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A community intervention to prevent traffic accidents among bicycle commuters

ABSTRACT

OBJECTIVE: To evaluate an educational intervention designed to prevent traffic accidents among workers that use the bicycle for commuting.

METHODS: A longitudinal intervention study with a stepped wedge implementation was carried out between January 2006 and May 2007. Five neighborhoods with distinct geographic characteristics were selected in the city of Pelotas, Brazil, and 42 census tracts were randomly selected from these neighborhoods. All households were screened for male bicycle commuters, resulting in a sample of 1,133 individuals. The outcomes analyzed were "traffic accidents" and "near accidents". The cyclists were interviewed monthly by phone to record traffic accidents and "near accidents". Every 15 days, from the second month of study, a group of about 60 cyclists was invited to attend the intervention meeting that included an educational component (a talk and a video presentation), distribution of a safety kit (reflective belt & sash, reflective tape and an educational booklet) and a bicycle breaks check-up (maintenance performed if necessary). Poisson regression adjusted for time effect was used to assess the intervention effect.

RESULTS: Nearly 45% of the cyclists did not attend the intervention. During the study period, 9% of the study individuals reported a traffic accident and 88% reported a "near accident". In total there were 106 accidents and 1,091 near accidents. There was no effect observed from the intervention on either of the outcomes.

CONCLUSIONS: The intervention tested was not capable of reducing traffic accidents among bicycle commuters. Lack of interest in safety by commuters and external factors, such as road design and motorist behavior, may have together influenced this result.

DESCRIPTORS: Accidents, Traffic, prevention & control. Workers. Bicycling. Transportation. Intervention Studies. Health Promotion.

INTRODUCTION

Reducing the number of traffic accidents in Brazil is a challenge for managers. Since the new Brazilian Transit Code[16] came into effect in 1998, through the implementation of the law that prohibits driving under the influence of alcohol, little has been accomplished to reduce the high mortality rate from accidents, which varied from 19.1 to 19.4 deaths per 100,000 inhabitants between 1998 and 2005.[11] Traffic accidents do not occur without reason. They result from deficiencies on roads and vehicles and, mainly, from human error. In addition, accidents mostly impact the younger population, making the research of this matter important for public health.[10]

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Currently, in various countries the bicycle is considered a viable solution for urban transit problems due to the large number of motor vehicles in large and medium sized cities.[13] Health benefits to users[1,a] and environmental preservation[b] are some of the advantages to the use of this mode of transportation.

Brazil has the sixth largest fleet of bicycles in the world, estimated at 75 million, of which a large part is utilized by workers for commuting to work.[c] In Pelotas, Rio Grande do Sul state, southern region, approximately 18,000 workers use a bicycle daily. The majority of which are adult males and of poorer social classes.[4]

In many Brazilian cities with similar topographical and socioeconomic characteristics, intense utilization of this vehicle and insufficient road infrastructure for bicycles contributes to a significant number of traffic accidents.[2,15] Studies undertaken in Pelotas point to bicyclists as a high risk group for the occurrence of accidents. Barros et al[5] (2003) showed proportional mortality and lethality rates for traffic accidents, on the order of 18% and 5%, respectively. In 2005, a population research study showed that 5.5% of workers in Pelotas, who used bicycles suffered traffic accidents with bodily injury during the 12 months before the study, just in commuting to work.[4] Utilization of safety equipment and risk behaviors in transit were also identified. In Pelotas, close to 30% of bicycles do not have functional breaks and only 28% have reflective equipment on the rear. Almost 40% of cyclist workers report frequently biking against traffic or crossing stopped traffic lights, in addition to other behaviors considered risky[3] and prohibited by the Brazilian Traffic Code.[6]

A review study by Forjuoh & Li[8] recommends interventions to increase the safety of cyclists in developing countries. The safety programs should include measures to increase visibility at night and incentivize safer behaviors in traffic. In this context, a strategy to reduce the occurrence of accidents was developed, since public policies to promote bicycle use and the safety of cyclists are practically inexistent in Brazil.

The objective of the present study was to evaluate an educational intervention to prevent accidents among workers that utilize bicycles as a mode of transport.

