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ECONOMIC IMPORTANCE OF THE PREVENTIVE MEASURES IN DENTISTRY

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ABSTRACT

Introduction: Previous studies have shown that the state of oral health in the area of Podrinje Canton is really poor. Taking into account that in the last five years are implemented two projects in the municipality it is necessary to examine the impact of preventive measures in dentistry on the oral health. **The research goals are:** a) To evaluate the impact of continuing education and local fluoridation on the state of oral health; b) To analyze the economic importance of preventive measures. **The examinees and methods:** For the purpose of the research on activities of continuing education on the importance of oral health and local fluoridation of teeth and to determine the economic aspects of the application of preventive measures is tested and reviewed 900 students from fourth to ninth grade. The children were divided into three groups of 300 students in each group: a) In the first group of children is carried out continuous education about proper tooth brushing and the importance of oral hygiene and local fluoridation twice a year during the last three years, b) In the second group children carried out local fluoridation twice a year during the last three years while in the third group, there were no continuous prevention measures; c) Used is a single questionnaire for all respondents. Data obtained in this study were analyzed by descriptive and inferential statistical methods. **The results and conclusions:** The importance of continuing education and local fluoridation is clearly reflected in the different values DMF-index, which was the subject of research. In the first group, in which is carried out continuous education and local fluoridation value of DMF index was 2.7, in the second group with local fluorination this value was 3.56, while in the third group, in which is not implemented preventive measures, the value DMF- index was 5.93. From an economic point the preventive measures are the cheapest, most effective and the best solution in order to maintain oral health.

Key words: oral health, local fluoridation, economic importance of preventive measures in dentistry, education.

1. INTRODUCTION

Caries is today, regardless of the good knowledge about its multicausal etiology and the possibilities for its effective prevention still the most widespread disease of our civilization, which affects about 95% of our population (1). It affects all populations and age groups (2), this is a disease that is very difficult to completely eradicate due to a complex interaction of biological factors, dietary habits, social status, etc. (3).

Because of its high incidence and socio-economic importance, the World Health Organization in 1982 defined the objectives, which should be achieved in the field of dentistry until 2000. These are:

- That 50% of children aged 5-6 years is free of cavities.
- That the DMF index in twelve year olds is less than 3.
- That 85% of the population in the age of 18 years is without a lost tooth.
- That in the age group 35-45 years is reduced by 50%

the number of extracted teeth (4).

Over 70% of countries in the world have managed to achieve this goal, as well as most European countries. The reasons for the improvement of oral health are numerous and complex, but is most often attributed to: the implementation of systematic school prevention programs and health education, then the massive and continuous application of fluoride, improved oral hygiene, more sensitive approach to the consumption of sugar, as well as changes in lifestyle and living conditions (5). The lowest DMF value is registered in Switzerland 0.84, followed by the Netherlands and Sweden 0.9 (6). A similar decrease in caries prevalence was recorded in Finland, Denmark, Sweden, UK, Germany and Iceland, where the DMF was below 1.5 and 23-49% of twelve years old were without caries. DMF-index in 1999 was 1.8 in Slovenia, 3.0 in Macedonia, 3.5 in Croatia, while the average DMF-index of twelve years old in Federation of Bosnia and Herzegovina according to WHO data for 1997 amounted to

Figure 1. DMF index in Europe among twelve year olds in 2014 (according to WHO)

6.2 (6). Information about DMF-index in Europe is shown in the Figure 1.

Caries is a disease of modern life, which is a financial burden both to the individual and society. Substantial financial resources are allocated for the treatment of caries.

For dental health care is allocated 5% of public health spending while from the private funds is allocated additional 16% of health care in OECD countries. Members of E27 spend about 79 billion € per year, while it is assumed that this figure in 2020 will be around 93 billion € per year for dental care (7).

EU countries spend on average 4.1 to 8.6% of gross national income on health, provided that this trend is increasing.

