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Effectiveness of an educational program on decreasing burns and injuries in Persian festival of fire: A burden of diseases approach

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ABSTRACT

Chaharshanbeh souri is a historical Persian firework festival which has several health and financial damages for Iranians near celebration of New Year. In this study we tried to find effectiveness of *Chaharshanbeh souri* educational campaign on decreasing burden of injuries due to fireworks of this day.

In this before-after study, an educational campaign was done for 2017 focusing on children and students. Data of a registry which was designed for gathering information of injuries and mortalities of this festival was used to show effectiveness of the program. Disability adjusted life years was calculated and compared before and after intervention.

The results of this study showed that mean age of injuries was increased from 27.75 to 32.65 years and DALY decreased significantly after the intervention (P=0.0460) showing that the intervention was effective.

Educational programs might be effective to decrease burden of injuries related to *Chaharshanbeh souri* festival.

1. Introduction

Chaharshanbeh Souri (Persian Festival of Fire) is a historical and traditional Iranian event that is celebrated on the eve of the New Year (Nowruz). Each year, by the end of the year, some people tend to distribute a wide and diverse range of explosive materials and fire crackers and fireworks even hand-made dangerous ones [1]. The consumers of such materials are mostly young people and teenagers who usually explode them in public streets and crowded centers and create explosive sounds, and make a lot of fear and discomfort especially for women and children. During the past years, many people including teenagers, youngsters and adolescents have died due to related explosions or have suffered from severe and irreparable damages. In some cases, financial damages have

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been huge to people and the firework users as well [2]. The events that have taken place on this Wednesday have been raised as a critical safety issue which create unusual condition across the society in a certain period of time. However, the Iranians are still keenly interested in holding this traditional celebration, so it is widely held throughout the country [3,4]. If such a situation continues with no planning and management, much more serious personal and social complications such as insecurity, physical illness, death, etc. will follow [5]. In 2016, an intervention was implemented to control the incidents and injuries of Red Wednesday in Guilan province, during which the possible incidents of this day and education and prevention at the community were all performed. In this intervention, pamphlets and flyers were published. Moreover, public education through social networks, holding congress and news conference, shaping popular campaigns, sending text messages and radio and television conversations were performed. The intervention started from the beginning of February 2016 and continued until March of the same year.

Different indicators are used to examine the importance of an incident and a disease, while the burden of disease is widely used in health policy making and planning and international comparisons as an indicator of health status. According to the definitions, the burden of disease means the sum of the years of lost life (YLL) and years lost due to disability (YLD). It is an important criterion for rating the status of health in society and observing their challenges [6]. Increasing burden of disease in the society creates a lot of financial and non-financial burden. According to the World Health Organization, the value of one year of life is three times more than that of the per capita GDP of each country [7,8].

The aim of this study was to determine the impact of the burden of burn incidents related to *Persian Festival of Fire* in Guilan from 2016 to 2017 and the effect of our *Chaharshanbe Suri* educational Campaign on the burden of diseases by analyzing and comparing the damages.

2. Methods and materials

This is a cross-sectional study conducted in three stages. In the first step, the information of the data registry system of the Red Wednesday in Guilan Road Trauma Research Center from 2015 to 2016 were used. According to the definition, all burn patients, ear, eye and nose injuries (274 cases) due to incidents on this festival from March 13, 2016 to April 3, 2016 were identified and the related data were collected. In the meantime, cases of burn with boiling water and electricity that are not related to the events of *Chaharshanbe Suri* were excluded from the study. In this research, YLD was calculated and compared, for two years from 2015 to 2016 (before and after the intervention).

2.1. *DALY (burden of disease)*

The burden of diseases is one of the most important causes of death and disability, so it is a very valuable indicator for planning and intervention. Obviously, this indicator will also be used to monitor and evaluate the mentioned plans. The burden of disease provides the most important and objective part of the evidence required for the assessment of evidence-based needs and policies. Appropriate application of the outcomes of burden of the diseases, along with evaluating the cost-effectiveness of interventions in cases of necessity, may be an indispensable opportunity for appropriate use of evidence in policy making and health management. The most important diseases, injuries and risk factors which cause the greatest burden of death and disability must be specified. The results provide a major part of the evidence compulsory for determining the basic research priorities, planning and managing health plans, human resource development and technology, and allocating health programs. Burden of Disease (BOD) based on DALY is the sum of life lost years due to early death and living with the disability.

