under 18. Recommended for the rest.
Sweden	Children under 15. The penalty for violating this rule is 55 euros.
South Africa	All cyclists

Moreover, in the following countries the use of the bicycle helmet is not mandatory: Germany, Belgium (recommended use), Bulgaria, Cyprus, Denmark, France (recommended use), Greece, Hong Kong, Hungary, Ireland, Italy, Latvia (recommended use), Luxembourg, Netherlands (recommended use), Norway, Poland, Portugal, United Kingdom, Romania (recommended use), Russia, Serbia, Singapore, Switzerland and Turkey. Completing the information above, several of the following sections of this document provide more details about the rules or the recommendations in some of the above countries.

In Europe, bicycle helmets offered for sale must comply with the European technical standard EN 1078 (bicycle helmets for adults) or the European standard EN 1080 (bicycle helmets for children). These standards specify that the protective effect of helmets should be subjected to an impact test at a speed of 20 km/h against a flat anvil and at 17 km/h against a curb-shaped anvil. These are the rates at which it is considered that the head of a cyclist crashes onto the road or a curb when he/she loses control of his/her vehicle and hits the ground. These speeds, on the other hand, are not necessarily representative in the case of an impact against a motor vehicle (such speeds may be considerably higher). The European standards are less stringent than in the U.S. or Australia (and the former British regulations), and the effect is unknown that this may have on a possible reduction in injury protection of cyclists.

As for the vests or reflective clothing, the following table shows the European countries in which there are any legal requirements in this regard, according to the European Commission:

Country	Compulsory use of vests or reflective clothing:
France	Outside of urban areas at night or in poor visibility
Slovakia	In poor visibility
Spain	When the use of lighting is mandatory, cyclists shall also wear some reflective garment allowing drivers and other road users detect them at a minimum distance of 150m on interurban roads
Hungary	Outside of urban areas at night or in poor visibility
Italy	Outside of urban areas at night or in poor visibility
Lithuania	At night and in poor visibility

In addition, the following countries recommend the use of reflective clothing: Belgium, Latvia and Czech Republic.

Sources:
1. www.dvr.de/betriebe_bg/daten/radhelmpflicht_europa.htm
2.http://ec.europa.eu/transport/road_safety/observatory/doc/safetyequip_bici_rules.pdf
3. www.etsc.eu/documents/scientific_review_of_cycling_safety_web.pdf

WHAT DOES... THE U.S.A. SAY?

The National Highway Traffic Safety Administration, (NHTSA) summarizes its advice on the use of cyclist helmets and reflective garments:

- Bicycle accidents can happen at any time. Bicycle helmets, when properly adjusted, reduce the risk of head injury by up to 85 percent, and the risk of brain injury by up to 88 percent.
- More children between ages 5 and 14 receive the emergency services of hospitals after having suffered injuries associated with bicycles than with any other sport. Many of these injuries are head injuries.
- The cyclist helmet laws improve children´s safety.
- As with car accidents, bicycle accidents (which can happen at any time) involve not only children but also adults, many of which are experienced cyclists. In fact, middle-aged adults represent the average age of cycling victims.
- Helmets are the most effective protective element to prevent head injuries for cyclists of all ages in the case of a bicycle accident. All cyclists –adults and children– should choose to use a helmet on all rides: it simply makes sense!
- Using a helmet on every ride can encourage other cyclists to do the same.
- When purchasing a helmet, customers must make sure to check that it has been tested and meets the standards set by the U.S. Consumer Product Safety Commission. Old helmets shall only be used if they have the stamp or label of one of the voluntary safety standards on bicycle helmets (ASTM, Snell, or ANSI).
- Make yourself visible. See and be seen at all times. Always think that other drivers and pedestrians may not have seen you. Cyclists must take responsibility as to being seen by car and truck drivers, pedestrians and other cyclists.
- In conditions of low natural light (at night, dusk or dawn, when dusty conditions affect on the road, or in bad weather) cyclists, especially children, should wear bright colored clothes or elements or fluorescent reflective materials: retro-reflective vests or jackets, wristbands, reflective back, legs or arms elements. Reflectors should be installed at the front and rear of the bicycle. When pulling a bicycle trailer clearly visible reflectors should be installed.
- Bicycle lights must work properly and be turned on. A flashing red light located in the rear of the bicycle, backpack or helmet significantly increases visibility. Many states have laws on lights on bicycles and should always be observed.
- You should attempt to prevent children from using their bicycle at night.

