

Factors associated with the use of motorcycle helmets in two Colombian cities

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Abstract *The aim of this study was to identify the prevalence and some characteristics associated with the use of motorcycle helmets in two Colombian cities. The researcher used quantitative and qualitative techniques. The prevalence of the use of a motorcycle helmet among motorcyclists was greater in Ibagué (98.1%) than in Valledupar (82.4%); among passengers in the city of Valledupar, it did not reach 2%. Men were 2.1 times more likely to wear helmets than women (IC 95:1.6-2.7). Using qualitative techniques, the factors explaining the reasons for use/non-use of helmets (being hygienic, climatic, esthetic and safety reasons) were identified for Valledupar. The use of the helmet is a protective measure in the event of traffic accidents; however, the prevalence of usage is not ideal. It is important for traffic and health authorities as well as the civil society to organize, in order to design and implement measures aimed at strengthening the use of this road safety gear.*

Key words *Safety, Highways, Colombia, Helmets*

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Introduction

The 2004 world report on traffic injury (TI) prevention established that such events are a serious public health problem to be discussed in the public agenda and that the number of traffic injuries is increasing¹. The World Health Organization (WHO) estimates that worldwide every year nearly 1,328 million persons die and another 50 million are injured from traffic injuries². In recent years, in the Western Hemisphere, there have been nearly 150,000 annual deaths due to TI, for an average rate of 16.1/100,000 inhabitants, out of which there is a notorious increase in volume and in proportion of deaths among motorcyclists^{3,4}.

In the Western Hemisphere, countries such as Mexico, Peru and Venezuela have standardized mortality rates due to TI at above 20/100,000 inhabitants. Colombia, The United States of America, Argentina, Guatemala, The Dominican Republic, Paraguay, and Brazil, among other countries, have rates of 10-19.9/100,000 inhabitants⁴; whereas countries such as Canada, Cuba and Uruguay have rates lower than 10/100,000 inhabitants⁵.

Colombia belongs to the second group of countries; however, its situation is still troubling. The latest report from the Colombian Institute of Legal Medicine (CILM) estimated that there was a greater number of deaths due to TI in 2013 than those recorded in the past decade. In 2013 the mortality rate reached 13.2/100,000 inhabitants, out of which over 44% of the deceased were motorcyclists⁶. In part, that situation is the result of an astounding increase in motor vehicles, especially motorcycles. It is estimated that nearly 1,600 motorcycle licenses are issued in Colombia every day; that is to say, that there are over 500,000 new motorcycles per year. In 2013, motorcycles became the number one motor vehicle in Colombia⁷⁻⁹.

There is substantial evidence that motorcycle helmets are highly effective for preventing disability and death when motorcyclists are involved in road accidents; however, many motorcyclists do not wear helmets. Some studies aimed at identifying factors associated with the use of road safety helmets have been conducted. On one hand, reports show that older, licensed motorcyclists with a college education and a higher income were more likely to wear a helmet¹⁰. Environmental studies found positive associations between the use of a helmet and driving in cities, on highways, and in police-surveyed areas¹¹. On

the other hand, young men with a lower level of education and no license are less likely to wear a helmet¹². The main reasons for not wearing a helmet stated in the literature on the topic are discomfort, sensorial limitation, underestimated risk, and negative mindsets regarding the personal road safety helmet¹³.

In the past few years, the World Health Organization has recommended monitoring and surveying the risk factors associated with the occurrence of traffic injuries, such as the use of a safety belt among motor vehicle drivers and passengers, the use of a helmet among motorcycle riders and passengers, the use of child seats for children under five years of age, blood alcohol tests, and measuring driving speeds⁵. As for the use of a helmet, the 2009 road safety regional report stated that 40% of the countries surveyed did not report the use of a helmet or the lack thereof. Among the countries that did, Argentina, Barbados and Jamaica had usage percentages of below 20%; Venezuela, Uruguay, Honduras and USA, reported usage from 50% to 60%; and Chile, Colombia, Canada and Cuba reported usage of above 60%. The use of a helmet is considered a life-saving measure in traffic accidents; it has been associated with reducing the risk of death by up to 40% and the risk of injury by nearly 70%^{14,15}.

