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Nota / Note

RIDING A BICYCLE... WITH OR WITHOUT A HELMET: PERCEPTIONS AND ATTITUDES CONCERNING HELMET USE AMONG FIGUEIRA DA FOZ YOUNG PEOPLE (2014-2016)*

ANDAR DE BICICLETA... CAPACETE, USAR OU NÃO? EIS A QUESTÃO: FATORES DETERMINANTES EM JOVENS DO CONCELHO DA FIGUEIRA DA FOZ (2014-2016)

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ABSTRACT

Traumatic brain injury is the leading cause of death and serious disability in bicycle accidents. We developed a study to examine local patterns of bicycle helmet use among young people in Figueira da Foz. We conducted a survey in which a questionnaire was applied to a sample of 1089 cyclists who were pupils in the Figueira da Foz Municipal District Schools. The questionnaire was designed to measure motivations relating to helmet ownership and use when riding a bicycle. In order to determine independent determinants, adjusted odds ratios were calculated by logistic regression analysis. Twenty-seven per cent of the cyclists were found to have experienced at least one accident along with traumatic brain injury, with the risk being higher in boys (aOR: 1.9; CI:95 %:1,5-2,6; p<0,05). Ninety per cent of the accidents did not involve a motor-vehicle, only the cyclist; they were caused by the cyclist losing control or hitting obstacles. Helmet use is determined according to literacy (OR: 2.5; CI:95 %:1,6-3,6; p<0,05), 5th and 8th school grade (OR: 3.6; CI:95 %:2,3-5,7; p<0,05 and a OR: 1.9; CI:95 %:1,3-2,7; p<0,05, respectively), and recreational cycling (OR: 2.8; CI:95 %:1,3-5,9; p<0,05). Most cyclists are not proactive, which is borne out by 77 % considering the helmet the most important equipment, while only 28 % use it frequently. Age is one of the most significant individual factors associated with helmet use. School-based programmes might increase its use among children. The helmet is an individual protection that should be encouraged.

Keywords: Accident, bicycle, helmet, traumatic brain injury.

RESUMO

Os traumatismos cranioencefálicos constituem a principal causa de morte e incapacidade grave nos acidentes de bicicleta. Realizou-se um estudo para identificar os fatores determinantes na sua utilização pelos jovens no Concelho da Figueira da Foz. Definiu-se uma amostra de 1089 alunos ciclistas, matriculados nos Agrupamentos de Escolas do Concelho da Figueira da Foz. Aplicou-se inquérito por questionário, auto-preenchido, medindo as motivações relativamente à titularidade e utilização do capacete. Na identificação dos fatores determinantes incluímos as variáveis independentes num modelo de análise de regressão logística múltipla, calculando-se os Odds Ratios ajustados. Registou-se que 27 % dos alunos referiram a experiência de pelo menos um acidente de bicicleta com traumatismo cranioencefálico, sendo esse risco superior nos rapazes (ORa: 1,9; IC:95 %:1,5-2,6; p<0,05). Em 90 % dos acidentados, não intervieram veículos automóveis ou motorizados, envolvendo apenas o próprio ciclista, resultado de despistes ou colisões com obstáculos. A utilização do capacete é determinada consoante a literacia (OR: 2,5; IC:95 %:1,6-3,6; p<0,05), o 5º e 8º ano de escolaridade (OR: 3,6; IC:95 %:2,3-5,7; p<0,05 e ORa: 1,9; IC:95 %:1,3-2,7; p<0,05, respetivamente) e a utilização recreativa da bicicleta (OR: 2,8; IC:95 %:1,3-5,9; p<0,05). A ausência de pro-atividade no uso do capacete, evidenciou-se quando 77 % dos alunos consideravam-no o equipamento mais importante, e apenas 28 % o utilizavam regularmente. A idade é um dos principais fatores determinantes na utilização do capacete. As campanhas de promoção poderão ser eficazes nas crianças em idade escolar. O capacete é uma proteção individual que deve ser incentivada.

Palavras-chave: Acidente, bicicleta, capacete, traumatismo cranioencefálico.