The term preventive measures imply total medical-dental measures for protection from disease and disease control, and in order to preserve the health and ability of people until old age (8).

Childhood and early school age is the time when permanently are acquired habits and when the health-educational information is timely provided, and school prevention programs represent around the world one of the most effective and economically most profitable methods in conducting oral-prevention programs (9). Therefore, to early school age should be paid special attention in order to promote oral health.

Preventive measures to combat tooth decay in children and young people, as well as its distribution among different social categories has always been of interest to all countries (10). The implementation of preventive measures in dentistry should start as early as possible, because healthy milk dentition is a good prerequisite for good oral health of permanent teeth (11) Preventive measures, to be implemented in the field of preventive dentistry and represent an integral part of health care for the child. These measures do not apply only to the prevention of dental disease as most prevalent disease diseases today, but ensure proper growth and development of the maxillofacial complex, then prevent

the development of diseases of periodontal tissues, as well as other diseases that can occur on this organ system (12).

Primary preventive measures are:

- Oral hygiene;
- The use of fluoride;
- Control of sugar consumption or proper diet and;
- The local measures aimed at preventing caries and periodontal disease (1).

In addition to basic primary measures in caries prevention is also very important to educate children and parents about the importance of oral health.

The prevention of oral diseases should be a priority in relation to the treatment of the consequences of oral diseases. In countries where the DMF-index is low emphasis is placed on individual prevention, as opposed to countries with high DMF-index which recommended and implemented the preventive measures for the general population. Since the state of oral health in the Bosnia-Podrinje Canton is really poor, the prevention program was made, which has been implemented for more than five years in urban primary schools of the municipality of Gorazde, and in the focus of preventive programs are:

- Education of children, and the parents about oral health;
- Regular fluoridation of teeth (twice a year);
- Advices related to oral hygiene, nutrition and the importance of timely protection of permanent teeth.
- This research aimed to provide answers to the following questions:
- Whether there are differences in the prevalence of the caries between different groups of respondents?
- Whether there are differences in values of DMF-index between different groups of respondents?
- How much "decay" exist in different groups of subjects?
- Whether prevention programs, which are implemented in Bosnia-Podrinje Canton, are positive from an economic point of view?

2. THE PURPOSE OF THE RESEARCH

To evaluate the impact of continuing education and local fluoridation at the state of oral health.

Analyze the economic importance of preventive measures.

3. THE EXAMINEES AND METHODS

In the school year 2014/2015 is conducted an extensive research, which is aimed at the identification of oral disease and the results of the application of dental preventive measures. This research was carried out with the consent of the parents, the ethics committee of Dental Medicine Faculty in Sarajevo, the Cantonal Ministry of Health of Bosnia-Podrinje

	IV grade	V grade	VI grade	VII grade	VIII grade	IX grade
I group children from primary school "Husein ef. Džozo (continuous education + fluoridation)	50	50	50	50	50	50
II group children from primary school "Fahrudin Fahro Bascelija" (fluoridation)	50	50	50	50	50	50
III group of children from other primary schools (control group)	50	50	50	50	50	50

Table 1. Subjects divided by groups

Canton, as well as the consent of the Cantonal Ministry of Education of Bosnia-Podrinje Canton.

Subjects were divided into three groups depending on the application of preventive measures. In each group there were 300 respondents from fourth to ninth grade.

A single questionnaire was used, which is recommended by the WHO.

The total number of respondents was 900, as shown in Table 1.

Registration of oral health is carried out in the classrooms according to WHO recommendations. Testing was carried out with one on the adjacent tooth starting from the most distal teeth in the upper right quadrant to the most distal tooth in the lower right quadrant.

To label the teeth were used letters for baby teeth and numbers of permanent teeth, according to the codes listed in Table 2.

The main criterion for the presence of teeth is to have at least one visible surface of the test teeth.