Ibagué (in the Andean area) and Valledupar (in the Caribbean area) are two middle-sized Colombian cities, 200 Km. and 850 Km., respectively, from Bogotá, the capital of Colombia. These cities were selected taking into account the urban growth rate and the high number of traffic-related injuries and deaths; furthermore, there have not been important road safety interventions in these two cities in recent years^{16,17}.

Road safety behavior is linked to the inhabitants' social, cultural, economic, legislative and political context, in a reciprocal relation between the individuals and the society, based on which socially-accepted practices are learned, built, given meaning, and transformed¹⁸⁻²⁰. Such learning involves interacting with the society and internalizing the ethics and values of the symbolic-cultural system shared among a social group, which become the basis for establishing what is considered appropriate. Values and ethics are molded into formal, social rules that individuals, States, governments and institutions use as criteria and guiding principles²¹⁻²³.

Before 2012, in Colombia there were few systematic observation studies that measured the use of a road safety helmet and/or other risk factors, which enable monitoring and/or evaluating

the effectiveness of road protection measures, in order to encourage their use. This article aims to determine the prevalence of using a motorcycle helmet and to identify certain road safety behaviors potentially associated with the use of a helmet or the lack thereof in the Colombian cities of Ibagué and Valledupar.

Materials and Methods

This is a combined study that uses quantitative research techniques (transversal observation and analysis) for estimating the prevalence of using a road safety helmet and some possibly associated variables, as well as qualitative research techniques (exploratory and descriptive) for identifying possible reasons for the use/non-use of motorcycle helmets in the cities that are the object of this research (July and August 2013).

The researchers observed a group of motorcyclists and motorcycle passengers and identified the use/non-use of motorcycle helmets in Ibagué and in Valledupar. The observation consisted of a planning process that included the revision, piloting, and standardization of a measuring instrument previously used in Mexico²⁴. Then, the researchers selected and trained the persons who observed and recorded the use of road safety gear among drivers, motorcyclists, and passengers (more specifically motorcyclists and passengers), following the parameters established in the protocol²⁵: identifying the sample size and the observation units, selecting the spots where data was to be recorded, systematically selecting the vehicles, conducting observation at traffic lights, and recording the variables, among others.

For calculating the sample size in each one of the cities, the researchers used the formula for calculating finite population samples:

$$n = \frac{N \cdot Z^2 \cdot p \cdot q}{d^2 \cdot (N - 1) + Z^2 \cdot p \cdot q}$$

Based on a previous study conducted in Mexico²⁶, the researchers used the following assumptions: a confidence level (Z^2) of 95%, with an error margin (d) of 2%, a prevalence (p) of 75% for the use of a motorcycle helmet. The finite population (N) corresponded to the number of motorcycles furnished by the Mobility, Transit and Transportation Secretariat of each city. Additional complementary methodology aspects can be found in a different publication²⁷.

The variables analyzed for the motorcyclists were sex, age group, use of a helmet, and the existence of distracting factors. Other items were also recorded, such as the time at which the observation was made, the type of road the vehicle was traveling on, and weather conditions (wet or dry road). The information was recorded in capture masks designed in Microsoft Access, and the capture masks were put through a capture validation process using 10% of the records. The prevalence in the use of a road safety helmet was estimated by sex in each city. For the bivariate analysis, the dependent variable was Prevalence in the use of a road safety helmet and the independent variables used were: City (Valledupar=0, Ibagué=1); Age (>59 years old = 0, >=18 to <59 years old = 1); Sex (Female = 0, Male = 1); Number of Road Lanes (3 Lanes = 0; 2 Lanes = 1); Distracting Factors (Absent =0; Present = 1); Weather Conditions (Dry Road = 0, Wet Road = 1).

The bivariate analysis was made to identify the possible association between each one of the independent variables and the Use (1) or Non-use (0) of a road safety helmet. The OR were obtained with confidence intervals (IC) at 95%. A multivariate analysis was made, keeping in mind that the variable City corresponded to a second level of study. The variables with a P value lower than 0.2 were kept in the bivariate analysis. Different interactions were tested (City*Sex, Sex*City, among others). The final model included variables with a P value level lower than 0.05.