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Introduction

Although the ever growing "virtual" childhood, bicycles still remain quite popular among children, as approximately 90 % of children own a bicycle by the time they are in third grade (Eufrásio R *et al.*, 2015). More than toys, they represent freedom and also a good way to keep them physically active. However, some of the expected health benefits while riding the bicycle are lost due to injuries, which may cause permanent disabilities and sometimes even become fatal (Kotler DH *et al.*, 2016; Linsday H *et al.*, 2014; WHO, 2006; WHO, 2008).

In the United States of America (USA), more children (5-14 years) and adolescents are seen in emergency departments for bicycle related injuries, than any other sport or recreational activity (SAFE KIDS WORLDWIDE, 2016). Nearly 66 % of such serious injuries require hospital admission (WHO, 2008).[6] Almost 25 % of all traumatic brain injuries (TBIs) in children, are bicycle related (Berg *et al.*, 2001). According to the World Health Organization, 75 % of deaths among injured bicyclists are due to TBIs, making it the leading cause of serious disability and death in bicycle crashes (WHO, 2006; WHO, 2008).

In the European Union, between 2008 and 2010, TBIs represented a considerable proportion among all road traffic injuries, particularly among those that led to hospital admission (36 % for pedestrians, 34 % for bicyclists, and 24 % for motorcycles) (EUROSAFE, 2013).

In Portugal, between 1999-2022, as reported by the National Authority on Road Safety, there were 41.645 bicyclists injured (3,7 % of the people injured in road traffic injuries in the time period) (ANSR, 1999-2022). For every 26 road traffic fatalities, one as due to a bicycle crash (ANSR, 1999-2022). The overall annual percentage of injured bicyclists has been steadily on the rising since 2010 up to 2022 (2,6 % and 6,9 %, respectively) (ANSR, 1999-2022). The highest annual number of bicyclists injured in road traffic crashes occurred in 2022 (n=2958) (ANSR, 1999-2022). This rise, as elsewhere, might result, from the rising commute with the bicycle, as a sustainable and affordable transport, among road users (WHO, 2006; WHO, 2008).

Fortunately we know the hazards of bicycling, making their prevention possible. In order to do so, it is important to follow some safety rules, such as always wearing a properly fitted bicycle helmet. It provides one of the few protections available for bicyclists, which can prevent the severity of a TBI resulting from a bicycle crash, thereby reducing the number of those killed or disabled (WHO, 2006; WHO, 2008; SAFE KIDS WORLDWIDE, 2016; Department of Transport, 2002; Kauschik *et al.*, 2015; CDC, 1995). In fact, over the years, systematic reviews have found that helmets reduce the risk of head injury by 48%-88%, severe brain injury by 60%-88% and face injury by 23%-33%, among bicyclists of all ages (Thompson D.C. *et al.*, 2000; Elvik R, 2011; Olivier *et al.*, 2017; Høye A, 2018).

Although the effective protection that bicycle helmets provide, their use remains low among school-age children, the group for whom TBI's incidence is the highest (SAFE KIDS WORLDWIDE, 2016; Berg *et al.*, 2001; CDC, 1995). This growing concern has led to the development of this study in order to ascertain attitudes regarding 1) bicycling, 2) helmet use and 3) to identify its predictors among school-age children in Figueira da Foz Municipality (Portugal); this way allowing to responsibly place additional focus on planning bicycle helmet programs to prevent head injuries.

Methods

In order to measure the students' perceptions, attitudes and motivations regarding the use of the bicycle and helmet, we conducted a school based survey over a three year period (2014-2016), applying an anonymous questionnaire to a sample of 1294 students involving all of the Figueira da Foz Municipality Schools. The study population, were students from the 5th, 8th, and 11th grades who participated for the first time in the school health/safety program: *"Safety on Wheels - Bicycle, Skateboard and Roller-Skate - Helmet Campaign."* The study was duly authorized by the School Boards of *Agrupamento de Escolas Figueira Mar*, *Agrupamento de Escolas do Paião*, *Escola Dr. Joaquim de Carvalho*, *Agrupamento de Escolas da Zona Urbana da Figueira da Foz* and *Agrupamento de Escolas Figueira Norte*.

The questionnaire of the *"National Survey Bike Helmet Usage"* of the US Consumer Product Safety was adapted, meeting the defined objectives.

The students were invited to complete a questionnaire, filled in a form on paper, in the classroom, at the beginning of each program session. Its completion took approximately 12 minutes.

