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Safety of child passengers who ride to school on a motorcycle: An observational study in two Argentine cities

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ABSTRACT

In low- and middle-income countries, the motorcycle has increasingly become a means of family transportation due to its low cost and the poor quality of public transportation. Consequently, many child motorcycle passengers are at an elevated risk of serious injury in the event of a traffic crash. The available research on child safety devices is scarce and focused mainly on helmet use, while other devices (e.g. high-visibility clothing) have received little attention. This observational study documented the safety conditions and related factors of primary schoolchildren who rode to school as motorcycle passengers in two cities of Argentina.

Data was obtained in the vicinity of 27 public primary schools in two cities of Argentina (one mid-sized city and the other a small city by the country's standards) between May 2018 and September 2019. A total of 1440 motorcycle occupants (656 drivers and 784 child passengers) were observed.

The use of an adequate helmet was lower among children (vs. drivers). Most of the children were unable to reach the motorcycle's footrests, did not use high-visibility clothing or a fastening device, carried a backpack, and mounted and dismounted the motorcycle in an unsafe place. Some children rode in front of the driver or in a motorcycle with three or four occupants. Use of helmet by drivers and driver sex (woman) were related with an increase in safety in children. The indicators were worse in the larger city.

The results revealed a low level of adoption of safety measures in children as well as in adults in both cities. This suggests that motorcycle travel is unsafe. Greater effort is needed to improve motorcycle safety, especially for children. It is important to debate regulatory details such as a minimum age for passengers, a limit on the number of passengers, and other safety criteria. It is also important to conduct educational campaigns that include the distribution of safety devices.

1. Introduction

Motorcycles are a common mode of personal transportation in many low- and middle-income countries [1–3]. In Argentina, motorcycle use has grown steadily in recent years, to the point that in 2017, it was estimated that there was one motorcycle for every two automobiles [4]. In line with this growth, the motorcycle has become a means of family transportation. Various factors explain this phenomenon, such as deficiencies in the quality and availability of public transportation [3], and the fact that motorcycles are more affordable than automobiles and have greater maneuverability, allowing them to better navigate inconveniences such as traffic jams [5–7]. However, the motorcycle has its disadvantages, the biggest being the rider's elevated exposure to bodily harm in the case of a traffic crashes [8,9]. In effect, in Argentina, motorcyclists have the highest rate of mortality of any group of road users [10,11].

When children ride as motorcycle passengers, they are as vulnerable as adults, although their protective needs are not the same [8,12,13]. In this respect, the WHO [8] indicated that the protective devices used by adults are not suitable for children because their physical and behavioral traits are different. Child safety measures such as helmets, fastening devices and the correct positioning of feet require special adaptations. However, there are only a few studies that allow us to understand the mechanics of child injuries because most of the models available are based on the study of adult motorcyclists [14].

When analyzing the safety of children as motorcycle passengers, the majority of researchers focused on the problem mainly from the perspective of individual behavior, paying less attention to vehicle traits and the environment [15]. Additionally, helmet use was the main focus of interest, while insufficient attention was given to other protective mechanisms [16–20]. It is possible that this is because there are no clear standards for other mechanisms besides helmets, as is case with adults, for example, in the use of protective clothing [15]. Further,

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much of the available evidence comes mostly from low- and middle-income countries, principally from the Asian continent, where transporting children on motorcycles is a socially visible problem [21–25]. These studies tend to show that helmet use among children is low, and consistently lower than among adults. They also suggest that helmet use is highest for drivers and decrease for every additional passenger [24,26]. It was lowest for children standing on the floorboard of the motorcycle (11.3% However, the evidence indicates that when children use helmets, they are less likely to suffer injuries, and when they do suffer injuries, they are not as severe [15].

A recent study conducted in various Latin American countries, including Argentina, widened its focus to encompass other protective factors in order to better understand the safety level of child motorcycle passengers [27]. The results showed that the safety indicators were very poor across all countries. A significant number of children could not reach the footrests, were seated inadequately (on the driver's lap or as a third or fourth passenger), did not wear high-visibility clothing, and did not use a helmet or used helmets that were not approved. It is important to point out that without these protective measures, the child motorcycle passenger is at risk of suffering various types of injuries such as burns, foot injuries and head trauma [28–31].