Children's Hospital of Philadelphia, (CHOP) is one of the most reputable companies worldwide in the investigation of childhood accidents. Researchers in this hospital indicate that parents should require their children to use a helmet whenever riding a bicycle, skateboard, scooter or skates. Whenever children "move on wheels," they should do so safely.

These researchers suggest that about 75% of all bicycle-related child deaths could have been prevented with a bicycle helmet. Recommendations on bicycle helmet issued by the Children's Hospital of Philadelphia are:

a) Helmets must meet or exceed the requirements prescribed in the Standards developed by U.S. Consumer Product Safety Commission

b) It is necessary to carry out the check "eyes, ears and mouth":

1. Eyes: when looking up with your eyes, you should see the front bottom edge of helmet. This lower edge should be between one and two fingers above the eyebrows.

2. Ears: the support straps of the helmet should form a "V" with the ear in the middle. Straps must be adjusted, without being uncomfortable.

3. Mouth: when the child opens his mouth as much as possible, the helmet should create pressure on his/her head slightly; if it doesn't, the straps need to be further tightened.

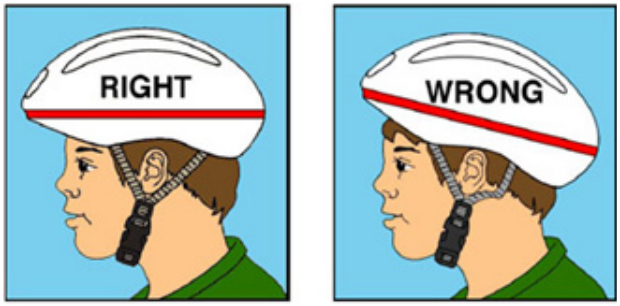
c) If the child does not want use the helmet, you should try to let the child choose his own helmet. There are helmets of many colors and styles, and the child should be able to choose a helmet that is attractive or "cool" and makes him or her not to want to take it off as soon as parents or responsible adults are away.

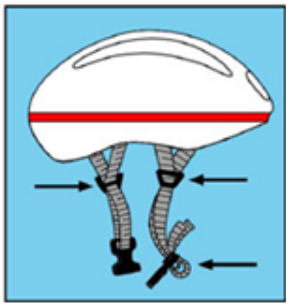
d) Parents should also use the bicycle helmet: it is more likely that children use bicycle helmets when other persons traveling with them to do the same.

e) Parents of children who use a bicycle helmet should talk to other parents to encourage them to all other children use bicycle helmets also.

f) Parents of children who already use a bicycle helmet should talk to other parents to encourage them so that all other children use bicycle helmets too.

The following illustration shows visually CHOP tips when setting the helmet:





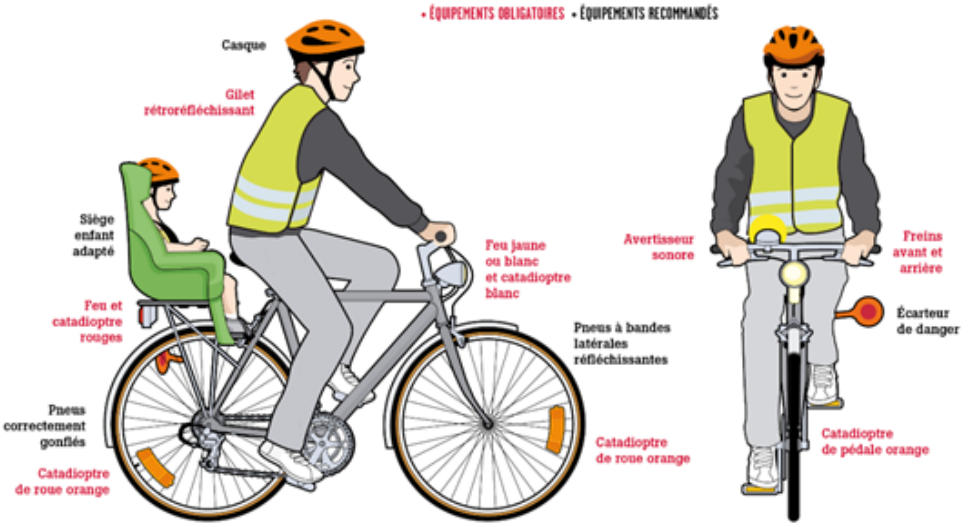
Sources:
1. www.nhtsa.gov/DOT/NHTSA/Traffic%20Injury%20Control/Articles/Associated%20Files/BikeSafetyforAdults.pdf
2. www.cchosp.com/cchpage.asp?p=474

WHAT DOES... FRANCE SAY?