The survey had 15 questions from which we defined and grouped the variables in study. It collected information about demographic characteristics such as age, gender, school grade, and geographical area (urban/rural). Although the survey also questioned ridership of wheeled sports (skateboard, roller/inline skates and bicycle), it focused on bicycle ridership and helmet use patterns: how many owned helmets, their frequency of use, the reasons they did or did not own and used helmets. Experience with bicycle related head injuries was derived from a question that asserted whether students ever had a head injury while riding a bicycle. If so, they were then asked to describe how it occurred. We use the term "bicyclist" to describe those who reported riding a bicycle at least once in the past year. Students were

asked *"When riding the bicycle, which of the following equipments is the most important - speedometer, helmet, bottle of water, bell, lights or reflective gear?"* Those, who answered the *"helmet"*, defined the variable "safety literacy".

Students were asked *"With what purpose and how often do you ride your bicycle?"* Responses included as purpose *"from home to school"*, *"transportation"*, *"recreational activity"* or *"sport"*. Responses included as frequency *"every day"*, *"several times a week"*, *"once a week"*, *"a few times a month"*, *"once a month"* or *"never"*. Students who said that they used a helmet either *"often"* or *"always"* were considered to be helmet users.

The primary objective of the analysis was to identify factors that predicted bicycle helmet use. Bicycle ridership and helmet use were profiled using conventional descriptive statistics, by sex, school grade (used as a proxy for age), and geographic location.

Students who reported that they did not ride bicycles were excluded from the analysis. Overall, 85,8 % (1089/1269) of the students enrolled, reported riding a bicycle (study population).

The dependent variables were bicycle related head injury and helmet use.

The chi-square test was implemented. A two-sided *p* value of 0,05 was considered statistically significant. In order to determine independent predictors, adjusted odds ratios and 95 % confidence intervals were calculated by multivariate logistic regression analysis. Statistical analysis was conducted using SPSS™ (IBM SPSS Statistics version 21). The response rate was of 98 % (1269/1294). Most of the respondents were from 8th grade (54,5 %), followed by 11th (32,2 %) and 5th grade (13,2 %).

Results

Overall, 85,8 % (1089/1269) of the respondent students rode a bicycle, of whom 51 % (555/1089) were boys.

Purpose of Bicycling Trips

Overall, 14 % of the bicyclists reported commuting to and from school (riding at least once a month), which was higher among 8th and 5th grade (16,7 % and 12,9 %, espectively) rather than those in the 11th grade (10,9%). It was reported among 23,2 % and 12,4 % of those who attended schools in rural and urban settings, respectively. Only 1,4 %, 2,5 %, and 0,6 %, among those in the 5th, 8th and 11th grade, reported riding a bicycle every day to school, respectively.

Over half of the bicyclists (51,4 %) rode it as an utility vehicle (active transportation other than to school); around 60,3 %, 49,9 % and 50,5 %, among 5th, 8th and 11th grade students, respectively. It was reported among 45,3 % and 52,9 % of those who attended schools in rural and urban settings, respectively.

The bicycle was used for exercise/sport by 83,7 % of the bicyclists; around 90,1 %, 83,1 % and 82 % among 5th, 8th and 11th grade students, respectively. It was reported among 81,3 % and 84,2 % of those who attended schools in rural and urban settings, respectively (Table I).

The majority (93,3 %) of the bicycling trips were for recreation; around 93 %, 94 % and 92 % among 5th, 8th and 11th grade students, respectively. It was reported among 94,1 % and 93,2 % of those who attended schools in rural and urban settings, respectively (Table I).

Bicycle-related Head Injury

Among the overall bicyclists, 26,6 % (290/1089) knew someone who had been in an crash with a head injury; while 27,5 % (299/1089) reported having such crash at least once; around 20,3 %, 28, 9 % and 27,9 % among 5th, 8th and 11th grade, respectively; as well as 30,5 % and 26,7 % of those who attended schools in rural and urban settings (Table I). Boys were more likely to report such crashes (aOR: 1,97 p<0,05) (Table II). Only 10,4 % of those self-reported crashes involved motor-vehicles (road traffic or inopportune door openings), evidencing that most of them were caused by losing control when bicycling (the three most common): unbalance (29,1 %), pavement conditions (20 %) and road obstacles (11,7 %) (fig. 1).