Based on the determined results there is a chance to really determine how much it cost to repair and how much money should be invested in order to repair the oral prob-

lems in each subject.

The values of each service are defined in the code book provided by the Federal Health Insurance and Reinsurance Fund.

To obtain more precise data, which are essential for determining the economic aspect of the preventive measures codes 2 and 3 will be divided into:

- F1-Single surface filling
- F2-Double surface filling
- F3-Multifaceted filling
- F4 - Repair of the dental crown.

Also, in determining the need for treatment will be considered only permanent teeth and will use the specified values from Table 3.

Use of resources will be calculated on the basis of adding value to every filled or extracted tooth in the oral cavity.

The necessary funds for reconstruction of oral cavity will be calculated so that gather the value of individual teeth, which is in need of treatment with the addition of the cost of treatment of periodontal disease if the same is present.

As in the study the radiography is not used, in case of dual facets, multiple facets filling and upgrade of the tooth crown, and in the deeper carious lesions will be used the service of indirect pulp capping with application of proper anesthesia.

To the extraction of permanent teeth also is added the value of appropriate anesthesia.

In determining the existence of gingival bleeding will use code for treatment of gingivitis with the application of the drug lump sum once per respondent. In determining the existence of deposits is used the code removal of supragingival lime per port, this is the code can be used up to two times per respondent, because the value of the account codes per arch.

Labels for baby teeth	Labels for permanent teeth	Tooth status
A	0	Healthy
B	1	Carious
C	2	Filling with caries
D	3	Filling without caries
E	4	Extracted due to caries
	5	Extracted for some other reason
F	6	Closed fissure
	8	Unrupted tooth
T	T	Trauma
	9	Unregistered permanent tooth

Table 2. Dental status codes

SERVICE CODE	TITLE OF HEALTH SERVICES	VALUE
112007	LOCAL INJECTION ANESTHESIA	3
112008	IMPLEMENTARY ANESTHESIA	5
112010	EXTRACTION OF PERMANENT TEETH	12
112020	REMOVAL OF OLD FILLINGS OR COVER	3
112021	INDIRECT PULP CAPPING	6
112023	SINGLESURFACEFILLINGWITHPOLISHING	15
112024	DOUBLESURFACEFILLINGWITHPOLISHING	21
112025	MULTIFACETED FILLING WITH POLISHING	31
112026	UPGRADE OF TOOTH CROWN	30
112033	TREATMENT OF GINGIVITIS STOMATITIS, CHEILITISWITHMEDICATIONAPPLICATION -PER VISIT	6
112034	REMOVAL OF SOFT DEPOSITS	9
112035	REMOVALSUPRAGINGIVALDEPOSITS-PER ARCH	6
112029	PULPEXTIRPATION-VITALORMORTAL-FINAL	30
112030	TREATMENTOFTOOTHGANGRENE -FINAL	62
112048	DEMONSTRATION OF ORAL HYGIENE TECHNIQUE IN GROUP	9
112050	FLUORIDATION OF TEETH GROUP-PER SESSION	9

Table 3. Classification of services of the Federal Health Insurance and Reinsurance Institute

4. RESULTS

In the first group of subjects, where was conducted continuous education about the importance of oral health and regular local fluoridation has spent 12,336 KM per price list of the Federal Institute for Health Insurance and Reinsurance (average per child 41.12 KM).

In the second group of children where the properly local fluoridation was carried out, but without continuous education was spent 13,731 KM (average per child 45.77KM).

In the third group of subjects, which did not have any preventive measures the group spent 17,513 KM (average per child 58.38 KM).