Although helmet use is not mandatory in France, the French road safety authority (Délégation à la sécurité et à la circulation routières) offers the following general tips and reminders:

- The bicycle helmet is recommended equipment to prevent head injuries
- A bicycle in good condition and well equipped helps ensure cyclist safety and that of other road users.
- In France, the following equipment is required on bicycles:
    - Two brakes, front and rear
    - A yellow or white headlight and a red taillight
    - A sound-warning devise
    - Catadioptric (retro-reflective) devices: red on the back, white on the front, and orange between the spokes and pedals.
- All riders and passengers must use a certified, retro-reflective vest when they ride outside of urban areas, at night or in poor visibility.

The figure below summarizes the tips and obligations of safety features of cyclists in France.



Source:
www.securiteroutiere.gouv.fr/conseils-pour-une-route-plus-sure/conseils-pratiques

WHAT DOES... THE NETHERLANDS SAY?

The Netherlands is one of the countries with the highest use of bicycles as a daily means of transport. In the Netherlands four out of five people have a bicycle, and bicycle riding (which represents a tradition of nearly 90 years) is generally considered a safe and daily activity. Bicycle helmets are not mandatory in this country, and the general approach is well summarized in the manual on helmets developed in 2006 by the World Health Organization:

Despite all infrastructures to improve cyclists´ safety, Dutch data on collisions and injuries indicate that cycling still has certain risks. This is especially true in the case of young children, whose basic motor skills are still developing. Children between 4 and 8 years-old, as cyclists, are especially likely to be involved in collisions and, as a result, to suffer head injuries requiring hospital admission.

From the mid 80s the proportion of Dutch children who use cyclist helmets has increased considerably. There are several reasons for this: parents are increasingly aware of the protection offered by bicycle helmets for children; establishments increasingly offer bicycle helmets along with bicycles; campaigns developed by the Dutch Association for Traffic Safety in schools and the media have promoted helmet use by children. Helmets have also become popular among skateboards and mountain bikes users, and this has produced a positive side effect with helmet use in traffic.

Research shows that Dutch children up to age seven readily accept the use of bicycle helmets, but after this age the perception that using a bicycle helmet is something "cool" or is fashionable drops. As a result, children from the age of eight use helmets less often than younger children.

As for the use of bicycle helmets by adults, there is broad agreement between the Dutch government, private organizations working in road safety and cycling groups on the following:

1. *Promoting the use of bicycle helmets is against recent government policies aimed at primary prevention of collisions (instead of secondary prevention of injuries) and promoting the use of bicycles as a general health measure.*

2. *Attempts to promote bicycle helmets should not have the negative effect of presenting cycling as a dangerous activity. Nor should promoting helmets produce a reduction in the use of the bicycle.*

3. *Because of these considerations, it has not been considered acceptable or appropriate as a road safety measure to legally require bicycle helmets in the Netherlands.*

Moreover, the Dutch Institute for Road Safety Research (Stichting Wetenschappelijk Onderzoek Verkeersveiligheid, SWOV), a key player at a global level, states:

a). In general, we can say that bicycle helmets, with the condition that they are in place and adjusted properly, are likely to be effective in reducing the risk of head or brain injury. In addition, researchers expect bicycle helmets to be particularly effective in the case of children, since children´s heads are at a lesser distance to the ground in case of falling than in the case of adults, and therefore the protection that helmets offer is relatively greater.

b) Head or brain injuries are relatively common among children and youngsters. Children and young people suffer brain injuries more often than older road users. Children also suffer brain injuries more frequently than other types of injuries.

c) More than 60% of all young cyclists seriously injured belonging to the age group of 0-17 years-old suffered head or brain injuries after colliding with a motor vehicle, compared with the average of 47% for all age groups. In the age group of 0-17 years old, the percentage of brain injuries in accidents not involving motor vehicles is between 33% to 56%, compared with the average of 29% for all age groups.

d) Among bikers between 0 and 5 years old, nine out of ten head or brain injuries occur in accidents not involving motor vehicles but from falls that occur without any collision with another opponent or object. When considering all age groups together, about three out of four head or brain injuries occur in accidents not involving motor vehicles. Bicycle accidents by falling without the involvement of other motor vehicle are difficult to prevent, in general terms.

e) Researches indicate that about 42% of all serious cyclist injuries could be prevented with the use of a properly adjusted helmet. Therefore, an increase in helmet use would result in a reduction in the number of victims.

f) It is recommended to promote the voluntary use of bicycle helmets.

g) International experience, for example in Australia, indicates that the legal obligation of bicycle helmet use reduces the number of people traveling by bicycle. In the Netherlands, the possible introduction of mandatory helmet use for cyclists is also likely to result in a reduction in cycling.

h) The mandatory use of helmets for cyclists should not be implemented in the Netherlands until all possible consequences have been investigated.