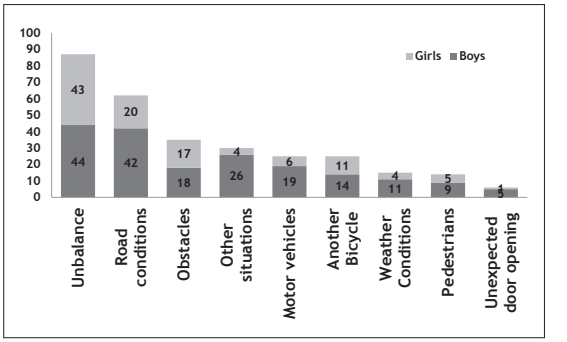

Fig. 1 - Number of self-reported bicycle accidents with head injuries, by cause, among the study cyclists' sample, in the Figueira da Foz municipality, 2014-2016.

***Fig. 1 -** Mecanismos causais de acidentes de bicicleta com ocorrência de traumatismo cranioencefálico, distribuidos por sexo, em alunos ciclistas no Concelho da Figueira da Foz, 2014-2016.*

Safety literacy

Most of the bicyclists (76,7 %) reported the helmet as the most important equipment one should wear, where such consideration was similar among boys and girls (74,5 % and 79,0 %), rural and urban areas (77,9 % and 76,5 %)

respectively. Nonetheless, this opinion had a wider range along the school grades, from 88 %, 79,1 % to 67,2 % among the 5th, 8th and 11th grade, respectively (Table I).

Bicycle helmet ownership and wear

Among the 43,3 % bicyclists who reported not owning a helmet (Table I), around 30,8 % stated as their main reason *"riding few times"*, which was also the most common one among girls (43,2 %) while *"discomfort"* (23,8 % overall) was the one most reported among boys (28,3 %) (fig. 2).

Among the bicyclists who reported owning a helmet (56,7 %) (Table), over half (58,9 %) reported *"safety standards"* and 17,8 % the *"comfort"* as the main factors considered when purchasing it (fig. 3). Helmet ownership was higher among boys (57,3 %), 5th grade (67,8 %) and those that attended school in urban areas (57,1 %) (Table I).

Among those helmet owners, 50,3 % did not wear it regularly. The main reasons included *"riding short distances"* (25,4 %), *"forgetfulness"* (17,4 %) and *"discomfort"* (17 %) (fig. 4). Those 49,7 % wearing it regularly, reported *"safety"* (81 %) followed by *"parental encouragement"* (17,2 %) as the main factors influencing their decision.

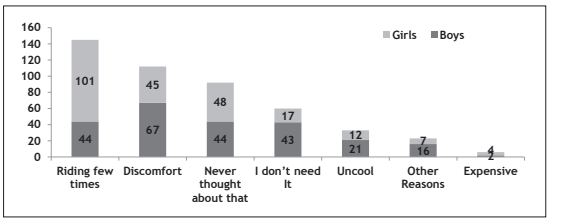

Fig. 2 - Main reasons for NOT owning a helmet, among the study cyclists' sample, in the Figueira da Foz municipality, 2014-2016 (N=471).

***Fig. 2 -** Principais motivos para a não titularidade do capacete, distribuídos por sexo, em alunos ciclistas no Concelho da Figueira da Foz, 2014-2016 (N=471).*

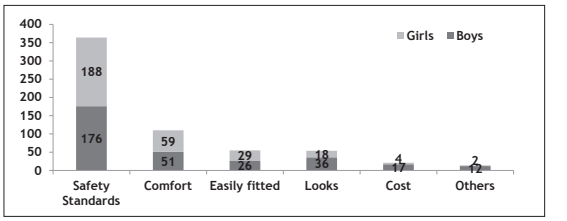

Fig. 3 - Main reasons taken into account when purchasing a helmet, among the study cyclists' sample, in the Figueira da Foz municipality, 2014-2016 (N=618).

***Fig. 3 -** Principais motivos considerados na aquisição de capacete, distribuídos por sexo, em alunos ciclistas no Concelho da Figueira da Foz, 2014-2016 (N=618).*

Table I - A description of the overall study sample, bicycle ridership, owning and wearing a helmet in the Figueira da Foz municipality, 2014-2016.