In summary, most of the available research analyzes helmet use as the main protective mechanism and only looks at other safety devices to a minor degree. The development of preventive actions requires awareness of the level of use of all the available protective measures and the analysis of the behavior of children during trips that are specific or a part of daily life for them, such as going to school. Additionally, although most of the research is from low- and middle-income countries like Argentina, it can be assumed that there are differences among countries and even within countries [15,24,27]. Therefore, this study's goal is to document the safety conditions of primary schoolchildren who ride to school as motorcycle passengers in two cities of Argentina (Balcarce and Mar del Plata). The objectives are: (a) to document the observed frequency of use of various safety measures (e.g., helmet, high-visibility clothing, fastening devices, footrests, seating position) of child motorcycle passengers; and (b) to identify possible human, vehicle and contextual factors associated with the various safety conditions that were observed. Contextual and vehicle variables are explored because previous studies in Argentina suggest that these factors can influence motorcyclists' safety behaviors. For example, as regard to vehicle variables, the presence of license plate (which is mandatory in Argentina, but not always present) was found consistently associated with helmet use [20,32].

2. Method

2.1. Study setting and participants

The observations were realized at 27 public primary schools in two cities of Argentina: Balcarce and Mar del Plata (see information about these cities in Table 1). These cities are 73 km apart. By Argentine standards, Balcarce is a small city and Mar del Plata is a mid-sized city. The sample for this study consisted of 1440 motorcycle occupants (656 drivers and 784 child passengers) observed on 656 vehicles. In Balcarce, 502 occupants were observed (223 drivers and 279 passengers) at 10 public primary schools located in an urban setting (schools in rural areas were excluded). In Mar del Plata, 976 occupants were observed (433 drivers and 543 passengers) in all of the city's primary schools (17 schools in total). Each observation unit refers to an event in which: (a) a motorcycle or scooter was used as a means of transportation to school; and (b) there was at least one child passenger.

2.2. Variables

In order to collect the data, a semi-structured instrument was developed to document: (a) Driver variables: approximate age group (<6, 6 to 12, 13 to 18, >18), sex and helmet use; (b) Passenger variables: number of passengers, use of safety devices (e.g. helmet, footwear), seating position of child (in front or behind the driver), foot positions, means of holding on (hands around driver's waist, fastening device, and holding on to motorcycle or loose); location of backpack (or other school supplies), and place of mounting or dismounting the motorcycle (on the street -least safer-, at the curb, on the sidewalk -most safer-);, and (c) Vehicle variables: motorcycle type (e.g. road, custom, scooter, cub type) and presence of license plate. Helmet use was coded into the following categories: adequate helmet and properly used (i.e. fastening motorcycle standard helmet), adequate helmet but improperly used (motorcycle standard helmet without fastening), inadequate helmet used, helmet is not used. The observation protocol was developed based on prior observational studies [32]. A pilot test was conducted to evaluate its performance, correct possible errors or omissions, and evaluate consistency across observers. Except for minor adjustments that had to be made for some variable values, the protocol worked satisfactorily.

Table 1
Data from the cities where observations were made.

Cities	Mar del Plata	Balcarce
Inhabitants	614,350	44,064
Province	Buenos Aires	Buenos Aires
Transport	29 public bus lines taxi services no segregate infrastructure for bikes or motorcycles	2 public bus lines taxi services no segregate infrastructure for bikes or motorcycles
Geography	Southern Atlantic coastal city Humid Pampas	Inland. Valley, highlands Humid Pampas
Minimum legal age for motorcycle passengers	No	No
Legally mandated helmet use	Yes	Yes
Legal number of riders	No	No

2.3. Procedure and data analysis

The observations were made between May 2018 and September 2019. In both cities, municipal transit and educational authorities were informed of the nature of the study and their authorization was solicited. School administrators were notified about the study, but the educational community was not, in order to avoid influencing the habitual behavior of parents and children. Observations were made on public roadways, not on school grounds, and during the hours that students arrived at and departed from school. At each school, observations were made three times on different days of the week. A prerequisite for the registration of a motorcycle and its riders was that a child passenger was present on a motorcycle which was observed to be dropped off or picked up in the vicinity of a school. If a motorcycle was observed more than once during an observation period, only the first documented observation was used. The data was gathered by psychology students who were trained under the framework of the study, and by the authors of this study themselves. In all cases, observations were realized by a team of two observers.

