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## Strengthening of Community Action for the Reduction of Motorcycle Accidents in Dezful, Iran

Maryam Mazaheri <sup>a</sup> | Nastaran Keshavarz Mohammadi <sup>b\*</sup> | Hamid Soori <sup>c</sup> | Ali Ramezankhani <sup>d</sup> | Toraj Kordealivand <sup>e</sup>

<sup>a</sup> School of Public Health, Dezful University of Medical Sciences, Dezful, Iran.

<sup>b</sup> Department of Public Health, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

<sup>c</sup> Department of Safety Promotion and Injury Prevention Research Center, School of Public Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

<sup>d</sup> Department of Public Health, School of Public Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

<sup>e</sup> Islamic Republic of Iran Police Force, Dezful, Iran.

\*Corresponding author: Nastaran Keshavarz Mohammadi

Department of Public Health, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran. Postal code: 198353-5511.

E-mail address: [n\\_keshavars@yahoo.com](mailto:n_keshavars@yahoo.com)

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### ABSTRACT

**Background:** Road traffic accidents are considered to be a leading cause of injuries across the world. Human factors have been reported to play a key role in road traffic accidents. The present study aimed to explore the approaches to the reduction of human errors and motorcycle accidents.

**Methods:** A participatory multistage intervention was designed and implemented through team participation. In addition, campaign interventions were implemented on the urban and high school levels on 148 students who owned motorcycles. The campaign encompassed seven strategies on the urban level and eight strategies on the school level in 2015.

**Results:** Compared to the same period in the past year, the rate of motorcycle accidents reduced from 56.91 to 47.32 (9.59%) and 65.34 to 51.77 (13.57%) in the one-month and three-month interventions, respectively. In addition, the human factors involved in motorcycle accidents (e.g., knowledge of students) improved significantly, while no significant differences were observed in the factors of attitude and behavior.

**Conclusion:** According to the results, the cooperation of all the stakeholders of motorcycles accidents in the design and implementation of evidence-based interventions could significantly reduce the rate of motorcycles accidents on an urban level.

## 1. Introduction

Road traffic accidents are considered to be a leading cause of injuries across the world [1]. According to the World Health Organization (WHO), the mortality rate of road traffic accidents has not increased significantly within the past decade although it remains unacceptably above 1.2 million cases per year. According to statistics, 90% of these mortalities occur in developing countries [2], and more than

three-quarters of these mortalities are reported in young male individuals [3]. Per each death caused by road traffic injuries, a minimum of 20 individuals undergo non-lethal injuries. Moreover, it is estimated that 20-50 million individuals experience such injuries every year [1].

Iran is one of the highest-ranking countries in terms of road traffic accidents [4]. Several factors are involved in the incidence of road traffic accidents in Iran, including the massive production of motor vehicles regardless of

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infrastructural conditions, low-quality process of obtaining the driver's license, improper roads, poor culture of using motor vehicles, and lack of adequate training [5]. The frequency of using motorcycles and bicycles for transportation and recreational purposes has been reported to be on the rise worldwide [2]. Pedestrians and motorcyclists are faced with the most severe injuries compared to other road users in road traffic accidents [1]. Half of the deaths caused by road traffic accidents occur in vulnerable users, such as motorcyclists (23%), pedestrians (22%), and bicycle/tricycle riders (4%). According to the literature, the mortality rate among motorcyclists has remained unchanged since 2010 in different countries, while approximately one-quarter of road-related mortalities is reported to occur among motorcyclists. Therefore, special attention must be paid to the safety of these individuals [6].

According to the traffic department of Dezful (Iran), there is almost one motorcycle registered per two individuals in this city, the population of which is 500,000, with the number of motorcycles estimated at 250,000 [7]. Due to the old and traditional urban design of Dezful (e.g., narrow streets and paths), motorcycles are a common choice for transportation. In addition, the hot climate of the city further encourages the use of motorcycles considering the high costs of cars with air conditioners.