To calculate all DALYs of a specific disease in a community, you must first calculate YLL and YLD and then sum the two:

$$DALY = YLD + YLL \quad (1)$$

YLL is the total life lost years due to early death and YLD is the total life lost years living with a disability with certain severity and length. For examining the burden of diseases, the data and information available for each disease or injury are used. To calculate YLL, Iranians' life expectancy based on their age and sex was extracted from the WHO life tables for 2015. The lost life years of the dead patients was calculated. To calculate YLD, the WHO standard method was used according to the following formula in which YLD was the lost life years due to disability, le life expectancy of the injured person according to WHO table for Iranian men and women in 2015 [8] was DWx, the weight of the disability caused by burn and other types of injuries in individuals, which is calculated in terms of TBSA or severity of injury for long-term treatment. Disability was calculated in terms of TBSA (total body surface area) for burns and related injuries due to burns (eye injuries, ear disorders, nose injuries and others) as World Health Organization recommendations. In this study burn of body is defined as burns in all parts of body except eye and ear (which have different disability weights because of different injuries due to burn). When the patients enter to the hospitals, first, at triage unit, the general physicians of hospitals which are trained for calculating TBSA and severity of related injuries calculate the severity of injury. After admission, the patient injury severity will be checked again by specialist (surgery specialists for burns and ENT specialists for nose and ear and eye specialists for eye injury). Calculating severity is a part of medical procedure and the disability weights are calculated from the WHO guidelines from severity of injury and TBSA.

$$YLD = \Sigma (le^{*}DWx) \quad (2)$$

2.2. *Intervention*

The intervention we used was public education. The target group of this educational intervention was the young age and teenagers who are more in danger of damages during *Chahrshanbe Suri Festival*. Our campaign officially named "*Be Happy, Be Careful*" published 2000 pamphlets with various educational messages and distributed them at schools and health centers, held seven radio and television interviews in provincial networks of Guilan, installed 12 posters and

banners in various regions of Rasht, Lahijan and Bandar-e-Anzali, held 2 press conferences with media, sent 70 educational and preventive messages on social networks and established a system for recording injuries and incidents during this critical festival. The campaign was funded by Guilan Trauma system (Contain a fund team from Medical University, Police, Fire Station of Rasht, Guilan education department and Guilan judiciary). Data gathering was done by Guilan road Trauma Research Center which has a supervisory rule on the function of Guilan trauma system and does not have any beneficiaries on the results of the campaign. The campaign began in February 2016 and continued its work until March 25, 2016.

2.3. *Analyses*

Descriptive mean and standard deviation were used for analyzing the data in descriptive part. For analytical part, t-test and Fisher were used employing STATA SE v13.1 and Excel.

3. Findings

Table 1 shows the descriptive findings of the study on age and sex, degree and percent of burns among victims during events of this festival before and after the educational intervention. As indicated in the table, in 2015, before the intervention, 3 people died due to burns, and the mortality rate for the intervention was 2, which was not statistically significant (p-value=0.517). Besides, 78.67% and 78.87% of the injured were men before and after intervention, respectively. The mean age of the injured patients due to the events of *Persian Festival of Fire* before the intervention was 27.75, but raised to 32.65 after intervention showing an increase at 90% confidence interval (p-value=0.0783). Furthermore, the mean percentage of total body surface area burn was 21.413 and 17.214 before and after the intervention, respectively. This difference was not statistically significant (p-value=0.4349). Before and after the program, 62% of the subjects (n=71.4) had third-degree burns, but no statistically significant difference was observed.

Fig. 1 displays the time series of burns caused by *Chaharshahnebo Suri* events for 2016 and 2017. Unquestionably, most events occurred at the beginning of the celebrations and especially on the last Wednesday of the year.

Table 2 shows frequencies and percentages of injuries by type of injury. As shown in the table, other types of trauma contained gashes, cut in hands, Nasal fracture, hand fracture and others had the highest percentage of injuries before the intervention as well as after it. After that, burn had the highest percentage before intervention (32 cases), while it decreased after intervention.