Sources:
1. www.who.int/violence_injury_prevention/publications/road_traffic/helmet_manual.pdf
2. http://swov.m17.mailplus.nl/genericservice/code/servlet/React?encId=12345&id=8624129&command=tlink

WHAT DOES... THE U.K. SAY?

Although the bicycle helmet is not compulsory in the UK, the Department for Transport (DfT), as part of its national road safety campaign THINK!, recommends the following:

- Always use the bicycle lights when it is dark or in poor visibility.
- Use brightly colored or reflective clothing during the day and reflective clothing or accessories during the hours of darkness. This increases the visibility of cyclists.
- Use a properly fitted and buckled bicycle helmet that complies with the technical standards.

Meanwhile, the London metropolitan transportation authority Transport for London, (TfL) recommends "using brightly colored clothing during the day and reflective clothing or accessories during the night; also consider wearing a helmet." TfL indicates that it is essential that the helmet is properly fitted, without moving sideways or front to back. TfL also recommends asking the shop where the helmet is purchased to prove that it meets the safety standards. When riding with children forming a single line with an adult leading the line and another in the last place (if only one adult rides with the children, he or she must ride in the last place, to see the children circulating ahead) is also recommended by the TfL. The adult circulating last can also ride more laterally away from the curb, or edge of the road to improve the safety of children.

Moreover, the Royal Society for the Prevention of Accidents (ROSPA), which dates back to 1916 and is one of the most prestigious institutions in the country in the field of injury prevention, also recommends that all riders use a helmet that meets the appropriate safety standards. ROSPA indicates that "bicycle helmets, when used properly, are effective in reducing the risk of serious head or brain injury as a result of an accident."

Sources:
1. www.gov.uk/government/uploads/system/uploads/attachment_data/file/9206/think-cyclist-toolkit.pdf
2. www.tfl.gov.uk/roadusers/cycling/23869.aspx
3. www.rospa.com/roadsafety/adviceandinformation/cycling/default.aspx

WHAT DOES...SWEDEN SAY?

The Swedish National Transport Administration (Vägverket, SNRA) says that children under 15 are required by law to use helmets when using this mode of transport in Sweden. This law applies whether the child rides his/her own bike or if transported by another rider in a child seat or children´s trailer.

Mandatory use of helmet for children is hoped to make cyclists continue to use the helmet when they reach adulthood. In addition, when an adult riding a bicycle transports a child as a passenger, the adult is responsible for making sure that the child wears a bicycle helmet.

Source:
http://publikationswebbutik.vv.se/upload/3676/89111_welcome_to_the_roads_of_sweden.pdf

WHAT DOES...THE EUROPEAN COMMISSION SAY?

The European Commission acknowledges that at present, there is a debate in many countries about the mandatory use of bicycle helmets. Some cyclists are against the helmet because it involves a requirement that conflicts with the feeling of freedom that provides the bike or because they are anti-aesthetic, uncomfortable or unnecessary on short trips. Others are strongly in favor of the helmet because it provides good protection for the head.

The European Commission also notes that studies conducted over the past 15 years in the United States, Europe, Australia and New Zealand indicate that bicycle helmets are effective in reducing the risk of head and brain injury. Critics of the legislation, however, indicate that reductions in the absolute numbers of cyclist deaths and serious head injuries can be explained, at least in part, by reducing cycling. Since there is good evidence that regular bicycle riding is associated with significant health benefits, and that these benefits amply outweigh the risk of injury, legislation that could reduce levels of bicycle use would be of concern according to the European Commission.

Source:
http://ec.europa.eu/transport/road_safety/specialist/knowledge/pedestrians/promote_cycling_and_bicycle_helmets_or_not/pros_and_cons_regarding_bicycle_helmet_legislation.htm

WHAT DOES... THE EUROPEAN ROAD SAFETY OBSERVATORY SAY?