Human factors have been reported to play a key role in road traffic accidents [2,8]. Evaluation of the road traffic accidents in Iran has indicated that human factors are the foremost influential factor in the incidence of driving accidents [9]. Some of the most important human factors in this regard include the negligence of the rules and regulations and driving errors [10], illegals peering [11,12], illegal overtaking [12,13], hurry while driving, drowsiness of drivers, and drivers' fatigue due to long distances [12]. Furthermore, research in this regard suggests that several psychosocial and social factors affect high-risk driving behaviors, giving rise to motorcycle accidents [14]. Some studies have also denoted some of the main factors that could stimulate high-risk driving behaviors in motorcyclists, including being single and young, lack of defined traffic regulations, the availability of motorcycles to unlicensed, young individuals, and cost-efficiency of motorcycles for transportation [15,16].

According to Ottawa Charter for Health Promotion, the reinforcement of community action and developing individual skills are key strategies for the reduction of road traffic accidents [17]. In this context, public participation involves the use of personal resources in order to participate effectively in a collective action. Public participation is a fundamental component of effective planning. Correspondingly, a comprehensive plan is conducted by the people, rather than for the people [18]. In addition, community and stakeholder participation could increase the efficacy and sustainability of such programs through addressing important community concerns.

The present study aimed to discuss some of the findings regarding comprehensive participatory programs for the reduction of motorcycle road traffic accidents in Dezful, Iran (code of ethics: 10) [19]. Furthermore, we investigated the effects of educational interventions on the improvement of the knowledge, attitude, and behaviors of individuals for the reduction of motorcycle accidents.

## 2. Materials and Methods

This participatory action research (PAR) was conducted using quantitative and qualitative data collection methods in four stages of planning, action, observation, and reflection in 2015. A schematic view of the research stages is depicted in Figure 1.

### 2.1. The Planning Stage

In the planning stage, the target population was identified, including adolescents, parents, motorcyclists, and the organizations related to road traffic accidents. Initially, a planning team was established consisting of the representatives of 26 relevant organizations. The intervention program was developed in seven participatory sessions during four months. The scientific concepts associated with each planning stage were provided to the team, and discussions to share experiences and perspectives were implemented. Following that, the required data and the individuals responsible for data collection were determined. The collected data were presented in following planning meeting, and decisions were made by consensus using decision matrices.

In addition to the planning team, the perspectives of the individuals toward the causes of the high rate of motorcycle accidents in the city and the appropriate solutions were explored using various techniques, including surveys via virtual networks, live radio programs and SMS, in-person meetings with different groups of participants, informal meetings with road traffic personnel, and providing educational interventions for young motorcyclists.

The planning team decided to focus on the human determinants of road traffic accidents. After the analysis of the data obtained by the public survey and performing the group discussion sessions of the participatory planning team, 32 high-risk driving behaviors in motorcyclists were identified and listed. Since it was not possible to evaluate each item in the list due to time constraint and costliness, six main determinants were prioritized using the decision matrix based on the objectives of the intervention. These determinants included running the red light, exceeding the speed limit, non-observance of the right route, using mobile phones or similar communication devices while riding, forbidden overtaking of bilateral paths, and pleasurable motorcycling (e.g., weaving through and wheelie). At the end of this phase, the intervention program for the campaign was developed with the participation of the planning team, targeting the categories of audience and public audience on an urban level with 148 students selected from two technical high schools who owned motorcycles. After conducting an online re-survey, the campaign was entitled the 'South Unique Riders' with the slogan of 'Pleasure, satisfaction, and security' with extensive public participation.

In order to collect the quantitative data on the human determinants of road traffic accidents, a questionnaire was developed by reviewing the available and relevant questionnaires (n=7), and the validity of the data collection tool was investigated. Moreover, the interventional and evaluation strategies were verified by the planning team [20].