METHODS

This community intervention with a phased implementation was performed in Pelotas, between January 2006 and May 2007, with male workers age 20 years or older who utilized bicycles to commute to work at least 30 minutes per day and five days per week. Two outcomes were analyzed:

- traffic accident: accident occurred on the route to work and the worker or a third party suffered bodily injury or material damage, with or without the involvement of other vehicles;
- near accident: situation reported by the cycling worker, based on the perception of a real imminent danger of an accident, including breaking, changing direction or any other quick maneuver to avoid an accident, performed by the cyclist or another user of the road, in addition to excessive dangerous proximity to another vehicle passing or passed by the cyclist, which occurs on the route to work.

A total of 1,200 individuals were invited to participate in the study through systematic sampling, a sufficient number to detect a reduction of 50% or more in the occurrence of outcomes, with a significance level of 5% and 80% power. Five neighborhoods were selected covering the entire peripheral urban area of Pelotas. They were selected according to convenience, for being the residential location of the great majority of cyclist workers. Eight census sectors with an average monthly income around ≤ R$ 600.00 (six hundred Brazilian Reals) were randomly selected in each neighborhood, for a total of 40 sectors.[d] All the households of the selected sectors were visited in order to develop a list of eligible people, of which 30 were randomly selected in each sector. In the sector where there were 30 or less cyclist workers, all were selected.

The selected subjects were contacted at home and invited to participate in the study. Those that accepted were given a closed and pre-coded questionnaire to register sociodemographic conditions, bicycle utilization patterns, use of safety equipment (observed on the bicycle), behavior in traffic and accidents suffered on the route to work in the 12 months preceding the interview.

After the initial interview, each cyclist worker was observed for ten months, by monthly telephone contact, with the goal of registering the occurrence of outcomes in the 30 days immediately before each telephone call. Information about bicycle use was also updated at this time. Two interviewers were trained to perform the monthly calls, and they did not have access to any information about the status of the participants pre- or post-intervention. Details about each accident, such as the place of occurrence, vehicles involved, time

[a] Litman T, Blair R, Demopoulos B, Eddy N, Fritzel A, Laidlaw D, et al. Pedestrian and bicycle planning: a guide to best practices. Victoria: Victoria Transport Policy Institute; 2006 [cited 2009 Aug 4]. Available from: http://www.mrsc.org/ArtDocMisc/ PedBikePlanGuide.pdf
[b] Federal Highway Administration. Measures to overcome impediments to bicycling and walking. Washington; 1993. (Case Study, 4).
[c] Secretaria Nacional de Transporte e da Mobilidade Urbana. Programa Bicicleta Brasil – Programa Brasileiro de Mobilidade por Bicicleta. Brasília: 2007 [cited 2009 May 26]. (Caderno de Referência). Available from: http://www.cidades.gov.br/secretarias-nacionais/transporte-e-mobilidade/programas-e-acoes/bicicleta-brasil/apresentacao/
[d] Instituto Brasileiro de Geografia e Estatística. Censo demográfico 2000. [cited 2009 Feb 06] Available from: http://www.ibge.gov.br

of day, light conditions, submission of an occurrence notification and bodily injury, were also obtained. Quality control was done in 5% of all the monthly telephone calls.

The intervention was implemented in a stepped wedge design, mainly due to ethical aspects, presupposing that the intervention could only benefit the study participants and therefore all should receive it. The study design ensures this, in addition to overcoming the logistical impossibility of administering the intervention to the entire group at once.

The intervention involved meetings with the group of cyclist workers every 15 days. After a systematic lottery to determine the order in which the census sectors would undergo the intervention, the cyclists of two sectors were invited to participate in each meeting, so that after ten months all groups had been invited. Thus, at the beginning of the process, all the participants were in the control group, and after they participated in the meeting, they moved into the intervention group. As set in the study design, at study end each cyclist would have contributed to an observation time period as the control and another period as an intervention, in accordance with when they participated in the meeting. The observation times thus were 50% intervention and 50% control. The period of 30 days, which includes the intervention meeting provided to each cyclist, was entirely counted as the intervention, if the meeting occurred in the first 15 days, and as a control, if not.

