

**Title:** Expectations of efficacy, social influence and age as predictors of helmet use in a sample of Spanish adolescents.

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## **Abstract**

Despite the proven effectiveness of helmets in avoiding or reducing the severity of brain injuries and the law requiring their compulsory use, both by drivers and passengers of motorcycles, approximately 20% of Spanish adolescent motorcycle users do not wear them. This study analysed the pattern of motorcycle and helmet use in a sample of Spanish adolescents (age range 14 to 17; n= 874) and the relationship this safety measure has with belief in its effectiveness and its use by friends and relatives. Overall more males than females ride motorcycles and this difference increased with age. Motorcycle drivers and passengers who always wear helmets consider them to be more effective than those who do not use a helmet all of the time. The best predictors of helmet use among motorcycle drivers were their beliefs regarding the helmet use of their friends and relatives. In the case of passengers, knowing that their friends always wear them and age were the best predictors of helmet use. Programmes and campaigns promoting helmet use must take into account the modelling effect of close referents or other role models in order to increase their effectiveness.

*Keywords:* Adolescents; Helmet use; Motorcycles; Traffic accidents; Social influence; Preventive behaviour.

## **1. Introduction**

In 2003, 17.9% of all fatal traffic accidents in the European Union involved moped and motorcycle, with Spain ranking third among the constituent countries in terms of the total number of fatal accidents involving these types of vehicles with 758 deaths (Bos et al., 2005). Despite the fact that mortality on Spanish roads has decreased in recent years, the number of fatalities in traffic accidents involving two-wheeled vehicles (the term motorcycle is used to encompass all powered two wheeled vehicles) has not fallen. In 2006 there were 467 deaths, while in 2007 the number rose to 528 (Directorate General of Traffic, 2008) and in 2008 the number of deaths fell to 390 (Directorate General of Traffic, 2009). However, the proportion of motorcycle fatalities is not evenly distributed among the different age groups, with the 15-to-24 year-old age group accounting for 34.2% of all motorcycle-related fatalities in Spain (Bos et al., 2005), and a substantial number of serious injuries. Traumatic brain injuries and facial trauma are the most frequent injuries suffered by victims of motorcycle accidents, and represent 50% of all deaths from traumatic injuries (Moore, Mattox & Feliciano, 2003). As is the case with victims of traffic accidents in general (Twisk, 2007), males are over-represented in the statistics. In 2006, 98% of the motorcycling deaths on Spanish roads in the 15 to 20 year age group were male (Directorate General of Traffic, 2007). Furthermore, in the first half of 2008 79.3% of those killed on Catalan roads (Catalonia, Spain) were also male (119 victims), with 20.6% being female (31 victims) (Catalan Traffic Service, 2008).

Since 1982, adolescents in Spain have been able to obtain a license that authorises them to drive a motorcycle (a two-wheeled vehicle whose engine capacity does not exceed 50cc) at 14 years of age. However, in recent years there has been much debate about whether to increase the age at which young people can drive motorcycles. Two arguments seem to justify an increase in the age for obtaining a motorcycle licence: the high accident rate for these types of vehicles recorded in 2004 and the adaptation of Spanish regulations to the European Directive. However, motoring associations and the automotive industry in general have criticised this proposed increase in age, which they consider unwarranted according to the accident statistics (Pàmies, 2005). Other research, however, highlights the increase in the accident rate involving motorcycles following the modification of the law in 1982, which allowed motorcycles to be ridden by 14 year olds (16 years old before this law) (Villalbí & Pérez, 2006). After years of debate, a law was recently passed that raises the minimum age for driving motorcycles to 15, although this law will not take effect until 2010. Furthermore, from this date motorcycle drivers will not be able to carry passengers until they are aged 18 (BOE, 2008). From a preventative point of view, is this legislative change warranted? Perhaps not, as previous research has shown that among adolescent motorcycle drivers, age is neither associated with a higher accident rate nor with greater helmet use by motorcycle drivers or passengers (Pileggi, Bianco, Nobile & Angelillo, 2006).

The results of numerous studies show the effectiveness of helmets in avoiding or reducing the severity of injuries in the advent of a motorcycle accident

(Hundley et al., 2004; Keng, 2005; La Torre, 2003; León & Hernández, 2004; Liu et al., 2004). Despite the proven effectiveness of helmets in avoiding or reducing the severity of brain injuries and the legislation requiring their use by both drivers and passengers of motorcycles in Spain since 1992, research has found 29% of those killed in motorcycle accidents in 2007 were not wearing a helmet at the time of the accident (Spanish Interior Ministry, 2008).