***Tabela I -** Taxas de utilização da bicicleta, titularidade e utilização do capacete por variável em estudo, em alunos ciclistas no Concelho da Figueira da Foz, 2014-2016.*

Study Variables (N=1089)	Bicyclists[a]	Bicycle Helmet Owners[b]	Bicycle Helmet Use[b]
	n (%)	n (%)	n (%)
Gender			
Boys	555 (51)	318 (57,3)	150 (27)
Girls	534 (49)	300 (56,2)	157 (29,4)
School Grade			
5° th	143 (13,1)	97 (67,8)	67 (46,8)
8° th	613 (56,3)	362 (59,1)	179 (29,2)
11° th	333 (30,6)	159 (47,7)	61 (18,3)
Geographical Area			
Rural	203 (18,6)	112 (55,2)	49 (24,1)
Urban	886 (81,4)	506 (57,1)	258 (29,1)
Safety Literacy			
Bicycle Helmet	818 (76,7)	500 (61,1)	266 (32,5)
Lights/Reflective gear	127 (11,9)	52 (40,9)	-
Bottle of Water	77 (7,2)	30 (39,0)	-
Speedometer	32 (3,0)	21 (65,6)	-
Bell	12 (1,1)	5 (41,7)	-
Purpose of Bicycling Trips			
Commuting to School	156 (14,4)	93 (59,6)	44 (28,2)
Utility Vehicle	555 (51,4)	317 (57,1)	155 (27,9)
Recreation	1007 (93,3)	590 (58,6)	295 (29,3)
Exercise/Sport	903 (83,7)	529 (58,6)	268 (29,7)
Bicycle-related Head Injury			
	299 (27,5)	163 (54,5)	83 (27,7)
Helmet Ownership			
	618 (56,7)	-	307 (49,7)

a) read in column; b) read in line.

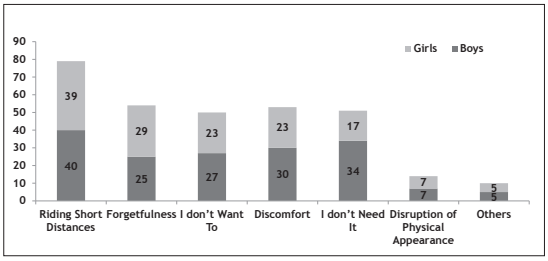

Fig. 4 - Main reasons for NOT wearing a helmet, for those cyclists among the study cyclists' sample who OWN a helmet, in the Figueira da Foz municipality, 2014-2016 (N=311).

***Fig. 4 -** Principais motivos para a não utilização do capacete, entre titulares, distribuídos por sexo, em alunos ciclistas no Concelho da Figueira da Foz, 2014-2016 (N=311).*

Among the bicyclists, 60 % reported they never wore a helmet or did not have access to one; 28,2 % reported that they wore it for all (16 %) or more than half the rides (12,2 %); while 11,8 % reported wearing the helmet less than half of their rides.

The overall helmet wear (28,2 %), was quite similar among girls and boys, 29,4 % and 27,0 %, respectively. It was higher among those youngest (46,8 %, 29,2 % and 18,3 %, in the 5th, 8th and 11 grade, respectively) (Table I).

The adjusted odds of wearing the helmet was significantly higher among recreational cycling ($_{a}$OR: 2,8; p<0,05), safety literacy ($_{a}$OR: 2,5; p<0,05), and school grade - 5th and 8th (OR: 3,6; p<0,05 and OR: 1,9; p<0,05, respectively) hence identified as predictors associated with helmet use (Table II).

Discussion

Purpose of Bicycling Trips

It is evident the popularity of the bicycle among the students surveyed, higher than the one registered in the USA (61 %) (Jewett Amy *et al.*, 2012) and Canada (74 %) (Davison *et al.*, 2013).

Table II - Results of multiple logistic regression analysis examining direct effects of specific variables on bicycle helmet use and bicycling-related injury in the Figueira da Foz Municipality, 2014-2016.