The qualitative component was used to attempt an understanding of the behavior observed in the Valledupar citizens: non-compliance with traffic regulations and little use of road safety gear such as a helmet, reflective vests, and safety belts (in four-wheel motor vehicles). The researchers identified the need to address such behavior, in order to analyze more in depth the symbolic-cultural system in which they flourish. Therefore, six focus groups were formed and six in-depth interviews were conducted with members of the different transit agencies and authorities, regarding the different aspects of the inhabitants' behavior regarding traffic regulations and the use of road safety gear.

Focus group scripts and transit agency and authority interviews were designed for information gathering. They shared the same main themes but included questions aimed at in-depth analysis according to each agency (Table 1). All the material collected was literally transcribed in order to analyze the contents. Deductive categories were included in every stage of the analysis

Table 1. Distribution of participants with qualitative techniques.

Data Collection Techniques	Population
Focus Group 1	Car and motorcycle drivers
Focus Group 2	Motorcycle drivers
Focus Group 3	Taxi drivers
Focus Group 4	Transit Authorities
Focus Group 5	Pedestrians
Focus Group 6	Health care workers and people involved in the care of traffic incidents
Interview 1	Transit Secretariat functionary
Interview 2	Woman injured in a traffic incident
Interview 3	Man injured in a traffic incident
Interview 4	Motorcycle parts store owner
Interview 5	Car parts owner
Interview 6	Car parts worker

based on the research objectives and questions. As the coding process advanced, inductive or emerging categories were included. Using the coded material, the researchers conducted description, triangulation, and information analysis processes, and they articulated the findings with theoretical explanatory elements²⁸. Participation in the interviews and focus groups was always voluntary, and also, permission was requested before recording the audio of each activity. All the participants read and signed a written consent form. This research was endorsed by the Universidad Javeriana Center for Development Projects (CENDEX) Ethics and Research Committee in Bogotá.

Results

The minimum sample size was met in each of the cities. The researchers determined a total of 1,020 observations for Ibagué (1,197 observations were made) and a sample of 2,128 observations were estimated for Valledupar (2,783 observations were made).

The motorcyclists' prevalence of the use of a motorcycle helmet was greater in Ibagué (98.1%) than in Valledupar (82.4%), see Table 2. The passengers' prevalence of the use of a motorcycle helmet was considerably greater in Ibagué (95.6%) than in Valledupar (1.2%), see Graph 1. Men had greater prevalence of the use of a motorcycle helmet than women ($p = 0.0001$); and there were no statistically significant differences among the different age groups, weather variations, and the

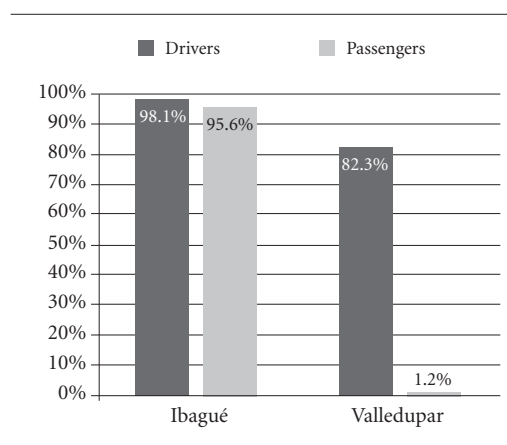
prevalence of the use of a motorcycle helmet ($P > 0.05$).

Using the bivariate analysis, it was established that the possibility of using a motorcycle helmet was much greater in Ibagué than in Valledupar ($OR_c = 10.8$ IC 95%: 7.1-16.5) among men than among women ($OR_c = 1.61$ IC 95%: 1.2-2.07), among motorcyclists who became distracted at traffic lights using their mobile phone, lighting a cigarette, etc... ($OR_c = 4.7$ IC: 95% 2.3-9.6). It is possible that this was a statistical correlation and not necessarily a cause-effect association. Motorcyclists showed less probability of using a helmet on smaller roads ($OR_c = 0.11$ IC: 95% 0.06-0.19), possibly because they perceived less risk as there is less traffic on such roads; there was no association between weather variations and the probability of using a road safety helmet in the two cities under study ($OR_c = 0.62$ IC: 95% 0.38-1.00) (Table 3).