Previous research has identified a number of variables which are related to adopting preventive behaviours when driving, including; social influence (Bianco, Trani, Santoro & Angelillo, 2005, State of Hawaii Department of Transportation, 2004; Canada Safety Council, 2006), belief in the effectiveness of the behaviour (Gras, Cunill, Sullman, Planes & Font-Mayolas, 2007) and the immediate consequences of its use (Block, 2001; Chiliaoutakis et al., 2000; Cunill, Gras, Planes, Oliveras & Sullman, 2004; Cunill, Gras, Sullman & Planes, 2005).

These variables are included in the social cognitive theory of Bandura and Walters (1963), which has been used as a predictive model of risk and prevention behaviours among vehicle drivers. According to the social cognitive theory, much of social learning results from observations of real actions carried out by others as well as the consequences involved. Bandura (1986) stresses that, in acquiring a skill, the model constitutes a learning rule. In accordance with this model, social approval of behaviour may change risky behaviour, especially among young people and adolescents. Helmet use by adolescents, when travelling by motorcycle, is closely related to the beliefs of friends and

relatives regarding the use of this safety measure (Bianco et al., 2005). Similar results have also been found in the Spanish population in relation to other preventive behaviours, such as seat belt use (Cunill et al., 2004; Gras et al., 2007). Bandura's (1991) model also considers the expectation of a positive consequence of the behaviour as another variable that predicts it being adopted. Therefore, the belief that using a helmet is an effective behaviour for reducing injuries or avoiding being killed in a motorcycle accident should be a predictor variable of the use of this safety measure (Fuentes, 2005; Gras et al., 2007).

### *1.1 Goals of the Study*

The aims of this study were to: 1) investigate the pattern of motorcycle and helmet use by adolescents and to analyse differences by gender and age; 2) evaluate boys' and girls' beliefs about the effectiveness of a helmet for avoiding serious injuries and death from motorcycle accidents, and its relation to self-reported use among motorcycle drivers and passengers; 3) study the relationship between self-reported helmet use and beliefs about the pattern of helmet use by friends and relatives among adolescents who travel by motorcycle as drivers and as passengers; and 4) identify which of these variables distinguish between helmet users and non-users.

## **2. Method**

### *2.1. Sample*

The participants were 874 secondary education students from all of the public secondary schools in the city of Girona (Spain), which represented 76.6% of the

total student enrolment at the schools. The sample contained 409 males (46.8%) and 465 females (53.2%) whose ages ranged from 14 to 17 (Mean = 15.08; SD = 0.82), with 95.5% being 16 or younger. The average age of the males was 15.09 (SD = 0.81) and 15.08 (SD = 0.84) for females.

## *2.2. Material*

Data were collected using an instrument designed for this purpose, which measured; demographic details (gender and age), motorcycle and helmet use among motorcycle users, along with efficacy expectations and beliefs concerning helmet use by the participants' friends and relatives.

The questions related to the pattern of motorcycle use were "How often do you drive your own or a borrowed motorcycle?" and "How often do you ride as a passenger on a motorcycle?". These questions were not mutually exclusive, as an individual may have travelled by motorcycle (on separate occasions) as both a passenger and a driver. The response options for these questions were "every day, more than once a week, once a week, less than once a week or never". Concerning the pattern of helmet use, the following questions were asked: "If you travel by motorcycle, as the driver, do you wear a helmet?" and "If you travel by motorcycle, as a passenger, do you wear a helmet?". The response options were "always, sometimes or never". To evaluate the expectations of results, participants were asked "To what degree do you believe a helmet is effective in avoiding serious injury or death in the case of a

motorcycle accident?” A Likert-type scale was used with 11 response options (0 = “not at all effective” / 10 = “extremely effective”). Two questions were asked to evaluate the normative beliefs regarding helmet use by relatives and friends: “Do most of your friends wear a helmet when they ride on a motorcycle (as drivers or passengers)?” and “Do most of your relatives wear a helmet when they ride on a motorcycle (as drivers or as passengers)?” The response options were “always, sometimes, never, I don’t know or they don’t travel by motorcycle”.

### *2.3. Procedure*

The first step was to obtain permission to carry out the study from the director of *Serveis Territorials del Departament d'Educació* (Regional Office of the Catalan Ministry of Education) in Girona (Spain). After obtaining approval, the responsible parties for each centre were contacted in order to explain the goals of the research and to request their authorisation. Following this, a time and day was agreed upon to administer the questionnaire to the classes. The teachers were present during the data collection. Participation of the students was voluntary and anonymous. Moreover, confidentiality of the data and the use of the data for research purposes only were also guaranteed beforehand.