***Tabela II -** Análise de regressão logística múltipla relativa aos determinantes de utilização do capacete e ocorrência de acidentes com traumatismo cranioencefálicos, em alunos ciclistas no Concelho da Figueira da Foz, 2014-2016.*

Study Variables	Bicycle Helmet Use		*P Value*	Bicycle Related Head Injury		*P Value*
	n (%)	$_{a}$OR (CI 95%)		n (%)	$_{a}$OR (CI 95%)	
Gender						
Boys (n=555)	150 (27,0)	1,0		188 (33,9)	1,977 (1,502 -2,602)	< 0,05
Girls (n=534)	157 (29,4)	1,114 (0,836 - 1,484)	0,461	111 (20,8)	1,0	
School Grade						
11th (n=333)	61 (18,3)	1,0		93 (27,9)	1,0	-
5th (n=143)	67 (46,8)	3,638 (2,311 - 5,725)	< 0,05	29 (20,3)	0,663 (0,412 - 1,069)	0,092
8th (n=613)	179 (29,2)	1,885 (1,314 - 2,706)	a 0,05	177 (28,9)	1,008 (0,728 - 1,396)	0,963
Geographical Area						
Rural (n=203)	49 (24,1)	1,0		62 (30,5)	1,205 (0,829 - 1,750)	0,321
Urban (n=886)	258 (29,1)	1,402 (0,995 - 2,208)	0,053	237 (26,7)	1,0	
Safety Literacy						
	266 (32,5)	2,454 (1,658 - 3,632)	a 0,05	-	-	-
Purpose of Bicycling Trips						
Commuting to School	44 (28,2)	1,064 (0,701- 1,615)	0,770	-	-	-
Utility Vehicle	155 (27,9)	0,836 (0,627 - 1,115)	0,223	-	-	-
Recreation	295 (29,3)	2,814 (1,345 - 5,889)	0,006	-	-	-
Exercise/Sport	268 (29,7)	1,389 (0,917 - 2,103)	0,121	-	-	-
Bicycle-related Head Injury						
	83 (27,8)	1,089 (0,789 - 1,503)	0,604	-	-	-

aOR (adjusted odds ratio); CI (Confidence Interval).

Bicycling combines physical and recreational activity, providing also transportation environmentally sustainable. Nonetheless, safety concerns are often quoted as the most important barriers preventing a broader choose of this mean of transportation. Previous studies have shown that the fear of unsafe roads and the increased risk for bicyclists to face a crash-related injury, are powerful deterrents that may stop parents from allowing their children to cycle (WHO, 2004; WHO, 2006; WHO, 2007; Everett *et al.*, 2016; Everson *et al.*, 2003; Rivara *et al.*, 1997); Timperio *et al.*, 2006; DiGuiseppi *et al.*, 1989).

The proportion of bicyclists that reported commuting to school, was similar to that estimated in other studies (fewer than 20 %) (WHO, 2004; Everett *et al.*, 2016; Everson *et al.*, 2003). High school students are less likely to commute, than those in middle school, as concluded elsewhere (Everson *et al.*, 2003; Timperio, 2006). Along with getting motorcycle driver's licence, or simply just not interested in riding the bicycle, one other possible reason is the distance from home to school which may be, on average, greater for students in high schools (Everett *et al.*, 2016; Everson *et al.*, 2003; Timperio *et al.*, 2006). Distance is a well known barrier to active school transport (WHO, 2004, Everett *et al.*, 2016; Everson *et al.*, 2003; Timperio *et al.*, 2006). Other studies, demonstrated that commuting was the most common among students who attended schools in urban settings, unlike our results (Everett *et al.*, 2016). Eighty six per cent of the bicyclists reported never having ridden from home to school, posing an interesting challenge to the school community, which is one of the main intervention areas duly stated in the National School Health Program aiming to promote sustainable transportations (DGS, 2015).

Enabling more students bicycling to school will require collaborative efforts among local government, public health and school officials, addressing school setting and bicycle infrastructure in order to ensure safe commutes (Everett *et al.*, 2016).

Bicycle-related Head Injury

Although the superficial injuries are the most common, mainly located to the arms and legs (Linsday *et al.*, 2014; ROSPA, 2015; Rivara *et al.*, 1997; Dinh *et al.*, 2015; Teisch *et al.*, 2015) the effects of a TBI can be quite profound, disabling and long-lasting, hence creating a serious burden up on the victims' families and also on the society (WHO, 2004; Costa *et al.*, 2015; ROSPA, 2015; Scholten *et al.*, 2015; Teisch *et al.*, 2015; Zibung *et al.*, 2016). More bicyclists reported at least one crash with a head injury, than those reported in Canada (5 %) (Davison *et al.*, 2013). It can be reasoned that the frequency of reported bicycle-related head injuries is not neglectable. Among those reporting a head injury, 89,6 % had no motor-vehicles involved, a proportion higher than that registered in the Netherlands (75 %) (SWOV, 2013). Studies have also demonstrated that most of the crashes involve only the bicyclist, often caused by falls, loss of control or collisions with other obstacles (CDC, 1995; WHO, 2007).