The meeting with the cyclists included a talk, video presentation[e] and distribution of an educational booklet. The talk and the video concerned safety in traffic, stimulating safe behavior in bicycle driving. Three factors were highlighted: being visible in traffic, having breaks on the bicycle and driving in a defensive way. The booklet summarized these ideas, and the participant was encouraged to show it to family members to reinforce the messages. The importance of bicycle use in the urban context was emphasized, working to increase the self-esteem of cyclist workers. In contrast to the healthy use of this transportation mode, traffic risks were emphasized. All the participants also received a reflective belt & sash, and a specialized team of mechanics placed reflective tape and performed the bicycle breaks check-up.

Focus groups were performed in the first phases of the study, which allowed for a better understanding of the main problems faced by cyclists in traffic, in order to decide upon the measures for stimulating safe bicycle driving behaviors and the use of safety equipment.

The meetings were coordinated by one of the authors of the article (GB), who directly participated in welcoming the participants to the talk, in the distribution of the booklets, as well as performing the quality control of the actions taken by the support team. This way, the dynamic character of the meetings was maintained. The meetings last approximately two hours in duration and had an average participation of 28 cyclist workers, with minimum and maximum values of seven and 48 participants, respectively.

Each cyclist worker received an invitation to the meeting a week in advance, which described the importance of participating and promoted the free distribution of safety equipment and bicycle check-up. The study coordinator reinforced the invitation to each participant by telephone a few days before the meetings. The meetings occurred on Sundays, in locations near the residences of the individuals, and in order to encourage their participation, a new bicycle was distributed in each one of the meetings by lottery. Those that did not attend were invited at least once to participate in another meeting.

Figure 1 shows the theoretical model for the determinants of accidents and near accidents involving cyclists, considering the potential intervention effect. Individual characteristics (sex, age, education and social class) are in the first level of personal factors. These characteristics are determinants of knowledge about cycling safety and rules in traffic, which in turn influences individual behavior in diverse daily situations. The factors related to the bicycle concerns the use of safety equipment (breaks, reflective materials and lights). The external factors are related to: a) conditions and characteristics of the commuting routes (type of road, types of pavement, presence of bicycle lanes or lines and quantity of crossings, among others); b) traffic: volume and velocity of motor vehicles, presence of heavy vehicles (buses and trucks) and presence of pedestrians and other cyclists, among others); c) inspection to enforce the traffic rules. The intervention sought to inform the cyclist workers of good traffic practices, creating knowledge and, in this way, encouraging safer behaviors in bicycle driving, in addition to equipping the vehicle and the cyclist with safety items.

For the analysis, Poisson regression was used to estimate the accident and near accident incidence rate ratio between the pre- and post-intervention period. The numerator was the sum of the number of accidents and near accidents, while the denominator was the sum of the number of months under risk of the outcomes occurring. The main independent variable was the indicator of the intervention or control, comparing the period that each cyclist contributed after the intervention to the control period. The occurrence of overdispersion was evaluated and corrected using robust variance. To evaluate the socioeconomic level, the National Economic Indicator (IEN) was utilized.[6]

[e] Projeto Ciclovida - Parte 1. Available from: http://www.youtube.com/watch?v=QNm1W7Wnv7E

The main per-protocol analysis was based on the real situation of participation by the individuals. Alternative analyses were performed for only the cyclists that received the proposed intervention and for all the participants, holding those that did not receive the intervention as if they had received it with the date and time they should have participated as the dividing point for the post-intervention period. The idea was to simulate an intent-to-treat analysis. All the analyses were adjusted for the effect of follow-up time, which is inherent to stepped wedge intervention studies.[9]

Double-data entry with automatic checking for consistency was performed with EpiInfo 6.4 software. The analyses were performed with the Stata 9.0 statistical program (Stata Corporation, College Station, Texas, USA).

Table 1. Workers that use bicycle as mode of transportation and presence at the educational intervention, according to demographic and socioeconomic variables. City of Pelotas, Southern Brazil, 2006-2007.