All students who were present in the class answered the questionnaire, but there were a number of missing values related to particular questions. The number of participants who answered each question is specified in the results. The data was collected during the 2005-06 academic year.



### 3. Results

Of the participants, 37.6% ( $n= 327$ ) drove a motorcycle with the remaining 62.4% ( $n= 542$ ) reporting that they had never driven a motorcycle. Driving a motorcycle was gender-related, with 23.4% of males and 6.9 % of females ( $X^2_1 = 86.39, p < 0.0005$ ) reporting driving a motorcycle every day, while 46.1% of the males and 76.7% of the females claim to have never ridden one. The vast majority of males (80.7%) and females (81.0%) reported that they always wore a helmet when driving a motorcycle. In addition, two thirds of the participants had ridden a motorcycle as passengers (some of these individuals had also driven a motorcycle) fairly frequently (66%,  $n= 577$ ). Among passengers, 82% ( $n = 464$ ) reported that they always wore a helmet as a passenger on a motorcycle. Table 1 presents the distribution of adolescents by age, motorcycle and helmet use. Motorcycle use both as a driver and as a passenger increased with age and the differences were statistically significant (drivers:  $X^2_2 = 6.1, p = 0.047$ ; passengers:  $X^2_2 = 8.76, p = 0.013$ ). The percentage of motorcycle users who always wore a helmet also increased progressively with age, but the differences were only significant in the case of passengers ( $X^2_2 = 10.51, p = 0.005$ ), and not drivers ( $X^2_2 = 2.61, p = 0.27$ ). Belief in the effectiveness of a helmet for preventing serious injury or death in the event of a motorcycle accident was rated between 7 and 10 (10 being the maximum) by 90% of the respondents, with a mean of 8.49 (SD = 1.58). Table 2 presents the descriptive indices of the variable “belief in helmet effectiveness” according to helmet use and gender of motorcycle drivers and passengers. The results of the Mann-

Whitney test showed that drivers and passengers who always used a helmet considered it to be more effective than those who did not use it on all occasions (Drivers:  $z=-2.5$ ;  $p = .01$  / Passengers:  $z=-3.3$ ;  $P=.001$ ). To evaluate the interaction between helmet use and gender, a two-way ANOVA was used. In agreement with the Mann-Whitney test, drivers who always used a helmet considered it to be more effective than those who did not use it on all occasions ( $F_{1,304} = 10.3$ ;  $p = 0.001$ ). Interestingly the effect of gender was not statistically significant ( $F_{1,304} = 0.23$ ;  $p = 0.63$ ), nor was the interaction effect ( $F_{1,304} = 0.25$ ;  $p = 0.62$ ). In the case of motorcycle passengers, there were also significant main effects for helmet use ( $F_{1,553} = 27.86$ ;  $p < 0.0001$ ) and gender ( $F_{1,553} = 2.02$ ;  $p = 0.046$ ). Among passengers, men believed the helmet to be more effective than women did. Adolescents who always used a helmet when they are motorcycle passengers believed this preventive measure to be more effective in comparison to those who did not always use it. However, there was no interaction effect between these two factors ( $F_{1,553} = 2.02$ ;  $p = 0.16$ ). Furthermore, a three-way ANOVA (for drivers and passengers) was used, which included age, helmet use and gender, but neither the main effect (Drivers:  $F_{2,296} = 2.2$ ;  $p = 0.12$  / Passengers:  $F_{2,545} = .68$ ;  $p = 0.51$ ) or interactions (Drivers: Interaction helmet use and age:  $F_{2,296} = 2.9$ ;  $p = 0.06$ ; third order interaction:  $F_{2,296} = 2.7$ ;  $p = 0.07$  / Passengers: Interaction helmet use and age:  $F_{2,545} = 1.9$ ;  $p = 0.15$ ; third order interaction:  $F_{2,545} = 1.7$ ;  $p = 0.18$ ) were significant.

Of the 868 adolescents who answered the question: “*Do most of your friends wear a helmet when they ride on a motorcycle (as drivers or passengers)?*”, almost half (47.5%) reported that most of their friends always wore a helmet when riding a motorcycle, 36.4% said they wore it occasionally and only 0.6% indicated that their friends never used a helmet. The remainder answered that they did not know (12.7%) or that their friends did not ride motorcycles (2.8%). In contrast, of the 867 participants answering the question on the helmet use of their relatives, 72.5% reported that most of their relatives always wear a helmet, 6.2% that they only use it sometimes, and only 0.7% reported that their relatives never wear a helmet. Of the remaining respondents, 6% stated that they did not know and 14.6% reported that their relatives did not ride motorcycles.