Apart from measures relating purely to the road infrastructure, the European Road Safety Observatory (ERSO) points to some of the specific road safety measures for cyclists and pedestrians:

- Bicycle helmets
- Improving visibility
- Education and training
- A more forgiving designs of car fronts

ERSO indicates that helmets are the only protection element in case of accidents that is available to cyclists, which can prevent head injuries in case of a fall of the rider. Moreover, in order to avoid the negative effect of helmets on the use of bicycles, ERSO indicates that the best approach would be to delegate their promotion to manufacturers and retailers.

As for visibility, ERSO indicates that both child pedestrians and cyclists benefit from visibility aids and the use of bright-coloured and retro-reflective clothing. Designers and manufacturers of children's clothing and accessories are well-positioned to incorporate retro-reflective materials into product lines. Parents, as well as public health and safety officials, should encourage the use of high-visibility clothing as component of whatever type of campaign for protecting children in traffic. Dangle tags, armbands, strips on school bags, and use of bicycle lamps are all recommended.

To ensure the highest possible visibility of cyclists, bicycles should be equipped with a red reflecting device and red lights at the rear, and white or yellow illuminating devises in front. In some countries, reflectors are also compulsory on the wheels (such as in The Netherlands), at the front or on the pedals. However, not all bicycles currently in use meet those legal norms.

Source:
http://ec.europa.eu/transport/road_safety/specialist/knowledge/pdf/pedestrians.pdf

WHAT DOES... THE EUROPEAN CYCLISTS' FEDERATION (ECF) SAY?

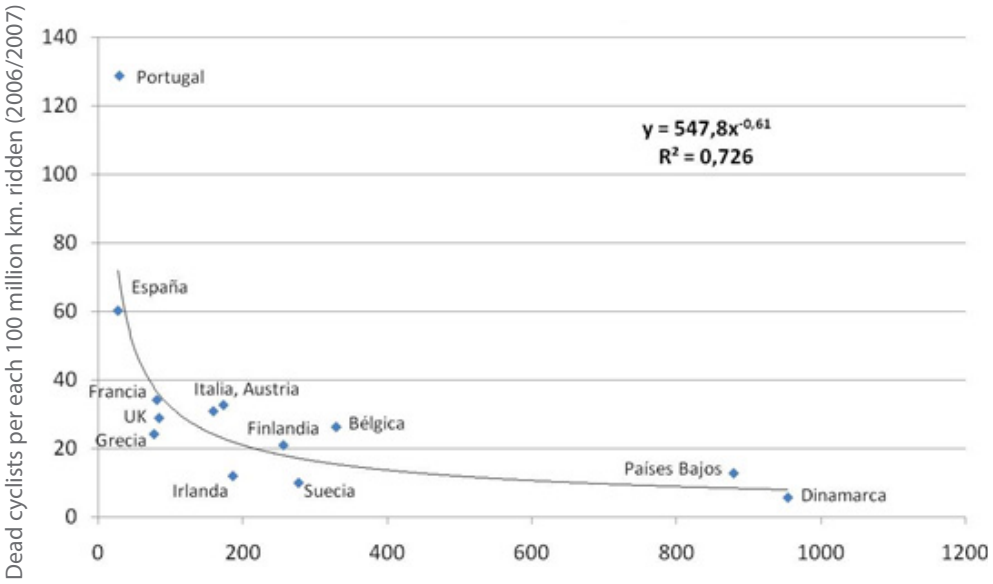
The European Cyclists Federation (ECF) includes 65 associations of cyclists from 39 different countries, was founded in 1983 and comprises approximately 500,000 users of bicycles. In 2010, the ECF published its Road Safety Charter – Halving injury and fatality rates for cyclists by 2020, which states in relation to the bicycle helmet:

"No to mandatory helmet laws. Making helmets compulsory has been asked for by politicians and health organizations in order to increase safety for cyclists. However, the story is more complex: wearing a helmet creates the image of cycling being an abnormally dangerous physical activity. While this may be the case for cycling as sports, it is not necessarily so for cycling as a daily means of transportation. Statistics show that the more cyclists there are on the road the safer it is actually to cycle; car drivers are more used to the presence of cyclists and tend to have cycling experience themselves. Taking this into account, ECF is not only absolutely against the mandatory wearing of helmets, but is also against shock-horror helmet promotion campaigns. The main effect of helmet laws has not been to improve cyclists' safety but to discourage cycling, undermining its health and other benefits. We therefore call upon authorities to:

- *Focus on well-established measures to promote cycling and cyclists' well-being*
- *Recognise that the benefits of cycling far outweigh the risks*
- *Refrain from promoting or enforcing helmet wearing without sound evidence that this would be beneficial and cost-effective compared to other safety initiatives."*

Data provided by the ECF on the relationship between the rate of cycling fatalities and the average number of kilometers ridden annually by each person in a total of 13 countries are shown below:

Relationship between cycling fatalities and average kilometers ridden per country



Kilometers ridden by bicycle per person and year

As for the lighting on bicycles, ECF would welcome binding technical minimum specification for cycle light products at a European level, ensuring functionality and improving the visibility of cyclists.