Mann-Whitney test revealed a significant difference in the value of consumed resources of group G1, in which was conducted continuing education with regular dental fluo-

G1- Respondents with education and fluoridation of teeth	G2- Respondents with local fluoridation, without continuing education	G3- Respondents without education and local fluoridation	Total
N	300	300	300
Mean	64.473	92.043	170.260
SD	65.3445	88.9046	128.1428
95% CI	45.000-62.921	66.000-90.000	118.079-137.000
25-75 P	15.000-93.000	30.000-124.000	89.500-245.500
Total	19342 KM	27613 KM	51078 KM

Table 4. Total funding for oral health

G1- Respondents with education and fluoridation of teeth		G2- Respondents with local fluoridation, without continuing education	G3- Respondents without education and local fluoridation	Total
N	300	300	300	900
Mean	23.353	46.273	111.883	62.819
SD	48.4125	76.8783	117.1194	
95% CI	0.000–0.000	0.000–21.000	64.000–92.460	
25–75 P	0.000–30.000	0.000–62.000	15.000–155.500	
Total	7006 KM	13882 KM	35649 KM	56537 KM

Table 5. The necessary funds for reconstruction in relation to oral health

ridation and group G2 of subjects with local fluorination, but without continuing education. $U_{40} = 472.00$, $z = 2.164$, $p = 0.0304$ $p < 0.05$.

Among respondents of group G1, or the children from fourth to ninth grade of elementary school "Husein ef. Džozo", which had a continuous education about the importance of oral health and regular local fluoridation is spent less funds per the price list of the Federal Institute for Health Insurance and Reinsurance (average per child 41.12 KM), unlike the respondents from group G2, in which was implemented local fluoridation, but without continuous education about the importance of oral health (an average per child of 45.77 KM).

Mann-Whitney test revealed a significant difference in spent funds between patients groups G1, where was conducted continuing education with regular dental fluoridation and patients groups G3 without applied preventive measures. $U_{38} = 465.00$, $z = 3.131$, $p = 0.0017$ $p < 0.05$.

Respondents from the group G1 (children from fourth to ninth grade of elementary school "Husein ef. Džozo", which had a continuous education about the importance of oral health and regular local fluoridation) spent less funds according to the price list of the Federal Institute for Health Insurance and Reinsurance (average per child 41.12 KM), unlike the respondents group G3, which was without education and local fluoridation (average per child 58.38 KM).

Mann-Whitney test revealed a significant difference in spent funds between G2 groups of respondents, in which is conducted local fluoridation, but without continuing education and G3 group of respondents without applied preventive measures. $U = 42\,340.00$, $z = 1.2060$, $p = 0.2060$.

Respondents in group G2, in which was implemented local fluoridation have spent less funds according to the price list of the Federal Institute for Health Insurance and Reinsurance (average per child 45.77 KM), unlike the respondents group G3, which did not underwent preventive measures (average per child 58.38 KM).

Funds needed for the rehabilitation of the oral cavity (need for treatment)

In the first group of subjects, where continuous education about the importance of oral health and regular local fluoridation was carried out is necessary to spend 7006 KM according to price list of the Federal Institute for Health Insurance and Reinsurance (average per child 23.35 KM) for the rehabilitation of the oral cavity.

In the second group of children where was carried out properly local fluoridation, but without continuing education is necessary to spend 13,882 KM (average per child

46.27KM). In the third group of subjects, in which was not carried out any preventive measures is necessary to spend 35,649 KM (average per child 111.88 KM).

Mann-Whitney test revealed a significant difference in the values of the necessary funds for reconstruction between patients group G1, in which was conducted continuing education with regular dental fluoridation and group G2 of respondents with local fluoridation, but without continuing education $U = 35\,472.50$, $z = 4.977$, $p < 0.0001$.

Among the respondents from group G1, or the children from fourth to ninth of grade elementary school "Husein ef. Džozo", which had a continuous education about the importance of oral health and regular local fluoridation required is less funds according to the price list of the Federal Institute for Health Insurance and Reinsurance (average per child 23.35 KM) for the rehabilitation of the oral cavity, as opposed to respondents from group G2, in which was implemented local fluoridation, but without continuous education about the importance of oral health (an average per one child per 46.27KM).