McNemar’s test was used to compare adolescents’ beliefs on helmet use by friends and family. Significantly more adolescents reported that their relatives always used a helmet, than those who reported that their friends always use a helmet ( $X^2_1 = 195.57$ ;  $p < 0.0005$ ).

Figures 1 and 2 show the percentage of adolescents who use helmets as drivers or passengers, respectively and who reported that their family and friends always use them. In every case, those who reported always wearing a helmet were also significantly more likely to report that their friends and relatives also always use it (drivers: friends  $X^2_1 = 31.67$ ;  $p < 0.0005$ ; relatives  $X^2_1 = 27.25$ ;  $p < 0.0005$  / passengers: friends  $X^2_1 = 24.37$ ;  $p < 0.0005$ ; relatives  $X^2_1 = 12.53$ ;  $p < 0.0005$ ).

Therefore, to identify the variables that best predict helmet use, two forced-entry logistic regressions (for drivers and for passengers) were performed. Firstly, the demographic variables (age and gender) were entered into the equation, to partial out their contribution to the prediction of helmet use, followed by the reported frequency of driving/riding as a passenger on a motorcycle, the belief in the effectiveness of helmet use and the belief that it is used by friends and family.

Tables 3 and 4 show the summary statistics for helmet use for drivers and passengers, respectively. The belief that friends and relatives always use a helmet was the best predictor of its use among motorcycle drivers. Among passengers, the variables that best predicted helmet use on all journeys were the belief that their friends always use it and age.

#### **4. Discussion**

More than a third (37.6%) of the adolescents reported that they rode motorcycles at least “fairly frequently”. As expected, riding motorcycles was gender-related, with more males than females reporting that they rode a motorcycle. These results are in accordance with those found in the statistics and studies of the Directorate General of Traffic (2003, 2005), the Spanish Interior Ministry (2007), and the findings of other researchers in Spain and in different countries (State of Hawaii Department of Transportation 2004; León & Hernández, 2004; Nakahara et al., 2005).

In the current study, 66% of the participants reported riding a motorcycle as passengers quite frequently, with no gender differences. These findings are remarkably similar to a study of Italian adolescents, which found that 66% of their participants reported using motorcycles as drivers or passengers (Bianco et al., 2005). However, the present findings are considerably higher than that found in a study of the general public conducted by the Directorate General of Traffic (2003), where the percentage was less than 20%. Although the current sample may not be representative of the Spanish population, due to the restricted age range, the results of this study appear to suggest that adolescents travel by motorcycle far more often than older people, who may have access to other types of vehicles. Thus, prevention campaigns aimed specifically at this sector of the population would be an appropriate way to improve motorcycle safety overall.

Among the adolescents in this sample, motorcycle use increased with age, both as drivers and passengers. Furthermore, helmet use, particularly among passengers, also increased with age. These results differ from those found by Plieggi et al. (2006), but are in agreement with those found by other researchers. For example, in a study carried out in India, the prevalence of various health-risk behaviours among the adolescent student population (such as not using a helmet) was found to be significantly associated with lower ages and the male gender (Sharma, Grover & Chaturvedi, 2007). In addition, a recent Taiwanese study of accidents involving motorcyclists has also found that young male

drivers were more likely to disobey traffic regulations (Hsin-Li & Tsu-Hurng, 2007). In accordance with these results, the initiative by the Spanish Interior Ministry to forbid drivers from carrying passengers until they are 18 years old, and to raise the age for obtaining a motorcycle licence, would appear to be appropriate. As higher percentages of helmet use were found from 16 years onwards, perhaps this measure should be made even more restrictive by two years, in other words increasing the minimum age to ride a motorcycle to 16 years old.

Eight out of every ten adolescent motorcycle drivers or passengers have reported that they always use a helmet, and no gender differences were found. These results are similar to those found by other researchers in Spain (e.g. Cunill, Gras, Sullman, Font-Mayolas & Planes, 2007). However, the rate of helmet use found here is much higher than that recently found in Italy by Bianco et al. (2005), who observed that only four out of every 10 young people reported using a helmet regularly when riding a motorcycle. This difference could be explained by the fact that Italy only legislated compulsory helmet use among all motorcycle users in 2000, compared to Spain, where its use has been compulsory since 1992. In the case of the Netherlands, 91% of motorcycle drivers and 80% of passengers used a helmet in 2006; this percentage was even higher in 2005 (93% and 85% respectively), and can be linked to the greater enforcement of the law by Dutch police (Ermens & Van Vliet, 2006). In countries outside Europe helmet use has also been found to be lower than that found in the present study, in spite of similar compulsory helmet-use laws

(Canada Safety Council, 2006; State of Hawaii Department of Transportation, 2004). Among motorcycle users who have had an accident, lower usage has been observed, both in Spain (65.4% of fatal accidents; Spanish Interior Ministry 2007), and in non-European countries (Hundley et al., 2004; León & Hernández, 2004; Nakahara et al., 2005).