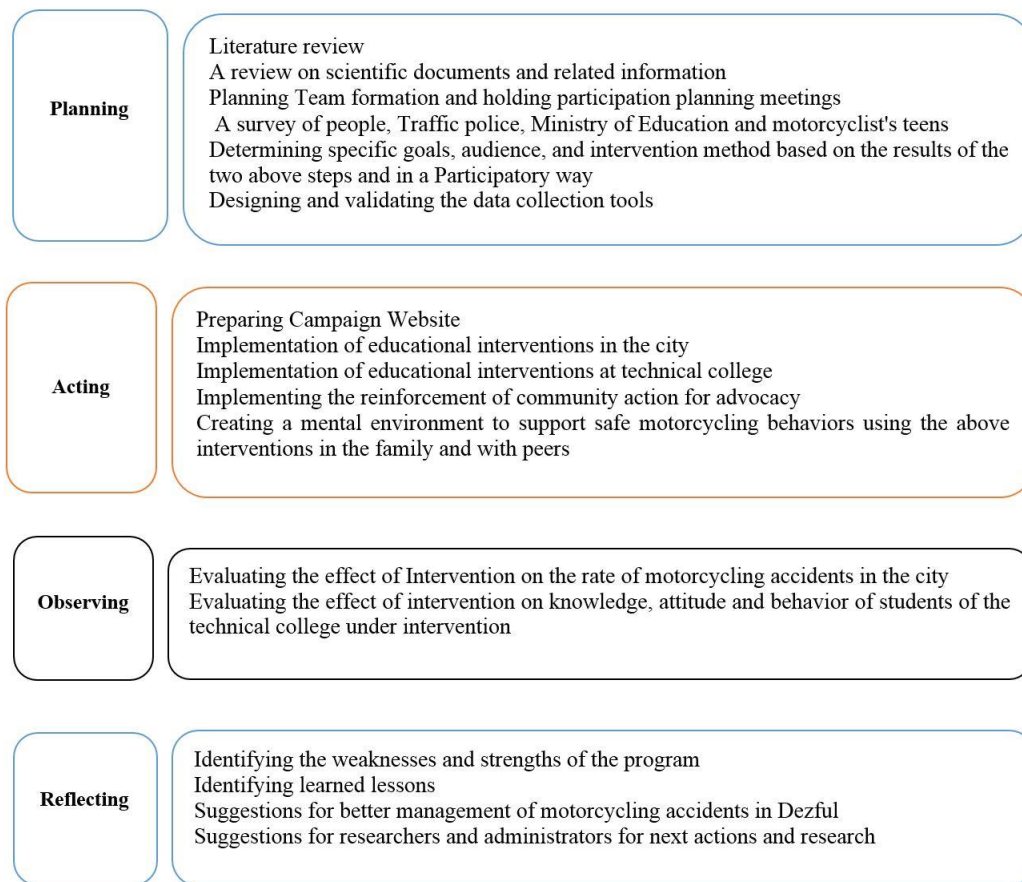


Figure 1: Research steps

2.2. The Action Stage

The actions conducted at this stage were taken in two steps of preparation and implementation, which were performed by holding a joint press briefing with the traffic police chief, providing a specific website for the campaign, performing a specific radio program on the local radio, developing multiple dedicated virtual channels for the campaign (via WhatsApp and Telegram), inserting the campaign homepage into the websites of the partner organizations, and design and validation of the educational contents of the campaign with the participation of adolescents, peer organizations, and the planning team. Moreover, the viewpoints of various individuals were explored using educational methods and different channels of message transmission. In the action stage, different actions were approved by the planning team within one month (Table 1).

2.3. The Observation Stage

In the observation stage, the effects of the intervention on the frequency of motorcycle accidents in the city on the knowledge, attitude, and behaviors of the students of the technical high schools were evaluated. The assessment was performed one and three months after the intervention.

2.4. The Reflection Stage

In the reflection stage, the strengths and limitations of the program and learned lessons were identified. Furthermore, suggestions were provided for the effective management of motorcycle accidents in Dezful to be used in the other programs in future actions and research. The general scheme of the study method is depicted in Figure 2.