The multiple analysis included the variables used in the bivariate analysis that had a significance level lower than 0.2. The final model included the variables with a significance level lower than 0.05. For this study, the multivariate level showed that the greatest predicting factor for using a motorcycle helmet was City, with more probability of usage in Ibagué than in Valledupar ($OR_a = 11.1$ IC 95%: 5.6-16.5). Sex showed a negative confusion, with a slightly greater probability of using a helmet among men than among women, adjusted by the rest of the variables included in the model: ($OR_a: 2.0$ IC 95%: 1.5-2.7). No association was found in the multivariate model between using a safety helmet and the

Table 2. Bivariate analysis. Characteristics associated to the use and no use of helmets in Ibaguè drivers and motorcyclists Valledupar.

Characteristics/Participants	Helmet Use				ORc (IC 95%)	P value
	Yes		No			
	n	%	n	%		
City						
Valledupar (Ref.)	2291	82.4	489	17.6	1	0.0001
Ibaguè	1163	98.1	23	1.9	10.8 (7.1 - 16.5)	
Sex						
Female (Ref.)	376	81.7	84	18.3	1	0.0001
Male	3078	87.8	428	12.2	1.61 (1.2 - 2.1)	
Age Group						
> 59 (Ref.)	13	92.9	1	7.1	1	0.51
≥ 18 a ≤ 59	3441	87.1	511	12.9	0.52 (0.7 - 3.9)	
Distractor						
Absent (Ref.)	3195	86.5	500	13.5	1	0.0001
Present	242	96.8	8	3.2	4.7 (2.3 - 9.6)	
Number of Lanes						
Three lanes (Ref.)	706	98.1	14	1.9	1	0.0001
Two lanes	2748	84.6	498	15.4	0.11 (0.06 - 0.19)	
Weather conditions						
Dry (Ref.)	3365	87.3	491	12.7	1	0.052
Light rainfall	89	80.9	21	19.1	0.62 (0.38 - 1.0)	

**Graph 1.** Prevalence of helmet use among motorcycle drivers and passengers in Ibaguè and Valledupar.**Table 3.** Multivariate analysis. Chance of helmet use Ibaguè drivers and motorcyclists Valledupar.

	ORa	IC 95%
City		
Valledupar (Ref.)	1	
Ibaguè	11.1	5.6 - 21.9
Sex		
Female (Ref.)	1	
Male	2.0	1.5 - 2.7
Distractor		
Absent (Ref.)	1	
Present	1.1	0.52 - 2.4
Number of lanes		
Three lanes (Ref.)	1	
Two lanes	0.99	0.42 - 2.3
Weather conditions		
Dry (Ref.)	1	
Light rainfall	0.66	0.4 - 1.1

variables Distracting Factors, Number of Lanes, and Weather.

Using the qualitative techniques, the researchers identified that individuals thought it normal for a helmet to be used only by the motorcyclist, which partly explained the low prevalence of the use of a road safety helmet by motorcycle pas-

sengers in Valledupar (Figure 1). Upon inquiring about the reasons behind this behavior, the inhabitants and the authorities said that it was related to the unauthorized practice known as