A descriptive analysis of the varying safety conditions was conducted in order to determine the frequency of each measure. The chi-square test was also used to identify possible factors associated with the various safety measures. Finally, a logistic regression analysis was used to find possible factors associated with helmet use in children. For this analysis, cases with lost data (a total of 78 cases) were excluded. The dependent variable was “helmet use/non-use,” while the predictive factors were the sex of the child, the motorcycle type, the presence of a

license plate, the number of occupants, helmet use and the gender of the driver, and the city. The variables were codified such that the odds ratio could be interpreted as the increase in the helmet-use rate. The data were processed using the SPSS software.

3. Results

Table 2 shows the percentage of helmet use for the samples of each city, broken down by occupant type. The frequency of use for the overall sample was low in both cities, but it was markedly lower in Mar del Plata. The use of an adequate helmet is reduced by half for children compared to drivers. Conversely, the use of an inadequate helmet is much higher for children compared to drivers.

Table 3 displays the percentages corresponding to other safety measures. Overall, we can observe that the safety of children is far from optimal. A significant number of children were unable to reach the motorcycle's footrests. Nearly none of the children observed wore high-visibility clothing or used a fastening device. Most of the children carried a backpack and mounted and dismounted the motorcycle in an unsafe place (i.e. the street). A small proportion of children rode in front of the driver, and in more than a third of the cases, there were three or four occupants on the motorcycle.

Table 4 shows the use percentage for each safety measure based on varying factors (the reported values correspond with the presence of the behavior). Significant differences were found based on the sex of the child with regards to mounting/dismounting the motorcycle and the means of holding on. Girls mounted/dismounted and held on in ways that were safer more frequently than boys did (i.e. mounting or dismounting on the sidewalk, holding on with their hands around driver's waist). Significant differences were also observed based on motorcycle type and helmet use, proper use of footrest, and mounting/dismounting behavior. Occupants on urban model motorcycles (cub type, moped 50 cc and street standard) had a lower rate of helmet use than motorcycle models commonly associated with intercity travel (custom, touring and sport); however, the reverse was found with respect to the use of footrests and safe mounting/dismounting. The presence of a license plate showed differences only with respect to the method for holding on (i.e. on motorcycles without a license plate, a higher percentage of the children held onto the driver's waist or were fastened with a special device compared to those who rode on motorcycles with a license plate). The number of occupants showed significant differences in three safety conditions. Motorcycles with three or more occupants showed lower rates of helmet and footrest use compared to motorcycles with two occupants. However, on motorcycles with two occupants, there was a greater likelihood that the child carried a load. Further, higher levels of helmet and footrest use, as well as safe mounting/dismounting were observed in cases when the driver wore a helmet compared to cases when the driver did not. The gender of the driver showed significant differences only in the child's helmet use (i.e. when the driver was a woman, the child was more likely to be using a helmet than when the driver was a man). Lastly, there were significant differences between cities across all safety indicators. Mar del Plata showed higher levels of correct footrest use and method of holding on, as well as a lower number of children carrying loads.

Additionally, logistic regression was used to analyze which variables (behavioral, vehicular and contextual) might be associated with helmet use in children (see Table 4). The results showed that helmet use in children was associated with use by the motorcycle driver. Children were more likely to use a helmet when the driver wore a helmet. Another associated factor was the number of occupants. A greater rate of helmet use was observed when there were two occupants on the motorcycle rather than three or four. Further, the mounting/dismounting variable also had a significant effect on helmet use. An increase in helmet use was observed in children who mounted and dismounted in a safe manner (i.e. at the curb or on the sidewalk rather than on the street). In terms of vehicular variables, the type of motorcycle was found to have a significant effect on helmet use. Motorcycles used for intercity travel (custom, touring and sport categories) showed higher levels of helmet use compared with the typical urban motorcycle model. With respect to the two cities, the helmet use rate was higher in Balcarce than in Mar del Plata. Lastly, no differences in helmet use were found in terms of the driver's gender, the presence of a license plate, the use of footrests, the method of holding on and the child's carrying a load during the ride to school.

4. Discussion

The main objective of this study was to learn about the safety conditions of primary school children who traveled to school on a motorcycle in two Argentine cities. The results revealed a low level of adoption for safety measures in children as well as in adults. This suggests that travel by motorcycle is globally unsafe and is far from adopting the recommendations proposed by the WHO [8].

In terms of helmet use, the frequency of use was very low overall. In the case of drivers, it was clearly lower than in previous studies conducted in Argentina [32]. Among children, use levels were even lower. The difference in helmet use among both groups is in line with the tendency observed in other countries [23–25]. This is an extremely worrisome behavior given that it exposes children to a greater likelihood of severe injury and even death [31,33].