Source:
www.ecf.com/wp-content/uploads/2011/10/ECF_Road_safety_charter.pdf

WHAT DOES... THE EUROPEAN TRANSPORT SAFETY COUNCIL (ETSC) SAY?

The European Transport Safety Council (ETSC) is one of the most prestigious independent entities in Europe. In the section of cyclist visibility and protection of its recent manual on cyclist safety, it recommends:

- Use bright colored clothing that allows cyclists stand out in traffic.

- At night, use reflective jackets or reflective strips on arms or legs.

- Equip your bicycle with front and rear lights, and check that they are in good working order before driving during nighttime hours.

- In general, make sure that the bike meets at least the minimum lighting and reflective requirements.

- Use a helmet. Make sure the helmet is properly fitted.

- Replace the helmet if it was involved in a collision.

Source:
www.etsc.eu/documents/Bike_Pal_cycling_manual_web.pdf

WHAT DOES... WORLD HEALTH ORGANIZATION (WHO) SAY?

The global report on road traffic injury prevention developed in 2004 by the World Health Organization (WHO) and the World Bank recommends that all countries, regardless of their income level, adopt international best practices including "establishing and enforcing laws that require cyclists and motorcyclists to wear a helmet."

Contrastingly, even though Australia, the U.S., New Zealand, Sweden, and other countries have legislation that requires cyclists to use this protective equipment, the global proportion of helmet use is low, as recognized by the WHO. In the State of Victoria (Australia), a new law back in 1990 requiring the use of helmets contributed to the increase of its user rate from 31% to 75% in one year and to its reduction by 51% of head injuries to cyclists.

Nevertheless, the WHO points out that there is a broader debate on whether the use of a helmet is the best way to increase cyclists´ safety, especially considering that the bicycle offers a pleasant means of recreation and vigorous physical activity, and its use should be widely promoted.

For the WHO, all injuries should be considered preventable, as is evident in the case of head injuries related to cycling.

Source:
1. www.who.int/world-health-day/2004/infomaterials/world_report/en/summary_es.pdf
2. http://whqlibdoc.who.int/publications/2006/9241562994_eng.pdf

WHAT DOES... THE AMERICAN ACADEMY OF PEDIATRICS (AAP) SAY?

The American Academy of Pediatrics, (AAP) indicates that bicycling remains the most popular recreational sport among children in the United States and represents the main cause of injury from practicing recreational sports. It is estimated that in 1998 23,000 children and young people under 21 suffered head injuries (excluding face injuries) while traveling by bicycle. The bicycle helmet, according to the AAP, is a protection element that can prevent the occurrence of up to 88% of serious brain injuries. However, most children do not use a helmet when traveling by bicycle, and teens are especially reluctant to use it.

The AAP issued a statement on the use of bicycle helmets in 2001, which was recently re-enacted in 2011. This statement describes the role that parents and pediatricians can play in promoting the universal use of helmets among children and adolescents in all bicycle rides:

- Bicycle trips, as with walking, to school offer great benefits to children´s health. Accompanying children to school by bicycle is another way to share the ride to school and also it is great form of doing exercise in the company of children.

- But, in addition to traffic exposure, bicycles carry certain specific concerns from the safety point of view. Although, if some basic precautions are taken, the bicycles risks can be reduced for students that use them to go to school.

    i. Bicycle helmets should always be used. Make sure your child always uses one when traveling by bicycle, no matter how short the trip is. The helmet should be approved by the U.S. Consumer Product Safety Commission.

    ii. Brightly colored clothing can help other drivers see cyclists in advance and with greater clarity in traffic. Make sure your child's clothes make him/her properly visible.

iii. Children should only be allowed to ride a bicycle when there is plenty of natural light. Children should not be allowed to ride a bicycle at dusk or dawn, or night.

iv. Younger children (until they turn 9) should ride a bicycle only when supervised by an adult, and never on roads open to traffic.

v. An adult should assess whether a child can travel by bicycle in traffic depending on the intensity of traffic and the child's maturity and ability to comply with all traffic regulations.

vi. All cyclists should comply with the basic traffic rules.

vii. Children should be taught to check the mechanical condition of their bike routinely. Tires, brakes, handlebars and seat depth should be checked at least once a year.