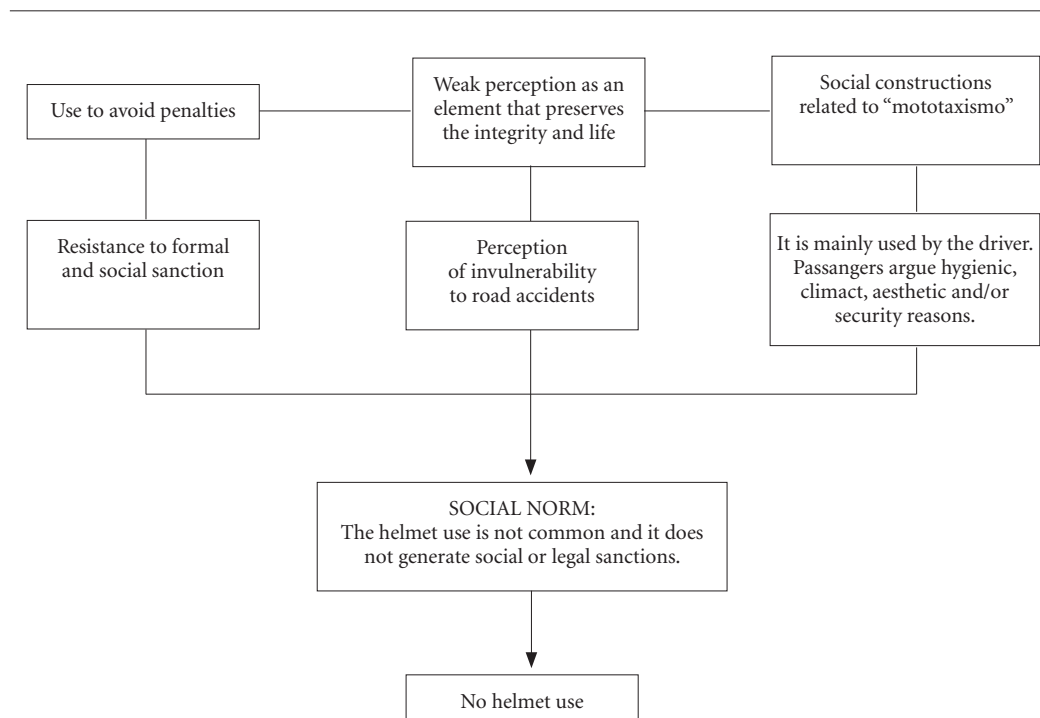


Figure 1. Explanatory hypothesis to no helmet use in Valledupar, 2014.

mototaxi – motorcycles transporting passengers for pay. That informal means of transportation has made people refuse to use a motorcycle helmet when they travel as passengers for hygienic reasons, because of the heat, and for security reasons; they say that the helmets might be sprayed with dazing substances, to facilitate robbery and other crimes. In the case of women, aesthetic reasons were further cause for not using a road safety helmet.

The difficulty in controlling the *mototaxis* and in presenting the inhabitants with alternatives to the “public” use of motorcycle helmets has made the authorities mainly demand that motorcyclists use helmets; not so much passengers. In general, the population identified the authorities’ limitations in controlling and penalizing the non-use of motorcycle helmets but the population also showed reluctance in cooperating.

The researchers also identified the incorrect use of helmets by a large number of the population. They wore it unbuckled, loosely placed on their head, hanging from their elbows or placed on their knees, and they only put it on properly when they noticed the presence of a traffic police agent. Upon inquiring about the importance of

a motorcycle helmet as safety gear, the persons interviewed gave more importance to the use of a helmet to avoid a ticket than as safety gear. Generally speaking, offenders were not socially or legally sanctioned for not using a motorcycle helmet.

Discussion

There seems to be a differential use of road safety gear according to geographic region in different countries and Colombia is no exception to the rule. This study found greater prevalence of the use of a motorcycle helmet in Ibagué than in Valledupar; the statistics shown in the latter city may be related to geographic location (as Valledupar is far from the main Colombian State capitals) and to the city’s lower social and economic development. This is consistent with other researchers’ findings, who reported greater use of a road safety helmet in the geographically central regions^{29,30}, where compliance with road safety laws and regulations is more controlled and where there are also reinforcement activities aimed at developing greater respect for the rules

and regulations. This level of control might not be applied in other regions due to cultural or financial circumstances. Certain studies conducted by Argentinian authors suggest that this geographic gradient might also be present within the cities. Reports show that the use of a motorcycle helmet is greater in the more developed, central areas of a city, probably thanks to greater police presence in those areas³¹. This is consistent with the findings of US researchers, who state that in suburban, rural and peripheral areas fewer motorcyclists use road safety gear³².

Even though Colombia has laws and regulations regarding the mandatory use of motorcycle helmets, compliance with such regulations is problematic^{33,34}. Using qualitative techniques, the researchers observed, especially in Valledupar, that compliance with the road safety laws and regulations is weak, and that the perception of risk and the possibility of being pulled over and sanctioned by the traffic authorities is low. As results showed, especially female passengers do not use a motorcycle helmet for climatic, aesthetic, and hygienic reasons. In Valledupar, as part of the symbolic and cultural context relating to helmet usage behavior, the researchers identified that this piece of road safety gear is not perceived as an object that guarantees safety and protects life; instead, it is used to avoid a traffic ticket and, therefore, it is used in an intermittent, incorrect fashion.