The next step was to calculate the burden of these burns. Table 3 sums the findings of the study for life lost years of deaths and life lost years due to disability. As shown in the table, the amount of lost years due to disability and mortality, as well as the DALY index, was significantly higher before the intervention than after the intervention. DALY for the pre-intervention period was 293.18, which reached 106.82 after the intervention.

Table 4 portrays the results of simple t-test to determine the reduction in the burden of burns related to *Persian Festival of Fire*. As indicated in the table, the DALY level in the post-intervention period was lower than before, which was statistically significant. Thus, per each injured person, 3.27 years reduction in DALY was reported. This decrease was statistically significant (p-value=0.0460).

Fig. 2 shows the findings of the study on DALY for 2016 and 2017. As shown in the figure, the greatest amount of burn injury occurred on March 15–17, and this figure was higher in 2016 than 2017.

4. Discussion

The present study implemented the educational intervention program to reduce the burden of burns in *Chaharshanbeh Suri* events in Guilan. However, it found that the severity and degree of burn were not significantly different before and after burn. The number of deaths due to burn incidents also diminished from 3 to 2, which may not be a remarkable statistically significant change. Though, the important issue was the increase in mean age of the injured group after intervention, from 26 to 36 years of age, however the result was not significant. This also reduces the burden of disease caused by incidents to a high degree that makes the training program feasible. The target group of "*Be Happy, Be Careful*" campaign included the students, teenagers and young adolescents who are generally the most interested in participating in this *Persian Fire Festival*. They are usually more injured due to related burn incidents of the day. Therefore, the measures taken by the campaign significantly decreased the burn rate of this age group. In most of the studies on the events of *Chahrshanbe Suri*, teenagers and young adolescents were the most vulnerable groups. For instance, in a study by Vaghardoost et al. in 2013, the mean age of the injured on this day equaled 18.34 years old [2]. In a research conducted by Saadat et al. in Tehran, it was found that the most vulnerable groups to the damages which may happen on this special day were teenagers and youngsters [9]. Similar results were obtained by Hatamabadi et al.

Table 1 – Descriptive findings of burns related to *Chaharshahnebo Suri* before and after the intervention.

Variable	Before intervention	After intervention	P-value	Test
Death %	5.1%	3.1%	0.584	Fisher
Sex—male %	81.7%	79.6%	0852	Fisher
Age(average)	27.75	32.65	0.0783	Two way t-test
TBSA	21.413	17.214	0.4349	Two way t-test
Degree of burn(type 3)%	62%	71.4%	0.320	Fisher

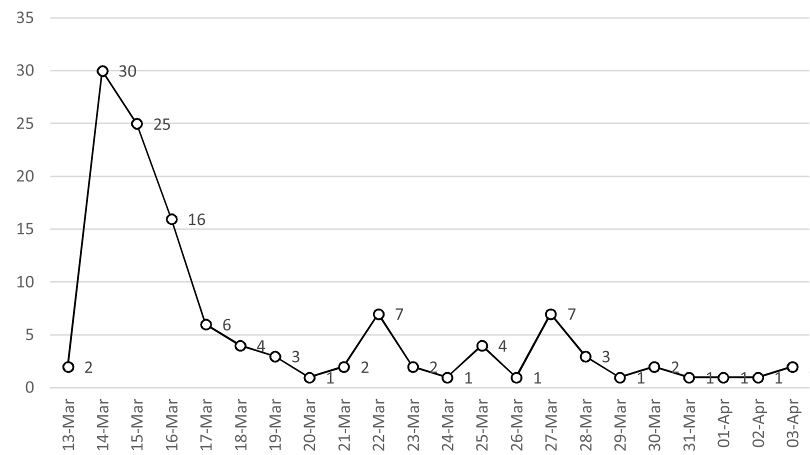

Fig. 1 – Time series of burns and injuries related to *Chaharshahnebo Suri* in 2016 and 2017.

Table 2 – Frequencies and percentages of injuries by type of injuries.