Table 1: Intervention components of the campaign

Conducted Measures	Implementation level
Both levels of city and schools	Public information by installing banners, posters, CDs, and presenting lectures
Both levels of city and schools	Broadcasting educational messages by radio and cellphone messages (SMS + social networks)
City	Exacerbating the training in certification training classes
City	Holding the training courses for Disabled Motorcyclists referring to the traffic department to deliver the sealed motor
City	Weekly notification of Friday prayer imam and imams of the congregation of the mosques
Both levels of city and schools	Announcing a day as a day without motorcycle accident
School	Displaying videos, photos, and clips
School	Holding practical training sessions to practice skills
School	student education through parents and teachers
School	Visiting of the traffic police Parking and injured people by students

### 3. Results and Discussion

#### 3.1. Motorcycle Accidents before the Intervention

Considering the significant differences in the reported rates of road traffic accidents as proposed by four main organizations (Road and Transportation, Insurance Company, Dezful University of Medical Sciences, and Emergency Medical Services [EMS] Organization), data in the road accidents in Dezful were collected using the statistics reported by the EMS as the baseline and post-intervention source of data regarding the frequency of motorcycle accidents as they were considered to be reliable. The analysis of the EMS data indicated an upward trend in the pattern of the accidents over the past three years (Figure 3).

Data analysis demonstrated that the vulnerability of motorcyclists was higher compared to the users of other vehicles. As such, the rate of the injured motorcyclists to the other injured drivers was 60% in 2011, 65% in 2013, and 59%

in 2014. In other words, more than half of the reported road traffic accidents involved motorcyclists. Furthermore, 79.77% of motorcycle accidents (EMS statistics) and 48.64% of the deaths due to motorcycle accidents (Forensic Organization statistics) occurred in the age group of 15-35 years. Therefore, this age group was selected as the target audience of the campaign. In addition, the most common causes of the accidents leading to injuries were the non-observance of the right route (40%) and distraction from the front (24%).

#### 3.2. Public Participation

The current research succeeded in attracting broad participation on both levels of authorities and urban population. However, the quantity and quality of the participation of the involved individuals and organizations (level, rate, and type of participation) were variable. Table 2 shows an overview of participation in each stage of the study.

