

## IMPACT OF AWARENESS-RAISING CAMPAIGN ON PREVENTION OF PYROTECHNIC-RELATED HAND INJURIES IN NORTH MACEDONIA DURING CHRISTMAS HOLIDAYS

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### Abstract

Firecrackers and other pyrotechnic materials are used worldwide to celebrate national, religious, cultural festivals and holidays. In our country the use of firecrackers is usually during the holiday season, particularly during New Year's and Christmas days. The majority of users of firecrackers are adolescents who want to make the celebration more exciting, not being aware of the harmful effects and severe injuries they can get by using pyrotechnics. The injuries caused by using pyrotechnics can vary from moderate such as first or second-degree burns to severe injuries like traumatic amputation of the fingers and hand, resulting in life-long mutilation. These injuries are expected to have long-term functional and psychological sequelae.

Precisely because of that, our clinic started an awareness-raising campaign on prevention of pyrotechnic-hand injuries (PPH campaign) named "Don't let the firecrackers ruin your holidays". The aim of this article is to present the impact of our PPH campaign in awareness raising against the use of pyrotechnic explosives and prevention of severe hand injuries by educating 15-16-year-old students about the dangers of using pyrotechnics and emphasizing the complexity of the hand and its importance in everyday life.

In our study we used an anonymous questionnaire in order to see what was the impact of our presentation and discussions on students during the PPH campaign. From our 5-year experience with this type of campaign, we can see that awareness campaigns gave excellent results in decreasing the number of hand injuries. Therefore, our goal is this PPH awareness-raising campaign to be organized every year for generations to come.

**Keywords:** firecrackers, adolescents, hand injury, surgery, PPH awareness campaign

### Introduction

Firecrackers and other pyrotechnic materials are sometimes used as entertainment during the holiday season, particularly during New Year's and Christmas days in our country. The majority of young teenagers (aged 12 to 18) use firecrackers to make the celebration more exciting, including a loud explosion and light effects of sparks in various colors. Surgeons from the University Clinic for Plastic and Reconstructive Surgery come

across a number of cases of pyrotechnic-related injuries, such as burns and severe hand injuries<sup>[1]</sup>. These injuries can vary from moderate such as first or second-degree burns (usually of the hands, face and neck) to severe injuries as well as traumatic amputation of the fingers and hand, resulting in life-long mutilation.

Confronted with this, our Clinic started a PPH awareness-raising campaign. The aim of this article is to present the impact of our PPH campaign on awareness raising against the use of pyrotechnic explosives and prevention of severe hand injuries.

### **Design of the campaign**

Starting from 2018, the University Clinic for Plastic and Reconstructive Surgery started a PPH campaign against the use of firecrackers, fireworks or other pyrotechnic explosives during Christmas holidays and New Year. Initially, the target group were children from elementary schools in the capital city of North Macedonia (10-14 years old). This year the campaign expanded to every town across the country, including children from the first year of high school (15-16 years old). Fifteen surgeons and 24 residents from our Clinic, 30 students from the European Medical Students Association (EMSA), and 10 medical doctors from other specialties and general practitioners participated as lecturers during the campaign. The PPH awareness campaign was not funded by sponsors and was performed with a single presentation given by our colleagues in schools with interactive discussion with students in each lecturer's hometown. The presentation contained images of real scenarios from our Clinic and emphasized the complexity of the hand and its importance in everyday life. The campaign was supported by the media by interviewing doctors from our Clinic<sup>[2]</sup>. The campaign started in the middle of December and lasted two weeks up to 29 December. During the campaign, 10,011 students attended the presentation, in 67 high schools and in 27 towns across the country, making this year's campaign the largest so far.

### **Outcomes**

The University Clinic for Plastic and Reconstructive Surgery in Skopje is the only tertiary reference center dealing with severe hand injuries in our country. From 1st of December until 31st of January, 24 patients with severe hand injuries were hospitalized in our Clinic during a 10-year period (from 2013 to 2023)<sup>[3]</sup>. The average age of patients was 37.70 (range 15-66 years). Six patients were younger (<18 years old) and 18 were adults (>18 years old). According to gender, 23 of the patients were males, and 1 was female. Three of the injured ended with partial or complete loss of a finger or hand. In comparison, this year (2023) at the University Clinic for Plastic Surgery, no patients were admitted with severe hand injuries due to the misuse of firecrackers and fireworks. The results show a gradual decrease of the number of admissions of patients with severe hand injuries resulting from the use of pyrotechnic materials. In order to see the impact of our presentation and discussions, we made an anonymous questionnaire and

From a total of 10,011 students who attended the presentation, 1253 students took part in a google forms survey questionnaire (Figure 1). Respondents were asked if they had ever used any kind of pyrotechnic devices or firecrackers and 45.8% reported positively, while 54.2% responded negatively. The biggest concern for respondents was their safety (13.7%), next in order was the safety of their pets (10.8%) and safety of the people near the explosion (6.2%), and 62.1% were concerned for all offered answers. The vast majority (67.5%) of those who attended our PPH campaign reported that they would never use pyrotechnic devices and 95% said that it made them stop and think how important it is to keep the human hand safe. Campaign awareness was associated with a large negative impact towards pyrotechnic devices and firecrackers abuse. Detailed responses are given in Table 1.