Mann-Whitney test revealed a significant difference in necessary funds between respondents from group G1, where was conducted continuing education with regular dental fluoridation and patients groups G3 without applied preventive measures $U = 19\,382.00$, $z = 12.616$, $p < 0.0001$.

Among the respondents from group G1, or for children from fourth to ninth grade of elementary school "Husein ef. Džozo", which had a continuous education about the importance of oral health and regular local fluoridation should be used less funds according to the price list of the Federal Institute for Health Insurance and Reinsurance (average per child 23.35 KM) for the rehabilitation of the oral cavity, as opposed to respondents from group G3, which was without education and local fluoridation (average per child 111.88 KM).

Mann-Whitney test revealed a significant difference in necessary funds between patients from group G2, in which was implemented local fluoridation, but without continuing education and G3 group of respondents without applied preventive measures $U = 27\,082.00$, $z = 8.617$, $p < 0.001$.

For subjects group G2, in which was implemented local fluoridation Was needed less funds according to the price list of the Federal Institute for Health Insurance and Reinsurance (average per child 46.27KM), as opposed to the respondents from group G3, which did not have preventive measures (average per child 111.88 KM).

5. DISCUSSION

This study, which followed the connection of caries and implementation of preventive measures in Bosnia-Podrinje Canton, verified the importance of preventive measures on the incidence and prevalence of dental caries. The importance of continuing education and local fluoridation is clearly reflected in the different values of DMF-index, which was the subject of this research. The first group of subjects, in which was carried out continuous education and local fluoridation value of DMF index was 2.7, in the second group of subjects, in which was carried out local fluoridation, this value is 3.56, while in the third group of respondents, where preventive measures was not carried out continuously the

value DMF index was 5.93.

Share of carious tooth in DMF-index, as well as the need for treatment is much lower in children where preventive measures were implemented.

In extensive research on 800 respondents, where respondents were children from first to eighth grade, which was carried out on the territory of Bosnia-Podrinje Canton in 2009 was examined the effects of short-term continuing education for a period of three months on oral health in children was as follows:

Score of repaired: non repaired teeth are changed in favor of restored teeth in children, where they conducted continuing education in most of the class (in the second and third there was no significant change) by about 20%.

There was no significant change in values of DMF-index, or with respect to the take a short follow-up period (six months) could not even expect to reach significant changes

Oral hygiene improved by about 40% in children, when continuing education was conducted in all grades except first grade (13).

Research for a period of three years from the application of preventive measures in terms of local fluoridation and continuing education is done in Banja Luka in children grades I-IV, where there was an improvement of oral health (DMF-index in fourth grade in 2005 amounted to 4.39 the value of oral hygiene index was 1.60. In 2008, DMF-index in fourth grade was 2.91 and the value of oral hygiene index 0.95 (14).

Similar research for a period of six months was carried out in Pancevo on a sample of 112 respondents of the second and seventh grade, where also after continuing education was reduced the frequency of children with gingivitis, as well as improved oral hygiene (15).

In Iran, the influence of continuing education on school-age subjects for a period of three months, which are also oral hygiene habits improved in the group of respondents with education (16).

The results of this research are very difficult to compare with other studies, because Bosnia and Herzegovina does not have data for similar research. In other countries have done the economic analysis but cannot be compared because of differences in health care systems, different financing and presentation of dental services. Thus, in Japan also registered positive economic indicators prevention of oral diseases, where it was found that fissure sealing and local fluoridation produce saving in material resources (17).

6. CONCLUSION

The importance of continuing education and local fluoridation is clearly reflected in the different values of DMF-index, which was the subject of this research. In the first group, in which was carried out continuous education and local fluoridation the value DMF index was 2.7, in the second group with local fluorination this value is 3.56, while in the third group, in which was not implemented preventive measures, the value DMF- index was 5.93.

From an economic point of preventive measures are the cheapest, most effective and the best solution in order to maintain oral health.

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