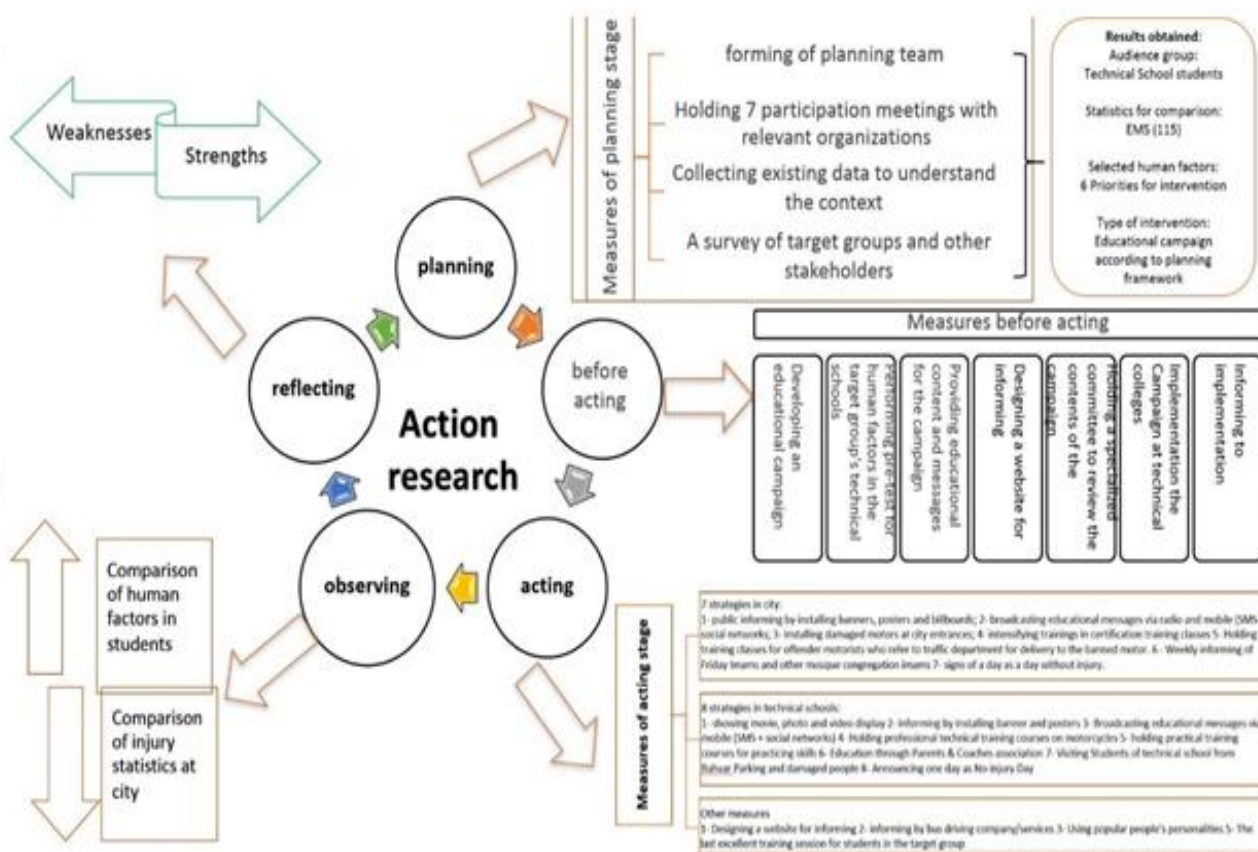
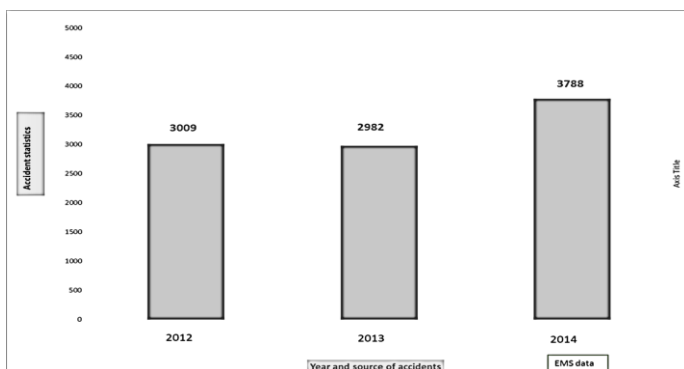


Figure 2: The Study Flowchart

**Table 2:** Overview of public Participation

Participation stage	Participants	Type of participation	Necessity	Number of people	Number of sessions
Planning	24 Organizations	Formal participation in planning meetings	Partnership	52	7
	People	Informal participation by announcing views to the researcher through participation in the live radio program and virtual network projects	Determining the priorities of the program, the preparation of content and educational messages	650	3
	Students	Informal participation by attending in survey meeting	Determining the priorities of the program	163	1
	Motorcyclists	Informal participation by attending in survey meeting	Determining the priorities of the program	12	1
	Educators	Formal participation by attending meetings	Campaign naming	7	1
	Traffic police	Formal participation by attending meetings	Determining the priorities of the program	30	1
Action	24 Organizations	Formal and informal participation in implementation	Displaying videos, producing and installing banners and posters, duplicating and distributing brochures, credit supply, implementing radio programs, sending SMS, holding training classes, speaking, coordinating the visit of parking, website designing	60	19
Evaluation	24 Organizations	Consultation	Verification of data	24	2



**Figure 3:** The pattern of traffic accidents leading to injury in Dezful; 2012-2014

### 3.3. Urban-level Results

Comparison of the incidence of motorcycle accidents pre- and post-intervention with similar months of the year indicated that while the incidence rate at the pre-intervention month was similar to the previous year, the rate of these accidents one and three months after the intervention reduced to 43 (9.59%) and 62 cases, with the overall frequency of motorcycle accidents estimated at 13.57% on an urban level (Table 3).