1. Have you ever used firecrackers?  
 Yes  
 No, never

2. What do you enjoy most about firecrackers and fireworks?  
 Loud noise  
 Sparkle, colours, visual effect  
 my friends are using it  
 Everything mentioned above  
 Nothing mentioned above

3. How big of an issue are firecrackers in your surroundings according to you?  
 There are no firecrackers in my surroundings  
 1  
 2  
 3  
 4  
 5  
 There are too many firecrackers in my surroundings

4. What is your biggest concern regarding lighting firecrackers?  
 Your safety  
 The safety of your family/friends  
 The safety of pets  
 Everything mentioned above  
 Nothing mentioned above

5. Did you like the presentation?  
 Yes  
 No

6. How much did you learn from the presentation  
 I didn't learn anything and it wasn't clear  
 1  
 2  
 3  
 4  
 5  
 6  
 I learned and understand a lot of things

7. Would you use firecrackers and pyrotechnics in the future?  
 Yes  
 No  
 Yes, under adult supervision

8. Will you convey the message "Let's congratulate each other with a beautiful thought, rather than firecracker explosions?" to your friends?  
 Yes  
 No

9. After the presentation, did you realize how important it is to protect our hands from injuries?  
 Yes  
 No

10. Did the presentation inspired you to maybe work someday in the field of hand surgery or bionic hand?  
 No, I don't want to work in these fields  
 Yes, I would like to work hand surgery  
 Yes, I would like to become innovator/scientist/engineer

**Fig. 1.** Questionnaire Don't let firecrackers spoil the holidays!

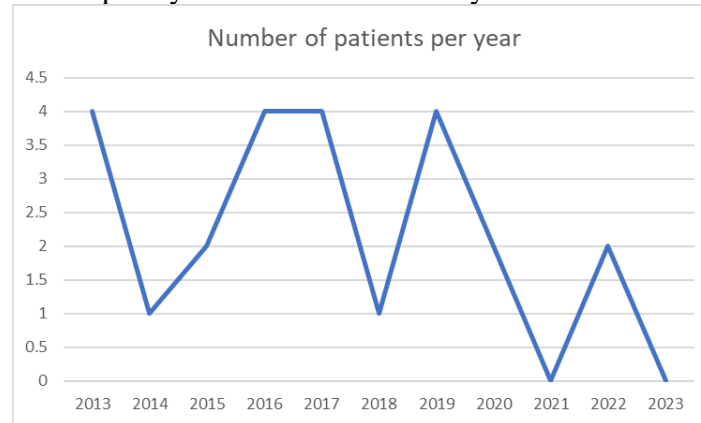
**Table 1.** Results from responses of questions from the questionnaire - Don't let firecrackers spoil the holidays!

Survey questions	Answers				
Have you ever used firecrackers?	Yes 46,6%	No, never 53,4%			
What do you enjoy most about firecrackers and fireworks?	Loud noise 17,7%	Sparkle, colors, visual effect 22,2%	My friends are using it 4,4%	Everything mentioned above 8,5%	Nothing mentioned above 47,2%
How big of an issue are firecrackers in your surroundings according to you, 1 meaning there are no firecrackers in my surroundings and 5 meaning there are too many firecrackers in my surroundings? There are no firecrackers in my surroundings	1. 9,03%	2 12,7%	3 29,55%	4 26,68%	5 22,04
What is your biggest concern regarding lighting firecrackers?	Your safety 13,6%	The safety of your family/friends 6,3%	The safety of pets 11,2%	Everything mentioned above 61,7%	Nothing mentioned above 7,2%
Did you like the presentation?	Yes 90,02%	No 7,83%			
How much did you learn from the presentation, 1 meaning I didn't learn anything and It wasn't clear and 5 meaning I learned and understand a lot of things	1 4,47%	2 2,96%	3 11,74%	4 22,44%	5 58,39%
Would you use firecrackers and pyrotechnics in the future?	Yes 16,3%	No 66,9%	Yes, under adult supervision 16,8%		
Will you convey the message "Let's congratulate each other with a beautiful thought, rather than a firecracker explosions" to your friends?	Yes 83,5%	No 16,5%			
After the presentation, did you realize how important it is to protect our hands from injuries?	Yes 94,6%	No 5,4%			
Did the presentation inspired you to maybe work someday in the field of hand surgery or bionic hand?	No, I do not want to work in these fields 75,48%	Yes, I would like to work hand surgery 13,02%	Yes, I would like to become innovator/scientist/ engineer. 9,82%		