Further, the adoption of other safety measures was also relatively low. The observed use of high-visibility clothing was practically nil and we documented behaviors that could affect the stability of the vehicle (i.e. many children were unable to safely rest their feet, were poorly secured to the vehicle and carried a school backpack). We also observed a small proportion of the children riding in front of the driver, which increases their exposure to head and face injuries [33]. Collectively, these results were poorer than the data from Lambrosquini et al. [27] for Argentina and other Latin American countries. On the other hand, these differences coincide with other findings that indicate variations in the adoption of safety behaviors across jurisdictions, even within the same country [15,24,27]. In Argentina's case, these differences could be because, although there is a national transit law and a national authority charged with road safety, each province, and each

Table 2
Helmet use for overall sample, drivers and child passengers, in Mar del Plata and Balcarce.

	Adequate helmet properly used % (*n*)	Adequate helmet improperly used % (*n*)	Inadequate helmet % (*n*)	A helmet is not used or is not present % (*n*)
Total sample ($n = 976$) [1]	17.5 (171)	2.4 (23)0	5.7 (56)	74.4 (726)
($n = 502$)[2]	32.5 (163)	.4 (2)	13.7 (69)	53.4 (268)
Driver ($n = 433$)[1]	24 (104)	2.8 (12)0	0.9 (4)	72.3 (313)
($n = 223$)[2]	48.4 (108)	.4 (1)	1.3 (3)	49.8 (111)
Child passenger ($n = 543$)[1]	12.3 (67)	2 (11)0	9.6 (52)	76.1 (413)
($n = 279$)[2]	19.7 (55)	.4 (1)	23.7 (66)	56.3 (157)

Note: [1] Mar del Plata, [2] Balcarce.

Table 3
Safety conditions of motorcycle child passengers.

Variables		Total % (*n*)	Mar del Plata % (*n*)	Balcarce % (*n*)
Feet resting on the footrests	*Yes*	68.1 (556)	61.5 (330)	81 (226)
	No	31.9 (260)	38.5 (207)	19 (53)
Use of high-visibility clothing	*Yes*	1.8 (15)	2.6 (14)	0.4 (1)
	No	98.2 (807)	97.4 (529)	99.6 (278)
Means of holding on	*Hands around driver's waist*	70.2 (575)	74.3 (401)	62.4 (174)
	Holding on to motorcycle or loose	28.7 (235)	24.1 (130)	37.6 (105)
	Fastening device	1.1 (9)	1.7 (9)	0 (0)
Carrying a load	*Backpack*	84.9 (692)	82.5 (444)	89.5 (248)
	No load	15.1 (123)	17.5 (94)	10.5 (29)
Mounting/ dismounting the motorcycle	*Curb*	26.4 (208)	22.4 (114)	33.7 (94)
	Sidewalk	32.4 (255)	32.6 (166)	31.9 (89)
	Street	41.2 (325)	45 (229)	34.4 (96)
	Did not dismount	2.3 (19)	3.5 (19)	0
Seating position	*In front of driver*	6.7 (55)	7.6 (41)	5 (14)
	Behind driver	93.3 (767)	92.4 (502)	95 (265)
Number of occupants	*Two*	59.9 (492)	59.7 (324)	60.2 (168)
	Three or four	40.1 (330)	40.3 (219)	39.8 (111)

municipality within, reserves the authority to set its own traffic rules and carry out enforcement as well as prevention campaigns.

Child safety conditions were associated with those of the other motorcycle occupants. In the first place, when there were more than two occupants, children had lower helmet use rates and were less likely to safely rest their feet. This association between decreased helmet use and an elevated number of passengers was previously observed in studies with Asian motorcyclists [24,26]. Second, we found that children traveled more safely when the driver wore a helmet. This is in line with previous research that showed an association between helmet use by the driver and by the passengers [32,34]. However, as was indicated, in the present study the prevalence of use was low in both groups. This means that the elevated risk of injury or death associated with non-helmet use affects an entire family group, or at least a significant number of family members. Lastly, the sex of the drivers also showed differences in the behavior of minors. When the drivers were women, children showed a higher rate of helmet use which had been found in similar observations before [32]. This result adds to the available evidence that indicates women display safer road behaviors, such as helmet use, than do men. However, as we will see later, the results of the logistic regression, a more robust method of analysis, did not maintain this association.