Variable	Sample size		Presence at intervention				p-value[a]
			No		Yes		
	n	%	n	%	n	%	
Age (years)							<0.001
20 to 29	326	28.8	188	37.1	138	22.1	
30 to 39	326	28.8	138	27.2	188	30.0	
40 to 49	289	25.4	108	21.3	181	28.9	
50 or more	192	17.0	73	14.4	119	19.0	
Skin color							0.596
White	755	66.6	342	67.5	413	66.0	
Black	220	19.4	99	19.5	121	19.3	
Mixed	158	14.0	66	13.0	92	14.7	
Marital status							0.098
Married or w/partner	904	79.8	381	75.2	523	83.6	
Single or w/o partner	229	20.2	126	24.8	103	16.4	
Neighborhood of residence							0.007
Três Vendas I	228	20.1	86	20.0	142	22.7	
Três Vendas II	250	22.1	107	21.1	143	22.8	
Porto	248	21.9	131	25.8	117	18.7	
Areal	228	20.1	96	18.9	132	21.1	
Fragata	179	15.8	87	17.2	92	14.7	
Schooling							0.667
0 to 3	221	19.5	95	18.7	126	20.1	
4 to 8	726	64.1	322	63.5	404	64.6	
9 or more	186	16.4	90	17.8	96	15.3	
National Economic Indicator (quintiles)b							0.889
1st	168	14.8	83	16.4	85	13.6	
2nd	240	21.2	109	21.6	131	20.9	
3rd	347	30.7	155	30.6	192	30.6	
4th	292	25.8	122	24.1	170	27.2	
5th	85	7.5	37	7.3	48	7.7	
Major occupationc							0.088
Production and services	683	60.5	312	61.8	371	59.5	
General salesman	255	22.6	119	23.6	136	21.8	
Other occupations	191	16.9	74	14.6	117	18.7	
Total sample	1133	100.0	507	44.7	626	55.3	

[a] Test for heterogeneity proportions. Adjusted for all variables and for variables of the use profile (Table 2).
[b] One value ignored.
[c] Four values ignored.

The study was approved by the Research Ethics Commission of the Universidade Federal de Pelotas. The objectives of the study and the confidentiality of the information were explicitly explained, and the interview was performed after verbal consent by the participant.

RESULTS

Among the 1,479 eligible cyclist workers, 21.7% were excluded due to address change, loss of employment or abandonment of bicycle use to commuting. In one neighborhood, two additional sectors with similar characteristics were incorporated, since the expected number of cyclists was not encountered. In total, 42 census sectors were utilized, and 1,133 cyclist workers, which constituted the study sample, were interviewed. There was a 1.7% refusal rate at this stage.

During the observation period, 22 meetings occurred for the intervention. The lost to follow up rate was 32.3% (366 participants). Replacement of the bicycle for another mode of transportation and change of municipality were the main reasons detected. The number of refusals during the period was five (0.4%). The original calculation of observation time was estimated at 12 thousand months, corresponding to the total individuals necessary for the sample (1,200) multiplied by ten months of observation, with this time equally divided between the control (pre-intervention) and intervention periods. Due to described losses at the end of the observation period, 9,930 months of observation were computed, which corresponds to 83% of the expected total, with 7,295 observation months in the control period and 2,635 observation months in the intervention period. These values were used as denominators for their respective periods. The participants that received the intervention and answered all the monthly calls were accompanied for two more months, in order to increase the observation time of the intervention period.

Table 2. Workers that use bicycle as mode of transportation and presence at educational intervention, according to profile of bicycle use. City of Pelotas, Southern Brazil, 2006-2007.

Variable	Sample size		Presence at intervention				p-value[a]
			No		Yes		
	n	%	n	%	n	%	
Days of use/week							0.119
5	415	36.6	172	33.9	243	38.8	
6	544	48.0	261	51.5	283	45.2	
7	174	15.4	74	14.6	100	16.0	
Time of use (min)/day							0.543
30	180	15.9	84	16.5	96	15.3	
31 to 45	202	17.8	96	18.9	106	16.9	
46 to 60	366	32.2	159	31.4	207	33.1	
61 to 90	199	17.6	87	17.2	112	17.9	
91 to 120	114	10.1	54	10.7	60	9.6	
More than 120	72	6.4	27	5.3	45	7.2	
Bicycle use (years)							0.004
More than 20	291	25.7	116	22.9	175	28.0	
From 16 to 20	176	15.5	60	11.8	116	18.5	
From 11 to 15	163	14.4	58	11.4	105	16.8	
From 6 to 10	254	22.4	128	25.3	126	20.1	
Up to 5	249	22.0	145	28.6	104	16.6	
Use at night							0.915
No	103	9.1	47	9.3	56	9.0	
Yes	1030	90.9	460	90.7	570	91.0	
Use on rainy days							0.163
No	217	19.2	110	21.7	107	17.1	
Yes	916	80.8	397	78.3	519	82.9	
Total sample	1.133	100.0	507	44.7	626	55.3	

[a] Test for heterogeneity proportions. Adjusted for all variables and for variables of the demographic and socioeconomic profile (Table 1).