Source- ([https://docs.google.com/forms/d/e/1FAIpQLSe5he2iPK\\_gaVZ0-X7yP53Lx-Y6v8VchyF7YCw-ZhG1BPP15Q/viewform](https://docs.google.com/forms/d/e/1FAIpQLSe5he2iPK_gaVZ0-X7yP53Lx-Y6v8VchyF7YCw-ZhG1BPP15Q/viewform))

## Discussion

The outcomes of this study have provided relevant information about the success of our PPH awareness campaign against the use of pyrotechnic explosives like firecrackers and fireworks in our country concerning the high number of hand injuries due to their use. The results have included data from a 10-year period (2013-2023) including data since the beginning of the campaign in 2018 until now<sup>[3,8]</sup>. Our study has demonstrated a correlation between patients' age and use of firecrackers<sup>[13]</sup>. Also, the findings have revealed the most common injury localization concerning the body parts exposed during the explosion and they indicated the prevalent gender-related variables<sup>[10-14]</sup>. Finally, the results of our campaign have provided a reflection of the correlation between the time of the year that these incidents occurred and the frequency of admissions annually.



**Fig. 2.** Number of patientens admitted to University Clinic for plastic surgery due to severe pyrotechnic-related injuries during a 10-year period

The latest data from this year indicate the most thriving results with zero injuries compared to previous years. Still, the results indicate a fluctuating decrease in numbers from the total number of 24 admitted patients at our hospital with the highest number in 2016-17, just before the beginning of the campaign. In 2019, numbers reached a repetitive peak, but in 2020 they rapidly decreased and finally bottomed out this year, displaying the efficacy and emphasizing the big accomplishment of the awareness campaign carried out by our clinic in collaboration with student organizations to prevent the repercussion related to severe hand injuries by using pyrotechnics.

All secondary schools from all cities of our country were included in the campaign. Secondary schools supported our campaign, providing us with the opportunity to educate their 15-16-year-old students about the dangers of using pyrotechnics. During our campaign we came to discuss some interesting topics with the students mainly about the common use of pyrotechnics and the most frequent types, where we got some very intriguing answers.

More than a half of the respondents (53.4%) of the questionnaire denied any type of use, while 46.6% gave an affirmative reply which initially gave us an indication about the campaign itself and finally confirmation about the chosen target group users of pyrotechnic explosives. It is noteworthy that the goal of our campaign has been reached not only through the aspects of zero admitted patients but also in the success of increasing the awareness about the dangers of using pyrotechnics. The majority of students (67.5%) declared that they would never use pyrotechnic devices and most importantly 95% said that it made them emphasize the importance of preserving the human hand.

Overall, the data provided a clearer understanding of the severity of explosive hand injuries supporting the theory that the use of improvised devices with explosives in order to provide more intense explosions results in more severe injuries. Severe hand injuries, caused by improper use, have been reported in several countries, including Europe and overseas<sup>[4-8]</sup>.

The data from our study also suggest that male patients, 95.83% or 23 in total, have been the most frequent patients with explosive hand injuries admitted to our hospital throughout the years. Another important correlation this analysis supports is the seasonal trend of the peak in annual cases presenting firecrackers and firework hand injuries concerning celebrating international cultural and religious holidays, especially on New Year's Eve and Orthodox Christmas holidays including orthodox New Year, beginning from late December to the second half of January. The explosion of fireworks on the occasion of a national holiday is a cultural phenomenon throughout Europe<sup>[3,4,6,7]</sup>, Asia<sup>[5,8]</sup> and the United States of America<sup>[3]</sup>, where up to 85% of firework-related injuries occurred in association with celebrations of Independence Day and New Year's Eve.

Although the use of pyrotechnic explosives is limited in our country by the implementation of law restrictions, there is still room for improvement in increasing awareness, for example, with the use of imprinted firework packaging with photos that illustrate severe injuries and lesions and sayings and quotes against the use of fireworks or any other pyrotechnics. Some of the examples include the motto of our campaign "Stop for firecrackers. Choose happiness!" or "Stay away from fireworks, you might lose a hand!". Through interactive discussions with students and support from secondary schools in our country, we managed to achieve our goal: during the New Year's holidays, there were no cases admitted to our clinic due to pyrotechnic injuries.

### **Conclusion**

The injuries caused by firecrackers have an evident physical impact on hand functioning and activities in all adolescents. Prevention is the key to reduce the incidence of these preventable injuries.

This study has shown that firecracker-caused hand injuries are preventable and that the key to reduce the incidence of these injuries is an effective massive and aggressive public awareness campaign through the media and raising awareness of the risks of handling fireworks through the educational system with lectures aimed at the targeted group - first year students at high schools throughout the whole country. Our previous 5-year experience with this type of campaign clearly demonstrated that this kind of PPH awareness campaigns gave excellent results in decreasing the number of hand injuries. Therefore, our goal is this PPH awareness campaign to be used every year for generations to come because only with massive awareness-raising campaign we can get the results we want, which is to have as few severe hand injuries as possible.

*Conflict of interest statement.* None declared.

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**Appendix I:** PPH (Prevention of Pyrotechnic-related Hand injuries) Collaborative group:  
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