Sources:
1. http://pediatrics.aappublications.org/content/108/4/1030.abstract?sid=8dbb64b3-14ff-41b1-b413-44124c06e67a
2. www.healthychildren.org/English/safety-prevention/on-the-go/pages/Safety-On-The-Way-To-School.aspx

WHAT DOES... THE SPANISH PEDIATRICS ASSOCIATION (AEP) SAY?

The Safety and Childhood Injury Prevention Committee of the Spanish Pediatrics Association (AEP), with regard the use of bicycle helmets in childhood and adolescence, states:

- Over 70% of children between 5 and 14 years old ride bicycles. This activity, although it is a popular means of transportation and a recommended sport, is not free of risks.
- According to the Directorate General of Traffic (DGT), approximately 20% of deaths in road accidents between 10 and 14 year-olds in Spain were bicycle users. Head injuries were the main cause of death.
- The bicycle helmet is one of the few passive safety measures that is available to cyclists (both children and adults) to minimize injuries in a fall or accident.
- The use of bicycle helmet can prevent or reduce the risk of serious head injury, even when the cause of the accident is a collision with a car. The protective ability of the helmet is based on absorbing part of the energy and distributing the impact´s maximum peak of energy over a larger area, as well as increasing the transfer time.
- Studies estimate that the proper use of the bicycle helmet reduces the risk of head and brain injury by 63% to 88%. The risk of death is 26% lower. Nevertheless, the vast majority of bicycle users, including children, do not use the helmet or use it incorrectly.

The Safety and Childhood Injury Prevention Committee of the ASP recommend:

1. If the use of the helmet is important in adulthood, its use in the case of children and adolescents is essential. These ages are key to instilling the importance of always cycling protected and to protect the heads of those least likely to see the danger.

2. All children and adolescents should wear a helmet every time they ride a bicycle.

3. Parents and other adults must also wear a helmet whenever they ride their bike. Parents should set an example in promoting a safe behavior for their children, and explain why it is necessary to protect their head.

4. The helmet should be used correctly. In order to do this:

   a) It has to be certified by the appropriate agencies. The technical standards specify that the helmet has to be durable, lightweight, well ventilated, easy to put on and take off, should allow the use of glasses and not interfere with the ability to hear traffic noise. It must also provide a viewing angle of at least 105 ° left and right, an angle of 25 ° up and 40 ° down.

   b) It must be in perfect condition. In fact, helmet has to be replaced if it has suffered a collision, is damaged or is too small. It is also recommended, despite being in apparent perfect condition, to replace the helmet at least every five years or when the manufacturer recommends.

   c) It must be the right size: helmets come in various sizes depending on the manufacturer. The proper size should match the size of the head circumference. Helmets usually come with extra pads or an adjustment ring to fit well on any head.

   d) It has to be secure: It should fit comfortably and securely on top of the head, covering the top of the forehead (one or two fingers above the eyebrows). Also side and chin straps and the buckle should be properly adjusted for a snug and comfortable fit. The helmet should not move from side to side or front to back.

5. In the case of young children as passengers on bicycles:

   - Besides using a properly fitted helmet, they should ride in a certified extra seat.

   - According to the General Traffic Regulation, the bicycle rider must be of age and the passenger must be younger than seven years, and he/she must travel in a certified seat. Bicycle trailers that appear to be safer to transport children are still not covered by the Spanish legislation.

   - For the safe transport of children on bicycles, they should at least be older than 1 year and should possess sufficient muscle strength to control their head movement in the event of a sudden brake, even with the additional weight of the helmet.

6. Parents and children must know all the essentials about the safe use of the bicycle. The use of a helmet is only one aspect of bicycle safety. Parents and children should know and adopt further safety measures such as:

- Using appropriate clothing
- Keeping a red, rear reflector on the bike
- Wearing reflective clothing at night and a front white light and rear red light
- Being familiar with the traffic regulations on public roads

As for the role of the pediatrician, the AEP indicates that as evidence of the effectiveness of health advice in the prevention of accidents and injuries in children, pediatricians generally must:

- Encourage parents to promote the use of helmet when children begin to ride tricycles or any vehicle or wheeled toy.
- Inform parents and children about the importance of wearing a helmet when riding a bicycle, and the danger if it is not used. This information is especially important for teenagers, as they are the most reluctant to wear them.
- Recommend to parents and other adults to also wear a helmet, as an example.
- Participate in community-wide campaigns to promote helmet use in childhood and adolescence.