Table 3. Number of occurrences, incidence rate and crude and adjusted to time effect relative risk (RR) for traffic accidents and near accidents among workers that used bicycle as a mode of transportation. City of Pelotas, Southern Brazil, 2006-2007.

Type of analysis	Observation time (in months)	Occurances in the period		Incident rate per 1,000 cyclist-months		Crude RR (CI 95%)		RR Adjusted for time (CI 95%)	
		Accidents	Near accidents	Accidents	Near accidents	Accidents	Near accidents	Accidents	Near accidents
Per protocol analysis						0,85 (0,52;1,41)	0,53 (0,41;0,69)	1,12 (0,57;2,22)	1,23 (0,95;1,59)
Control period	7295	81	915	11,1	125,6				
Intervention period	2635	25	176	9,5	66,8				
Total	9930	106	1091	10,7	110,0				
Intent to treat analysis						0,90 (0,58;1,39)	0,42 (0,33;0,54)	1,23 (0,64;2,37)	0,92 (0,71;1,18)
Control period	6406	71	886	11,1	138,3				
Intervention period	3524	35	205	9,9	58,2				
Total	9930	106	1091	10,7	110,0				
Analysis of individuals that received the intervention						0,79 (0,46;1,36)	0,48 (0,36;0,64)	1,13 (0,48;2,69)	1,10 (0,81;1,49)
Control period	3823	46	523	12,0	136,8				
Intervention period	2635	25	176	9,5	66,8				
Total	6458	71	699	11,0	108,2				

During the study, 9% of individuals reported suffering at least one traffic accident and 88% a near accident. In total, 106 traffic accidents occurred, with 81 accidents in the control period and 25 in the intervention period. The overall accident incident rate observed during the study was 10.7 per 1,000 cyclist-months, corresponding to 1.3 accidents for each 10 cyclist-years. There were a total of 1,091 near accidents, with 915 in the control period and 172 in the intervention, for a total incident rate of 110.0 per 1,000 cyclist-months or 13.2 for each 10 cyclist-years.

Of the 1,133 cyclist workers in the study, 626 (55.0%) participated in the meeting, for which they were invited and received the proposed intervention.

Tables 1 and 2 describe the sample of cyclist workers in relation to the sociodemographic characteristics and the bicycle utilization profile, respectively. They analyze the differences between individuals that participated in the meetings for the intervention implementation and the other individuals. Table 1 shows that the majority of cyclist workers consisted of young adults, between the ages of 20 and 39 years, with white skin, married or living with a partner. The Fragata neighborhood presented the smallest number of participants, despite adding two more census sectors. The majority had, at most, elementary schooling and belonged to the intermediate levels of the IEN.[6] More than 60% worked in the production of goods and services (mason or mason's assistance, painters, longshoremen, or cargo loaders). The variables of age and neighborhood of residence showed significant differences between the individuals who did and did not receive the intervention.

Table 2 indicates that the majority of cyclist workers utilized the bicycle five or six days a week, between 30 and 60 minutes/day. Mean daily use was 74 minutes with a median of 60 minutes. More than 50% utilized the bicycle as their mode of transportation for more than ten years, and the majority also circulated on rain days and at night. Only the variable "use of bicycle" showed a significant difference in relation to the participants who received the intervention and the other individuals.

Between the individuals who continued until study end and those considered as lost to observation, a significant difference was observed in relation to the variables of age, neighborhood of residence, IEN level and profession (data not shown).