The authorities' limited ability to enforce control and the population's reluctance to cooperate encourage and reinforce non-compliance with road safety laws and regulations. This situation hinders a change in mindset regarding the importance of the willingness of motorcyclists, and especially passengers, to use a road safety helmet, because the current behavior is socially accepted in Valledupar. Working at improving the cultural concepts relating to the use of a motorcycle helmet is key to a change among the population concerning such bad practices. In addition, it is important to analyze the origins of the social construct of "being a motorcyclist" and

certain contextual identity factors linked to road safety³⁵.

Women's prevalence of the use of a motorcycle helmet, as found in this study, does not coincide with previous studies that reported women's greater probability of using a motorcycle helmet and, in general, their safer road behavior as compared to men^{31,36-39}. This study found no association between weather conditions (rainy days with wet roads) and the use of a motorcycle helmet, which goes against the reports of Argentinian researchers from Mar de Plata, who stated a positive association between rainy weather (wet roads) and the use of a motorcycle helmet³⁹. In addition, no differences were found in the inhabitants' use of a motorcycle helmet according to age group; however, the age range taken into account for observation was very wide (18 to 59 years of age) and it might have hidden a lesser use of a motorcycle helmet among young adults, as this age group has been described in the literature on the topic as the most inclined not to use the proper personal road safety gear^{12,13,30}.

The results of this study show the need to increase efforts aimed at ensuring compliance with the applicable road safety laws and regulations in Colombia, especially among motorcycle passengers and in hot weather areas. To do so, it is imperative to reinforce the efforts of the control agencies, in order to promote the use of life-saving gear, such as a motorcycle helmet^{40,41}. Along those lines, in December 2014, Valledupar authorities issued Decree 00396 to promote road safety⁴². Due to the above, preliminary reports stated the startup of a safe, affordable (the fare is 0.25 cents of a dollar) mass public transit system, thus discouraging the use of motorcycles as a means of transportation. In addition, Valledupar has seen an increase in the number of traffic police officers, to control the city's road safety. They supervise and encourage the use of a motorcycle helmet among motorcyclists as well as motorcycle passengers, and oversee compliance with road safety rules. All of the above has decreased the traffic accident rate in the city^{43,44}.

Collaborations

JMR Hernández, FAC Tovar and LKA Ruiz participated equally in all stages of preparation of the article.