Sources:
1. www.aeped.es/documentos/cascos-bicicleta-en-infancia-y-adolescencia
2. http://enfamilia.aeped.es/prevencion/utilizacion-cascos-bicicleta

WHAT DO... AUTOMOBILE CLUBS (RACC AND RACE) SAY?

The Royal Automobile Club of Catalonia (RACC) reminds that "it is compulsory to use the helmet for road journeys, but it is also recommend using it in town."

The Royal Automobile Club of Spain (RACE), reminds that the bicycle helmet "is required on interurban roads, but it should also be used in town. It is our only passive safety devise and absorbs the energy of an impact to the head. Whether you are a professional cyclist, a cyclo-tourist or a beginner, do ALWAYS wear a helmet."

Sources:
1.www.racc.es/pub/ficheros/adjuntos/adjuntos_consejos_conduccion_responsable_jzq_e75d736b.pdf
2. www.race.es/seguridad-vial/campanas/seguridad-vial-ciclistas/recomendaciones

CONCLUSIONS

In Spain in 2010 bicycles were involved in 3,606 accidents with victims in which 67 cyclists were killed and 3,429 others were injured.

Head injuries are responsible for about three-quarters of all deaths of cyclists.

A recent study in Spain of 67 fatalities of children under 15, including five cyclists aged between 5 and 12 who died, found that all of them had suffered head injuries. In three out of these five cases, head injuries were the most serious injuries (in the two other cases the body area most seriously injured could not be determined, so the head cannot be ruled out). None of the five children who died used a helmet. In view of this information, it is apparent that the bicycle helmet is an injury protection element of maximum relevance in Spain.

According to different estimations, helmets provide a reduction of between 42% and 88% of all severe head (skull and scalp) and brain injury, for all ages of riders. The effectiveness in the case of facial wounds, especially in the lower areas, is smaller, and there is disagreement as to the relationship between the helmet and neck injuries.

International evidence shows that bicycle helmets are effective, both in the case of an accident by a fall of the rider on the roadway without the intervention of any motor vehicle, as well as in the case of collisions between bicycles and motor vehicles.

The effectiveness of bicycle helmets in the case of children is greater than in the case of adults since children suffer more falls, more head injuries and, therefore, the protective effect of helmets is more significant to them.

According to the European Road Safety Observatory (ERSO), the lack of visibility is an important factor in many accidents involving cyclists. While international literature provides little specific data on the effectiveness in reducing accidents of the use of bright colors and retro-reflective garments, it is clear that such use constitutes one of the basic ways to alleviate the aforementioned cyclists´ lack of visibility in many accidents. The use of such garments, therefore, should also be promoted during the day (bright colored and fluorescent clothes) and at night (retro-reflective clothing).

In addition to the above findings, and as a result of all the information gathered in this paper, the following final recommendations can be offered:

1. It is necessary to conduct a study on cyclist accident rates in order to quantify the current prevalence of head injuries in Spain and the estimated effectiveness bicycle helmets in our country.

2. It is also recommended to determine the utilization rates of bicycle helmets as part of the periodic reviews of the use of protection systems (belts, child restraints, motorcycle helmet and daytime running lights) that are conducted annually in Spain.

3. Until the use of the helmet becomes universally accepted and materialized on public roads, it is recommended to carry out campaigns to promote voluntary use of bicycle helmets.

4. The same recommendation as mentioned above can be applied to high-visibility clothing for cyclists (wearing bright, fluorescent colors during daytime and clothes with retro-reflective materials during the night).

5. Since the bicycle helmet is more effective in the case of children, and since the duty of guardianship of children is unquestionable, it is recommended to take into consideration the compulsory use of bicycle helmets among children as soon as possible.

6. Since the bicycle is a healthy and sustainable means of transport, and since therefore its use should be promoted as part of mobility policies, it is recommended to pay more attention to the future safety of this group of road users.

Furthermore, various associations of Spanish and European cyclists oppose to mandatory use of helmet arguing that it could translate into less use of bicycles and a reduction of the positive effects that cycling offers to health, traffic and the environment. Therefore, it is necessary to continue the social and technical debate that allows the following question to be addressed: How can cycling be promoted as a form of leisure and a healthy and sustainable mode of transport, while at the same time achieve the universal use of the bicycle helmet, an element with a demonstrated effectiveness in preventing injuries?