Variable	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
	Before intervention		After intervention		Total	
Burn	32	20.38	10	8.55	42	15.33
Eye injuries	28	17.83	45	38.46	73	27.01
Ear disorders	21	13.38	15	12.82	36	13.14
Other types trauma	76	48.41	47	40.17	123	44.89
Total	157	100	117	100	274	100

Table 3 – Findings of the study for life lost years due to mortality and lost life years due to disability and the total DALY index for the pre- and post-intervention period, and the total burden generated during the two-year period.

	Before intervention	SD	After intervention	SD	Total	SD
YLL	141.2	42.48	10.7	1.7	151.9	64.16
YLD	151.98	43.61	96.12	40.48	248.11	59.58
DALY	293.18	93.84	106.82	40.86	400.01	103.61

Table 4 – Findings of simple t-test for reduced burden of burns related to *Chaharshanbe Suri Festival*.

Group	Mean	Standard error	Lower limit	Upper limit
Before intervention	5.0549	1.617999	1.814956	8.294931
After intervention	1.669	0.638496	0.393252	2.945116
After-before	3.2788	0.8492	1.59	4.96
P-value=0.0460		t=2.0160		

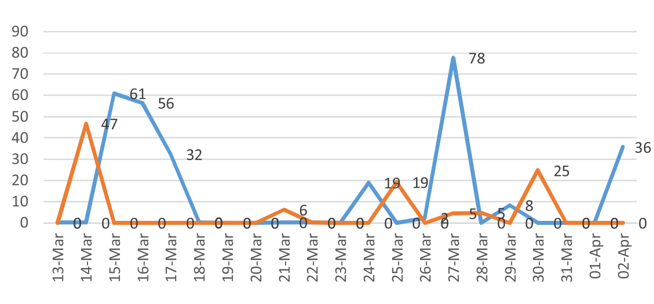

Fig. 2 – Findings of study on estimated DALY in terms of day for the years 2016 and 2017.

and Alinia et al. [1,10]. One of the reasons for the young to be the most vulnerable group to these incidents is their presence in the ceremony and their higher curiosity for playing with fireworks. As a result of a study, more than 80% of the

participants in this festival of fire (with or without injury) were under the age of 30 [11] .Another study by Saadat et al. realized that only 1.1% of the residents of Tehran made arrangements and preventive measures to prevent possible incidences and burns on Red Wednesday, and not only did they have enough knowledge about how to behave on this day but also they did not gave their children practical advice [9]. What is certain is the need to implement training programs to prevent the occurrences of *Chahrshanbe Suri*. The findings of our study insist that such training programs can reduce the burden of the burns related to the celebration. Similar festivals are performed around the world on different dates, combining fireworks and other games. In India for example, Diwali Festival involves 15–30 year-old ones more than other groups due to burns where prevention programs and protective campaigns using websites and social networks and public education programs have been highly recommended [12]. In a study by Wang and his colleagues in China, researchers have emphasized on promoting public awareness for reducing the related burn incidents [13]. The implementation of interventions in fireworks programs and celebrations, especially among youth and adolescents, minimizes the damages and is believed to be very effective.

5. Limitations

Firstly, in the data used, only the burns related to this festival were mentioned, while in addition to the burns, other incidents such as falling and assault may have also been occurred. As these cases may have not necessarily been due to *Chahrshanbe Suri*, they were excluded from the sampling. Secondly, they included the data of individuals who were referred to the Velayat Hospital of Rasht. Because of the prohibition of holding this event using explosive materials at this celebration, many injured people refer to hospitals in the days later than the festival, especially on the first day of the New Year, the effects of which are also examined in certain time periods. In addition, some people may refuse to refer to hospitals for treatment, which necessarily involve lower degrees of burns or other injuries. Thirdly, in this study, the injury site was not available to be compared accordingly.

6. Conclusion

The findings of the study suggest that the implementation of educational interventions and "*Be happy, Be careful*" campaign for burn incidents occurring on Red Wednesday caused the decreased burden of related burns, therefore, implementing such an intervention would be effective. Although this intervention did not significantly reduce the number of burns, given that the intervention aimed at the young age group, it increased the mean age of the injured victims for about 10 years, reducing the burden of burns. For future studies, it is recommended to examine the cost-benefit and cost effectiveness of similar interventions.

Conflict of interest

No conflict of interest could be declared to this study.

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