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References

1. World Health Organization (WHO). *World Report on prevention of road traffic injuries*. [accesado 2012 abr 1]. Disponible en: <http://whqlibdoc.who.int/paho/2004/927531599X.pdf>
2. World Health Organization (WHO). *Global Status report on road safety 2013. Supporting a decade of action*. Geneva: WHO; 2013.
3. Pan American Health Organization (PAHO). *Road Safety Facts in the Region of the Americas*. Washington (PAHO); 2013.
4. Morais Neto OL, Montenegro M de M, Monteiro RA, Siqueira Júnior JB, da Silva MM, de Lima CM, Miranda LO, Malta DC, da Silva Junior JB. Mortalidade por Acidentes de Transporte Terrestre no Brasil na última década: tendência e aglomerados de risco. *Cien Saude Colet* 2012; 17(9):2223-2236.
5. Organización Panamericana de la Salud (OPAS). *Informe sobre el Estado de la Seguridad Vial en la Región de las Américas*. Washington: OPAS; 2009.
6. Castillo DA. Comportamiento de lesiones y muertes por accidente de transporte, Colombia, 2013. In: Instituto Colombiano de Medicina Legal. *Forensis, 2013: Datos para la vida*. Bogotá: Imprenta Nacional; 2014. p. 169-224.
7. Colombia. Ministerio de Transporte. *Registro Único Nacional de Tránsito del Ministerio de Transporte de Colombia*. [accesado 2014 ene 1]. Disponible en: www.mintransporte.gov.co
8. Fundación Ciudad Humana & Fondo Nacional de Prevención Vial. *Caracterización de los motociclistas colombianos*. [accesado 2013 sep 1]. Disponible en: <http://www.fpv.org.co/uploads/repositorio/informemotos.pdf>
9. Rodríguez JM. Situación de las lesiones de motocicleta, el caso de Colombia. In: Hajar M, organizador. *Los accidentes como problema de salud pública en México: retos y oportunidades*. México: Intersistemas S.A.; 2014. p. 209-228.
10. Hung DV, Stevenson MR, Ivers RQ. Barriers to, and factors associated, with observed motorcycle helmet use in Vietnam. *Accid Anal Prev* 2008; 40(4):1627-1633.
11. Gkritza K. Modeling motorcycle helmet use in Iowa: evidence from six roadside observational surveys. *Accid Anal Prev* 2009; 41(3):479-484.
12. Sreedharan J, Muttappillymyalil J, Divakaran B, Haran JC. Determinants of safety helmet use among motorcyclists in Kerala, India. *J Inj Violence Res* 2010; 2(1):49-54.
13. Papadakaki M, Tzamalouka G, Orsi C, Kritikos A, Morandi A, Gnardellis C, Chliaoutakis J. Barriers and facilitators of helmet use in a Greek sample of motorcycle riders: Which evidence? *Traffic Psychol Behav* 2013; 18:189-198
14. Larson K, Henning K. Implementing proven road safety interventions saves lives. *Int J Care Injured* 2013; 44(S4):S3.
15. Liu BC, Ivers R, Norton R, Boufous S, Blows S, Lo SK. Helmets for preventing injury in motorcycle riders (Review). *Cochrane Database of Systematic Reviews* 2008; 1:CD004333.
16. Fondo de Prevención Vial de Colombia. *Estadísticas Departamentales 2010*. [accesado 2015 mayo 1]. Disponible en: <http://www.fonprevial.org.co/investigacion/estadisticas>