Boys had a higher likelihood of a reported bicycle-related head injury, a similar result to that reported in other studies and reports, which have demonstrated boys being more likely to be injured than girls (Linsday *et al.*, 2014; Kauschik *et al.*, 2015; Jones *et al.*, 2009; Linsday *et al.*, 2014; Klein *et al.*, 2005; NHTSA, 2020).

The higher frequency of reported head injuries among 8th and 11th grade (although not statistically significant), may be attributed to them undertaking higher risk behaviours when bicycling (ROSPA, 2015; Jones *et al.*, 2009; Linsday *et al.*, 2014; Klein *et al.*, 2005; Lajunen *et al.*, 2001). In fact, adolescence is a time for exploration, testing the limits in which the sensation-seeking may be gratifying and greatly influenced by peer pressure (WHO, 2008; Rivara *et al.*, 1997).

Although not statistically significant, head injuries also appear to be more likely among bicyclists in rural settings, as also demonstrated in other studies (Davison *et al.*, 2013).

Bicycle helmet ownership and wear

Over half of the bicyclists reported owning a helmet, similar to previous studies, ranging from 46 % to 84 % (Ross *et al.*, 2010).

Not only the percentage of bicyclists, but also the reasons for not owning a helmet are similar to those reported more than 20 years ago in Great Britain (around 40 % of bicyclists, stated *"no particular reason for not having one"*, *"looked silly"*, *"cost"*, *"not enough risk to justify"*) (Taylor *et al.*, 1996).

The proportion of those students who reported wearing the helmet regularly, was lower than in the USA and Canada (40 %) (SAFE KIDS WORLDWIDE, 2016; Jewett Amy *et al.*, 2016; Davison *et al.*, 2013).

Helmet use was slightly higher among girls, unlike in Canada, where it was higher among boys (78 %) (Davison *et al.*, 2013). It was also higher among students attending schools in urban areas unlike rural ones, which some suggest it to be related to socioeconomic factors (Klein *et al.*, 2005; Lajunen *et al.*, 2001; Harlos *et al.*, 1999).

Other studies have also demonstrated higher likelihood of helmet use for recreational purposes (Klein KS *et al.*, 2005; Lajunen *et al.*, 2001; Harlos *et al.*, 1999).

Age is one of the most significant individual predictors of helmet wearing. As a result, as children grow up,

they are less likely to use bicycle helmets. Its use was higher among the youngest as demonstrated elsewhere (Jewett Amy *et al.*, 2016; Davison *et al.*, 2013; Klein *et al.*, 2005; Lajunen *et al.*, 2001). A study conducted in Ontario (Canada) indicated similar trend along with a higher helmet wearing among 12-14 year old and lowest among 15-18 year old, 72 % and 33 %, respectively (Irvine *et al.*, 2002).

The odds of wearing the helmet among 5th grade, was three times higher than of those in the 11th grade. This may be attributed to the fact that those youngest are more likely to comply with their parent's instructions, highlighting the educational impact concerning the helmets wearing incentive (Berg *et al.*, 2001; Jewett Amy *et al.*, 2012; Davison *et al.*, 2013; Klein *et al.*, 2005; Lajunen *et al.*, 2001; Irvine *et al.*, 2002). As adolescents develop their curiosity and will to experiment, they are not always able to understand and respond to eventual hazards, often disregarding their parents, hence diminishing ones influence, as they grow older (WHO, 2008; ROSPA, 2015; Irvine *et al.*, 2002).

Over 70 % of the students did not wear the helmet regularly, although recognized as one of the few safety measures available to protect from severe head injuries in case of an accident (Dinh *et al.*, 2015; Irvine *et al.*, 2002; Zibung *et al.*, 2015; Sethi *et al.*, 2015; Kett *et al.*, 2016; Persaud *et al.*, 2012). In fact, more than half reported never wearing the helmet, unlike other studies which have shown data around 30 % (Jewett Amy *et al.*, 2016).