Another interest of this study was to analyze if there were differences in the adoption of safety measures by children according to varying vehicular conditions. Motorcycle type was a factor associated with the presence of a number of safety measures. Previously, Ledesma et al. [32] obtained similar results. In motorcycles with a higher number of cylinders, the observed helmet use rate was higher, although the rate of safe positioning of feet and safe mounting and dismounting was lower than for motorcycles with fewer cylinders. This may be due to the mismatch between the size of the vehicle and the child. One can assume that the users of different motorcycle types may have different

Table 4
Child passenger safety conditions by factor.

Factor	Value	% of helmet use[a]	x^2 (df)	% of footrest use	x^2 (df)	% of holding on method[b]	x^2 (df)	% carrying load	x^2 (df)	% safe mounting/ Dismounting[b]	x^2 (df)
Child's sex	*Male*	32.8	1.17^{ns} (1)	69.3	.82^{ns}	69.2	4.15* (1)	87.2	1.14^{ns} (1)	54.6	3.27*
	Female	29.2		66.2	(1)	75.7		84.5		61.1	(1)
Type of motorcycle	*Cub*	30	9.96* (4)	68.2	9.95* (4)	70.4	2.65^{ns}	84.8	6.41^{ns} (4)	63.3	16.15**
	Moped 50 cc	31.1		73		75.6	(4)	80		58	(4)
	Street standard	26.3		64		75.9		91.2		47.8	
	Custom, touring, sports, other types	43.3		57.6		68.3		88.3		48.3	
	Scooter	46.2		84.6		74.4		87.2		43.6	
License plate	*Yes*	32.5	1.16^{ns} (1)	68.1	.11^{ns}	70.5	4.18* (1)	85.7	.01^{ns} (1)	56.6	1.26^{ns}
	No	27.1		66.7	(1)	79		86		61.9	(1)
Number of occupants	*Two*	39.8	45.34**(1)	78.4	67.86**(1)	71.5	.48^{ns} (1)	92.2	43.21**(1)	59.2	.87^{ns}
	Three or four	16.8		49.8		73.8		75.3		55.7	(1)
Driver's helmet use	*Yes*	53.5	108.24**(1)	81.3	25.83**(1)	73.2	.11^{ns} (1)	89.7	3.73* (1)	63.6	4.02*
	No	17.3		62.5		72		84.4		55.6	(1)
Driver's sex	*Male*	47.5	13.01**(1)	65.8	2.01^{ns} (1)	74.5	2.27^{ns}(1)	84.4	1.77^{ns} (1)	56.9	.22^{ns}
	Female	61.3		70.6		69.7		87.7		58.7	(1)
City	*Mar del Plata*	24.6	30.29**(1)	39.1	32.48**(1)	77.4	18.72**(1)	83.3	8.05*(1)	53.9	8.91*(1)
	Balcarce	43.8		19.1		62.9		90.7		65.1	

Note: [a] Percentage of helmet wearing (vs. not wearing), [b] percentage of children who hold their hands around the driver's waist or use a fastening device (vs. children holding on the motorcycle or loose), [c] percentage of mounting or dismounting at the curb or on the sidewalk (vs. mounting or dismounting on the street).

* $p < .05$.

** $p < .01$.

Table 5
Factors associated with helmet use among child motorcycle passengers. Results of multiple logistic regression analysis.

Predictor Variables	B	S. E.	Wald	Df	*p*	ExpB
Driver's sex (ref: Male)						
Female	0.332	0.191	3.029	1	0.082	1.394
Driver's helmet use (ref.: No helmet used)						
Helmet used	1.322	0.190	48.360	1	<0.001	3.749
Type of motorcycle (ref.: Cub-model)			9.112	4	<0.05	
Moped 50 cc and Scooter	−0.034	0.282	0.014	1	0.905	0.967
Street Standard	0.090	0.258	0.123	1	0.726	1.094
Custom/Touring/Sport/ Other types	884	0.320	7.616	1	<0.05	2.421
Scooter	0.523	0.423	1.530	1	0.216	1.688
Presence of motorcycle license plate (ref.: No)						
Yes	0.395	0.249	2.508	1	0.113	1.484
Number of occupants (ref.: three or four)						
Two occupants	1.094	0.217	25.383	1	<0.001	2.986
Footrests (ref.: foot not on footrests)						
Foot on footrest	0.371	0.222	2.782	1	0.095	1.449
Mounting/dismounting (ref.: street)						
Curb or sidewalk	0.496	0.192	6.691	1	<0.01	1.642
Transporting a load (ref.: carries a load)						
Does not carry a load	0.201	0.297	0.456	1	0.500	1.222
Method of holding on (ref.: to motorcycle or loose)						
Hugging the waist or special fastening device	313	0.206	2.303	1	0.129	1.367
City (ref.: Mar del Plata)						
Balcarce	0.603	0.202	8.946	1	<0.01	1.828