Figure 2 presents the proportion of accidents and near accidents occurring each observation month among the participating cyclist workers. In relation to near accidents, a strong decreasing tendency was found in the first ten months, with 20.9% of interviewees reporting having suffered the outcome in the first month and only

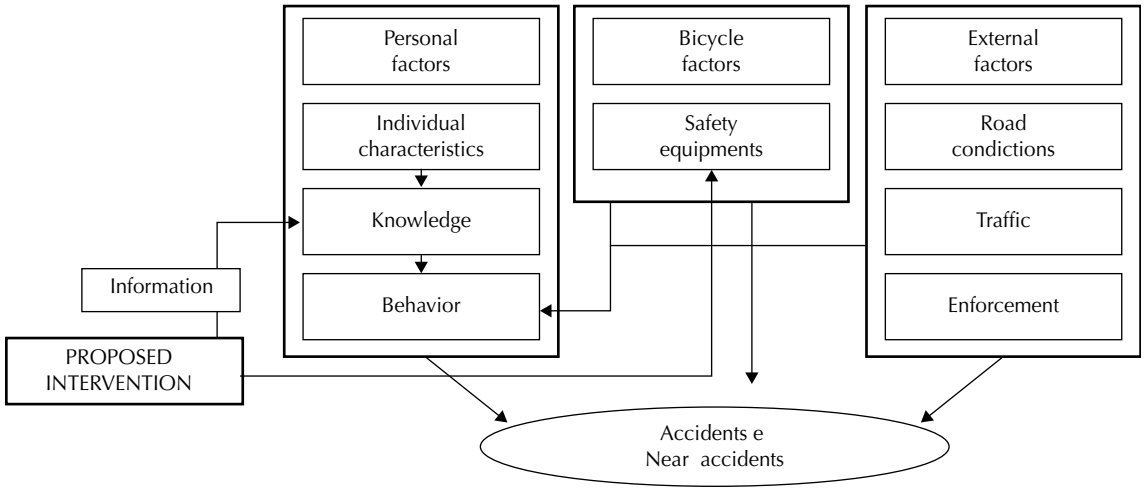

Figure 1. Hierarchical model of determinants for the occurrence of traffic accidents and near accidents and the proposed intervention. City of Pelotas, Southern Brazil, 2006-2007.

2.6% in the tenth month, with a subsequent increase in the last two months. In regards to accidents, the figure shows similar results during the entire period, except for the 11th month, when a decrease in occurrence was observed.

Table 3 shows the incident rates for accidents and near accidents suffered by cyclist workers during the control and intervention periods, presents the period under observation, the number of accidents and near accidents in each period and the respective crude and adjusted relative risks for the effect of time. In regards to traffic accidents, the per protocol analysis showed an incident rate of 11.1 accidents per 1,000 cyclist-months in the control period and 9.5 accidents per 1,000 cyclist-months in the intervention period, corresponding to a non-significant gross relative risk of 0.85. After adjusting for the effect of time, this value inverted its direction, indicating a 12% greater risk for the occurrence of accidents among cyclists that received the intervention, which was also not significant. The intent-to-treat analysis and the analysis with only the participants that received the proposed intervention showed similar results as the per protocol analysis.

Table 3 indicates a significant decrease in the incident rate for the outcome of near accidents in all the analyses performed, between the control and intervention periods. In the overall per protocol analysis, the decrease from 125.6 to 66.8 near accidents per 1,000 cyclist-months reflected a significant protection of almost 50% following the intervention. After adjusting, the obtained result inverts and loses statistical significance. Similar values were observed in the other analyses performed.

DISCUSSION

In the reviewed literature, there was no work with an objective similar to this study. It is possible that this is the only study to perform an intervention based on an educational component to promote the use of safety equipment and evaluate the intervention's impact.

The lack of a protective effect from the intervention can have two explanations. Supposing that behavior change can avoid accidents, the proposed intervention did not reach a level of change necessary to lead to a reduction in the occurrence of traffic accidents. Behavior changes by cyclists are not sufficient to reduce the number of accidents because other factors (road conditions and traffic) are the principal determinants for their occurrence.

The primary hypothesis could be reinforced by some problems that occur during field work. Non-attendance of the meetings and follow-up losses were the main study limitations. The lack of interest in participating in the event about traffic safety and the necessity of some of the invitees to work on Sunday may have determined their absenteeism. The lower participation of younger cyclist workers can be explained, in part, by the characteristics of this group having less motivation to participate in events of this nature. Besides this, Rose[14] (1985) argues that in population prevention strategies, when the perception of individual risk is low, there is low motivation to adopt the intervention. Additionally, we did not detect the reason for the differences between the groups in regards to neighborhood of residence, since the methodology utilized to promote participation in the meetings was strictly maintained.