17. Departamento Nacional de Estadística de Colombia. *Proyecciones de población para Colombia, departamentos, grupos étnicos y sexo*. [accesado 2013 dic 1]. Disponible en: <http://www.dane.gov.co/index.php/poblacion-y-demografia/proyecciones-de-poblacion>
18. Bandura A. *Social learning theory*. New Jersey: Prentice-Hall; 1977.
19. Ibañez T. *Introducción a la psicología social*. Barcelona: Editorial UOC; 2004.
20. Gómez JE; Centro de desarrollo y desarrollo científico. Aprendizaje ciudadano y formación ética política. Universidad Distrital Francisco José de Caldas: Bogotá; 2005.
21. Elster J. Social Norms and Economic Theory. *J Econ Perspect*. 1989; 3(4):99-117
22. Eslava J, Torres A. Tejiendo el hilo de Ariadna. Laberintos de la legalidad y la integridad. Bogotá: Ecoe Ediciones; 2013.
23. Girola L. Anomia e individualismo. Del diagnóstico de la modernidad de Durkheim al pensamiento contemporáneo. México: Anthropos; 2005.
24. Perez-Núñez R, Híjar M, Rodríguez-Hernández JM, Hidalgo-Solórzano E, Hydder A, Chandran A et al. *Protocolo para el monitoreo y evaluación del impacto de intervenciones destinadas a prevenir las lesiones causadas por el tránsito en dos ciudades de México*. Cuernavaca, México. 2011.
25. Rodríguez JM, Peñolozza RE, Montoya NV. Primer informe técnico de avances del proyecto “Caracterización e identificación de factores de riesgo asociados a lesiones causadas por el tránsito para el diseño de intervenciones efectivas en dos ciudades de Colombia” al Departamento Administrativo de Ciencia y Tecnología de Colombia. COLCIENCIAS. Bogotá. 2013.
26. Perez R, Aruana C, Híjar M, Socorro M., Lunnen J, Hyder A. The Use of seatbelts and child restraints in the Mexican cities. *Int J Inj Contr Saf Promot*. 2013;20(4):385-93.
27. Rodríguez JM, Peñalozza Q, Ariza LK, Flórez CF, Camello FA, Montoya SM. Factores de riesgo asociados a lesiones causadas por el tránsito y propuestas de intervención para el contexto Colombiano. Bogotá: Ecoe Ediciones; 2015.
28. Bonilla-Castro E, Rodríguez-Sehk P. La investigación en ciencias sociales: más allá del dilema de los métodos. Bogotá: Grupo Editorial Norma; 1997.
29. Xuequn Y, Ke L, Ivers R, Du W, Senserrick T. Prevalence rates of helmet use among motorcycle riders in a developed region in China. *Accid Anal Prev*. 2011; 43(1):214-9.
30. Morais Neto OL, Malta DC, Mascarenhas MD, Duarte EC, Silva MM, Oliveira KB, Lima CM, Porto DL. Factores de riesgo para accidentes de transporte terrestre entre adolescentes no Brasil: Pesquisa Nacional de Saúde do Escolar (PeNSE). *Cien Saude Colet*. 2010; 15 (Suppl. 2):3043-52.
31. Ledesma RD, Peltzer RI. Helmet use among motorcyclists: observational study in the city of Mar del Plata, Argentina. *Rev. Saúde Pública*. 2008; 42(1):143-5.
32. Zwerling C, Peek-Asa C, Whitten PS, Choi S, Sprince NL, Jones, MP. Fatal motor vehicle crashes in rural and urban areas: decomposing rates into contributing factors. *Inj. Prev*. 2005; 11(1):24-28.
33. República de Colombia. *Ley 769 de 2002 por la cual se expide el Código Nacional de Tránsito Terrestre y se dictan otras disposiciones*. [accesado 2015 oct 1]. Disponible en: <http://www.alcaldiabogota.gov.co/sisjur/normas/Norma1.jsp?i=5557>
34. Híjar M, Pérez-Núñez R, Inclán-Valadez C, Silveira-Rodrigues EM. Road safety legislation in the Americas. *Rev Panam Salud Publica*. 2012; 32(1):70-6.
35. Tunnicliff D, Watson B, White KM, Lewis I, Wishart D. The Social Context of Motorcycle Riding and the Key Determinants Influencing Rider Behavior: A Qualitative Investigation. *Traffic Inj Prev* 2011; 12(4):363-376
36. Kulanthayan S, Umar RS, Hariza HA, Nasir MT. Modeling of compliance behavior of motorcyclists to proper usage of safety helmets in Malaysia. *J. Crash Prevent* 2000; 40(6):1937-1942.
37. Liping L, Gongli L, Qien C, Zhang AL, Lo SK. Improper motorcycle helmet use in provincial areas of a developing country. *Accid. Anal. Prev*. 2008; 40(6):1937-1942
38. Akaateba MA, Amoh-Gyimah R, Yakubu I. A cross-sectional observational study of helmet use among motorcyclists in Wa, Ghana. *Accid Anal Prev* 2014; 64:18-22.
39. Ledesma R, Lopez S, Tosi J, Po F. Motorcycle helmet use in Mar del Plata, Argentina: prevalence and associated factors. *Int J Inj Contr Saf Promot* 2013; 22(2):172-176.
40. Crompton J, Oyetunji T, Stevens K, Efron D, Haut E, Haider A. Motorcycle Helmets Save Lives, But Not Limbs: A National Trauma Data Bank Analysis of Functional Outcomes After Motorcycle Crash. *J Surg Res* 2010; 158(1):1-15.
41. Forjuoh S. Supporting the UN Decade of Action for Road Safety 2011-2020. *Int J Inj Contr Saf Promot*. 2010; 17(4):213-214.
42. Alcaldía de Valledupar. *Decreto 00396 de 2014. Por el cual se adoptan medidas para el control del servicio de transporte de motocicletas y para fomentar medidas de seguridad vial*. [accesado 2015 feb 1]. Disponible en: http://valledupar-cesar.gov.co/apc-aa-files/3238616_2376566653565353663393335/20141230110758793.pdf
43. Alcaldía de Valledupar. *Disminución de accidentes de tránsito en primer trimestre de 2015*. [accesado 2015 abr 1]. Disponible en: <http://rptnoticias.com/2015/03/alcaldia-de-valledupar-reporta-disminucion-de-accidentes-de-transito/>
44. Gómez B. *Comunicación personal*. Marzo de 2015.

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