profiles. For instance, users of more powerful motorcycles may have a greater sense of danger that translates to a higher helmet use rate. This should be further explored in future studies. Another factor observed in this study was the presence of a license plate. In Argentina, even though they may be required by law, license plates are not always present. Although the absence of a license plate showed statistically appreciable differences in only one behavior (i.e. method of holding on), other safe behaviors were also observed left often. This finding might indicate a certain casualness in the use of a motorcycle and lower adherence to the rules of the road, which would be in line with the results of previous studies on helmet use in the general population [20,32].

As the study was conducted in two cities of different sizes, we were interested to see if this factor influenced the practice of motorcycle safety. In Mar del Plata, the larger of the two cities, all of the safety indicators were lower. There may be various explanations for this difference, but it is worth pointing out that in Balcarce, traffic enforcement was present in the area around some of the schools. This was not observed in Mar del Plata. Additionally, most of the schools in Mar del Plata were located on the edges of the municipality, where traffic enforcement is practically nil. The association between enforcement and adherence to traffic rules has been shown in numerous occasions [35,36].

Additionally, the logistic regression showed a similar pattern of associations between helmet use and the various factors analyzed. Children registered higher helmet use rates when drivers also wore a helmet, when there were only two occupants on the motorcycle (i.e. child and driver), when they mounted and dismounted in a safe manner, when they rode on motorcycles used for intercity travel, and when they were in the city of Balcarce. It is important to highlight that the driver's helmet use and the number of occupants had a relatively higher weight than the other factors (see Table 5). As indicated in previous studies as well, both of these factors appear to be the key to understanding helmet use in child passengers [24,32,34]. It should also be noted that among safety behaviors (holding on, resting feet, etc.), the only one associated with helmet use was mounting/dismounting location. This appears to indicate that safe behaviors are independent of each other. Lastly, as previously indicated, sex was strikingly not associated with helmet use in the logistic regression, in contrast with the observed results mentioned previously. Further research is necessary to draw definitive conclusions in this regard.

In summary, the results indicate that greater effort is needed to improve motorcycle safety, especially for children. It is important to debate the regulatory details with respect to the minimum age of passengers, the permitted number of passengers, and other safety criteria. For instance, some countries have established a minimum age of 12 years (Portugal, Austria, the Czech Republic, etc.), while others set a lower age limit but demand additional safety measures (e.g., must reach footrests, use of a special child seat, etc.). In this regard, prior evidence shows that the establishment of a minimum age requirement for obtaining a motorcycle driver's license is associated with a reduced level of child injuries. It can be assumed, therefore, that a similar age restriction for passengers could also improve child safety. There are also educational actions taken in other countries that can serve as models to develop local interventions. One such example is to be found in Ederer et al. [37], where it was shown that helmet use among children increased after an intervention took place in primary schools that included road safety education and the distribution of free helmets.

Although these findings provide a better understanding of the safety conditions of child motorcycle passengers, this study has its limitations. Admittedly, observations in a natural context lower the possibility of clearly identifying certain variables. For example, with respect to helmet use, it was difficult to distinguish two of the four use conditions (size and adequate use vs. inadequate use). This factor probably contributed to the polarization in the frequency of use among those who did not use a helmet and those who used one adequately, both options that are more easily observable. Additionally, estimating a subject's age can be influenced by the observer's subjective perception. To overcome these limitations, it would be interesting for future studies to use observational methods together with self-reporting techniques. This would make it possible to gather socio-demographic data that cannot be obtained with precision via observation, as well as allow researchers to probe the possible motives behind the behaviors of motorcycle occupants. Technological options to collect data, such as the use of trrafic cameras, are another alternative to complement direct observation, but these are not always available in low- and middle-income countries. Although the study has its limitations, its results provide new information about the safety conditions of child motorcycle passengers and shines a light on a road safety issue that is seldom analyzed.

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