It should not be forgotten that according to this study two out of every ten adolescents do not systematically use a helmet when riding a motorcycle, despite their legal obligation to do so and the empirical evidence of its effectiveness in preventing serious injuries or death (Nakahara, et al., 2005; Norvell & Cummings, 2002; Peek-Asa, McArthur & Kraus, 1999; WHO, 2003). Action must be taken to enforce the law regulating helmet use in order to help improve adolescent road safety.

Adolescents generally reported that helmets are effective at preventing serious injuries or even death in the case of an accident, and both drivers and passengers who report using them tend to give helmets higher effectiveness scores than those who do not use a helmet regularly. In the case of passengers, males believed more strongly in the effectiveness of helmet-use, although this difference did not result in greater use of these safety devices by males. Previous research on other safety devices, such as car seat belts, has also found that the belief in the effectiveness of the device is a significant predictor of its use among car drivers (Gras et al., 2007). However, in contrast [Stevenson et al. \(2008\)](#) found that belief in its effectiveness was not related to seat belt use in

Chinese drivers. The results of the present research support Bandura's social cognitive theory (1990), as belief in the effectiveness of a helmet was strongly related to engaging in the preventive behaviour of wearing a helmet. Consequently, disseminating information that highlights and proves the effectiveness of helmet-use can strongly encourage greater use of this device by adolescents.

Adolescents believe their relatives use helmets more frequently than their friends do. The perception that relatives, who are generally adults, take more precautions than young people may reflect a social desirability bias. Nevertheless, similar findings have been made by other researchers (Bianco et al., 2005; Canada Safety Council, 2006; State of Hawaii Department of Transportation, 2004; Lajunen & Räsänen, 2001) using accident data. This again highlights the excessive risks taken by young people, especially males (Goldenbeld, Twisk & Houwing, 2008; Hsin-Li & Tsu-Hung, 2007; Sharma et al., 2007).

Adolescent motorcycle drivers who reported that most of their friends use helmets when riding motorcycles adopt this safety measure more frequently than those who do not believe their friends use them. In fact, belief in helmet use by friends was the best predictor of helmet use by adolescents on all occasions. This relationship was also found between adolescents' self-reported helmet use and whether or not they believe their relatives use a helmet. This variable also predicted helmet use among adolescent motorcycle drivers. In



accordance with Bandura and Walters (1974) and Bayés (1995) these results back the inclusion of social influence as a relevant variable for predicting preventative behaviour, and are in agreement with the findings of other researchers in relation to: helmet-use (e.g. Bianco et al., 2005; Canada Safety Council, 2002; State of Hawaii Department of Transportation, 2004; Plieggi et al. 2006); seat belt use (Chliaoutakis et al., 2000; Cunill et al., 2004; Gras et al., 2007; Harrison, Senserrick, & Tingvall, 2000); and in relation to driving style and how this effects the number of motoring offences committed by children and their parents (Beck, Shattuck, & Raleigh, 2001a, 2001b; Bianchi & Summala, 2004; Shope, Waller, Raghunathan, & Patil, 2001).

Programmes and campaigns promoting helmet use among Spanish adolescents should take into account the modelling effect peer role models and other models have on adolescent helmet use. In addition, faced with the problem that motorcycle accidents among adolescents represents, it is advisable to remind parents, legal guardians and other relatives of the strong influence they have on adolescents' driving behaviour, and to start educational programmes before adolescents begin driving vehicles.

There are a number of possible methodological limitations of this study. Firstly, this research suffers from the usual perceived weaknesses of research using self-reported data, mainly social desirability bias. However, research investigating the affect of social desirability bias on self-reported driving behaviours has found this bias to, mostly, have a non-significant effect on

responses (Lajunen, Cory, Summala, & Hartley, 1997; Lajunen & Summala, 2003; Sullman & Taylor, 2010). In addition, as in all cross-sectional studies, the conclusions of this study are limited to demonstrating relationships rather than causation. Although a possible cause and effect relationship has been suggested, it is impossible to make definitive statements using a cross sectional survey. Another limitation of this study is that the sample of adolescents may not be representative of Spanish adolescents in general, as the participants were all from one city in Spain. Furthermore, caution is advised when generalising these results to other populations, as these findings conflict with those made in a Chinese sample. Future research is needed to test these findings in different areas of Spain and in different cultures.

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