Previous studies have consistently noted several barriers to helmet wear, which are quite similar to those present in our findings. Among those barriers we have cost, lack of knowledge regarding its effectiveness, negative peer pressure, riding short distances, discomfort, forgetfulness, inconvenience, disruption of physical appearance, concerns about ridicule, and socioeconomic factors (Berg *et al.*, 2001; EURO SAFE, 2013; DEPARTMENT OF TRANSPORT, 2002; CDC, 1995; Klein *et al.*, 2005; Lajunen *et al.*, 2001; Ross *et al.*, 2010; A Irvine *et al.*, 2002).

It is worth to point out a reason mentioned by a bicyclist for not wearing the helmet: *"I've never hit my head"*. It is worrisome when their safety and risk perceptions, once waiting for such injuries to happen, only then considering the need for protection gear. It is evident the unperceived vulnerability to injury as well as to the ability of the helmet to prevent head injuries, also widely demonstrated in other studies (Kett *et al.*, 2016; Persaud *et al.*, 2012).

Nonetheless, "*safety*" and *"parental encouragement"* were registered as the main reasons among those who reported wearing the helmet, as demonstrated in other studies (Berg *et al.*, 2001; Lajunen *et al.*, 2001). Hence, suggesting continued needed investment in a safety culture influencing parents and peer opinions about safety benefits of bicycle helmets (Berg *et al.*, 2001; Lajunen *et al.*, 2001).

It is essential to understand the individual perceptions and external influences that predict helmet use in order to effectively develop educational promotion programs. Whatever the prevention strategies considered, it is necessary to take into account the children's development in their different contexts and often in dynamic change (WHO, 2006; WHO, 2008). Approaches to overcome some of those known barriers to bicycle helmets include community-based programs and bicycle helmet legislation, which might be particularly effective among school-age children (WHO, 2006; WHO, 2008; Kauschik *et al.*, 2015; CDC, 1995; Jewett Amy *et al.*, 2016; Kett *et al.*, 2016). Several studies have consistently demonstrated in several countries, a direct link between highest rates of bicycle helmet use and the existence of safety intervention programs to promote it (WHO, 2006; WHO, 2007).

There has been a heightened awareness of the importance of wearing helmets: from parents ever more aware of the protection that helmets offer, along with safety standards, helmet legislation, public educational campaigns and better-fitting-looking bicycle helmets have been contributing to encourage helmet use (WHO, 2006; WHO, 2008; Monclus J, 2013).

Limitations

As with all studies, the findings of this one are subject to limitations, which should be considered when interpreting the results. Such findings were based on self-reported information by students following the application of questionnaires, in order to measure their behaviours. Once few evidence is available on reliability and validity of self-reports, there is a risk of both over and underreporting (Brener *et al.*, 2003). The results do not include any observations, hence including several biases such as memory effects, interpretation (possible misunderstanding of questions) and social desirability (Ross TP *et al.*, 2010). Also, the categorization of the variables *"Purpose"*, *"Frequency of Helmet Use"* and *"Geographical Area"* determined a classification bias. Frequency of bicycle and helmet use, were assessed with descriptive terms (*"never"* through to *"always"*) rather than specific periods of time, which may have been misinterpreted by participants. Although the overall study limitations, its results may reflect in some way, those of the overall population offering rapid preliminary and exploratory results. This kind of study is suitable for rapid assessment of groups in a population (Rothman *et al.*, 1998).

Conclusions

Age, safety literacy, and cycling for recreational purposes were identified as the strongest predictors of helmet use in the Figueira da Foz District. In fact, helmet use was higher among children as opposed to adolescents. Although 76,7 % of the bicyclists considered the helmet the most important equipment, its use remained low as only 28,2 % reported wearing it regularly, evidencing a serious lack of pro-activity in its use, which puts a lot of them at a serious risk for TBI in case of a head injury. Such findings present serious reasons for concern, which should be integrated in planning community campaigns promoting bicycle helmet use in Portugal. Such interventions require collaborative efforts among local government officials. One of such should include school-based programs, prioritizing adolescents, over a long period of time, in order to endure those aimed changes in attitudes.

The long time due attention by the duly officials in mobilizing such interventions may help our current reality, once those who begin wearing bicycle helmets early on, are more likely to act accordingly as adults.

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