### 3.4. School-level Results

Among 148 students aged 15-18 years, almost a quarter of the students (24.3%) owned a motorcycle for 3-5 years; these individuals were mostly within the age range of 10-12 years, 33.8% of whom rode motorcycles for 1-3 years, and one-fifth of these cases (18.2%) were motorcyclists for more than five years. Additionally, more than half of the students

(54.7%) owned a motorcycle, and the others had access to the motorcycles owned by their family members.

Data analysis indicated that the intervention resulted in the improved knowledge, attitude, and behavior of the students. However, no significant improvement was denoted in the mean score of attitude and behavior (Table 4). Meanwhile, all the mentioned high-risk behaviors were observed to improve significantly in most of the cases, including illegal overtaking ( $P=0.008$ ), non-observance of the right route ( $P= 0.008$ ), illegal speeding ( $P= 0.001$ ), and running a red light ( $P = 0.001$ ). However, no significant improvement was observed in pleasurable motorcycling and using mobile phones while riding. On the other hand, the attitudes of the students improved after the intervention toward compliance with the rules and regulations, observance of the right route, and speed reduction, which were among the prioritized items of the program.

According to the results of the present study, community action could reduce the rate of road traffic accidents even in the cities known to have a high number of motorcycles and motorcycle accidents. In addition, evidence suggests an association between community empowerment and health outcomes [21]. In this regard, some scholars believe that the key domains of empowerment include participation, community-based organizations, local leadership, resource mobilization, seeking reason, problem evaluation, communication with other people and organizations, the role of external factors, and program management [21]. In the current research, almost all these domains were considered in practice. However, our findings indicated that

attracting public participation in the reduction of road traffic accidents is very difficult, yet crucial.

In recent years, official executives have focused on reducing the number of the casualties caused by road traffic accidents, and less attention has been paid to preventive policies. For instance, available studies and statistics indicate that the reduction of the mortality rate of road traffic accidents or the intensity of the imposed burdens are easier than reducing the incidence of road traffic accidents, which in turn has led to the higher rate of injuries since the reported situations are mainly related to the assessment of mortality [22]. Moreover, evaluations of the changes in the mortality rates of road traffic accidents in Iran in the 2000s and 2010s have indicated that the number of road traffic deaths has decreased, while the frequency of the injuries caused by road traffic accidents has been steady or on the rise [23].

In the current research, six high-risk driving behaviors were investigated. Several studies have confirmed the positive impact of training on the correction of human factors or reduction of the risks associated with the negative behaviors of drivers in road traffic accidents, including motorcyclists [24]. The results of the present study showed that training and enhancement of collective action could significantly reduce the rate of road traffic accidents.

Some of the limitations of the current research were the short duration of the intervention and inability to assess the effects of non-human factors. Nevertheless, the obtained results could effectively significantly decrease the rate of the road traffic accidents involving motorcyclists, which makes the intervention most successful worldwide, especially considering its limited time and available resources. For instance, officials in Thailand have managed to reduce the risk of motorcycle accidents by 29% through implementing educational-interventional programs regarding safe motorcycling in the form of multi-dimensional training courses over two years. In the mentioned study, the frequency of road traffic accidents was reported to diminish by 11.5% after the intervention [24]. It is notable that the duration of the training campaign in the current research was only one month, which is significantly less than the duration of training in the

mentioned study; nonetheless, the obtained results seemed promising.

The authors of this paper believe that the overall success of the project was due to the effective attraction of various strata of people, including motorcyclists and the youth, as well as numerous organizations, and their motivation for collective actions for the evidence-based identification of the intended target audience and adoption of effective, multilevel educational strategies. These issues have also been reported in numerous successful studies in this regard [25].

As the participation in the present study initiated from the planning stage of the program to the implementation stage, it resulted in the partnership of the project, enabling the researchers to improve public knowledge and develop more effective planning and program implementation.

The public identification of needs and priorities leads to the empowerment of the community members to take action and own the project as was achieved in the current research [26].