Concerning follow-up losses, substitution of a bicycle for another transportation mode, mainly motorcycles,

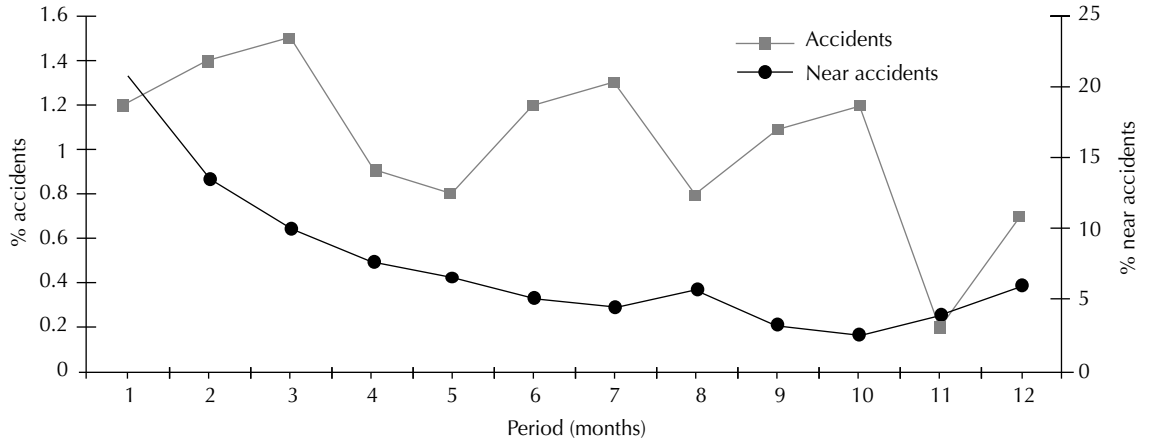

Figure 2. Proportion of accidents and near accidents occurrences among cyclist workers in the sample during the study observation period. City of Pelotas, Southern Brazil, 2006-2007.

was responsible for 52% of cases. Another important reason was migration to other cities, with approximately 28% of cases. These two factors can perhaps explain the greater number of losses among younger cyclists (potential motorcycle users and migration, besides the previously mentioned lack of interest) and among those in the lower fifth of the IEN (subject to migration for better work conditions).

In contrast, the data analysis restricted to those that participated in the intervention did not show any sign that there could be an intervention effect.

Considering previous research findings and the results found in the baseline study,[4] we believe that the second hypothesis is more plausible. The evaluation of risk factors for accidents reported in the 12 months preceding the interview did not show an effect of any one risky behavior or from the lack of safety equipment on the bicycle. Only the simultaneous reporting of three highly inadequate behaviors (riding after ingestion of alcohol, zigzagging through traffic, and riding rapidly) showed an increase in the occurrence of traffic accidents. This behavior was restricted to only 22.2% of the study sample.

The use of stepped wedge interventions is common in community interventions that are considered without risk. The particularities of their analysis, though, are not widely known. In the present study, the need to adjust for the effect of time, external to the intervention, became evident. Without this adjustment the result would be irremediably biased. The gathering of information about traffic accidents and near accidents during the 30 day period immediately before each telephone call, minimized the possibility of recall error. In compensation, the monthly contact may have caused a progressive lack of interest in participants and reduced the reporting of outcomes, principally in relation to near accidents. In addition, repeatedly responding to questions about accidents may have caused a change in perception or understanding about the event. The high reduction observed in reports of near accidents from the beginning of the study, without relation to the intervention, suggests that this may have happened, as indicated by the change in the effect direction when adjusted for the exposure time. Since an intervention capable of reducing traffic accidents, be they implemented by public or non-governmental agencies, did not happen during the study period, we believe that the reduction in reports of near accidents is connected with the alternatives described.

In summary, the present study suggests that an intervention based on an educational component and the promotion of the active use of safety equipment is not capable of reducing accidents among cycling workers. Some studies suggest that interventions of this nature can be effective in developing countries and, therefore, should be implemented and tested.[7,8] Nonetheless, a literature review[12] concluded that isolated educational programs, attempting to only change individual behavior, are not effective in reducing accidents. This supports changing the strategy of many countries where the principal actions for traffic safety are based on educational campaigns. The results of the present study corroborate the findings in the literature and reinforce the thesis that the number of accidents will not considerably decrease without actions that also include improved road infrastructure and the effective application of legislation (with comprehensive and systematic law enforcement).

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