The campaign in the present study positively influenced four out of six high-risk driving behaviors. The two high-risk behaviors of pleasurable motorcycling and using mobile phones while riding did not improve significantly although the former was identified as the most important cause of motorcycle accidents at the pre-intervention stage. This could be due to the high psychological need of motorcyclists to show off and the lack of opportunities, places or facilities to address this need safely, which causes these individuals to perform risk acts on the streets. It is also notable that as these individuals were mostly aged less than 18 year (the legal age of applying for a driver's license), they have never received formal training on motorcycle riding. For the first time, the program in the present study familiarized these individuals with driving rules and regulations. Therefore, it could be concluded that the training of drivers may be an effective alternative to learning through trial and error, especially in cases where driving errors may bring about irreversible consequences [27]. It is suggested that authorities adopt proper policies to allow underage driving training in cities such as Dezful, where there are social norms that allow adolescences to start riding motorcycles as early as the age of nine years or even sooner.

**Table 3:** Comparison of motorcyclists' Injuries before and after intervention in Dezful by using T-test.

Time	Number of Injuries	frequency of accidents	Mean	SD	T-test	Pvalue
Before intervention 2014	223	45.82	7.76	2.95	0.454	0.65
(September) 2015	223	45.1	7.43	2.72		
1Month after intervention 2014	277	56.91	9.23	2.68	2.30	0.032
(January) 2015	234	47.32	7.80	2.34		
3 Months after intervention 2014	318	65.34	10.6	2.20	3.69	0.001
(March) 2015	256	51.77	8.53	2.12		

**Table 4:** Comparison of Knowledge, Attitude, and Behavior of Self-Report Scores of Students in the Target Group before and after the Intervention by using ANOVA, N = 148.

Index	Time						Repeated Measurement (ANOVA)
	Before		After (1month)		After (3month)		
	Mean	SD	Mean	SD	Mean	SD	
Knowledge	74.27	12.5	77.45	12.4	75.51	12.5	0.008
Attitude	28.42	3.6	28.81	3.8	28.51	3.7	0.24
Behavior	51.49	9.1	52.65	8.2	52.98	8.6	0.13

The effects of the intervention in the current research persisted for three months, and although they diminished in some cases, the studied parameters did not relapse to the state before the intervention.

According to the traffic police statistics, the foremost and most frequent cause of car accidents in Dezful was the non-observance of the right route, which has also been reported in Yazd (Iran) for the same reasons (i.e., narrow streets and numerous intersections as in Dezful) [19]. The results of the present study also indicated that the students were not aware of this issue and the associated consequences. Therefore, this item was incorporated into the training program, and significant improvements were observed in the domains of the attitude and behavior regarding the observance of the right route and speed limit after the intervention. After the intervention in the current research, the attitudes of the subjects enhanced remarkably although the mean score of attitude remained changed. The other studies in this regard have also denoted the positive effects of appropriate training on the attitude of young drivers [28], which is considered to be a significant influential factor in safe driving.

#### 4. Conclusion

The current research provided important data despite the possible limitations. According to the results, the participatory campaign improved the knowledge, attitude, and behaviors of adolescent motorcyclists without a driver's license and formal training. Furthermore, community action was found to be remarkably effective in solving this community issue despite the lack of adequate facilities and prior experience of the community members in teamwork. Even in the cases where there were disbeliefs in the effectiveness of the intervention, the provided evidence and scientific approaches could be properly used to design health promotion interventions and programs. These programs highlight the need for the involvement and support of the related organizations in health problems, including road traffic accidents, requiring them to pay special attention to the essential principles and skills in order to gain public support and participation, so that the proper communication and planning of health interventions would be possible. This study also confirms the need for effective partnership and community empowerment [26,29].

#### Authors' Contributions

M.M., and T.K., collected the data and worked on the methods; K.N., supervised the study and reviewed and edited the drafted manuscript; H.S., A.R.,...; analyzed the data and wrote the first draft. All authors revised, read, and approved the final manuscript.

#### Conflict of Interest

The authors report no conflict of interest.

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