ORIGINAL ARTICLE

CONTENTS

Epidemiology of dental caries in internally displaced children during wartime in Ukraine

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ABSTRACT

Aim: To conduct a comprehensive analysis of the oral health status of this vulnerable population in order to collect objective data that will contribute to the development of effective strategies for maintaining and improving oral health in wartime conditions.

Material and Methods: This epidemiological study was carried out within the initial 6 months of the full-scale invasion of the country. The oral health indices of 1050 internally displaced children, aged 3 to 17 years, seeking dental care at the Municipal Children Dental Clinic in Poltava, were analyzed.

Results: The total sample comprised 620 children aged 6-11 years (mean = 8.5, SD = 0.76), with a gender distribution of 52% boys and 48% girls. The participants were divided into three age groups: Group I (6-7 years), Group II (8-9 years), and Group III (10-11 years). The average prevalence of dental caries, as measured by the dmft + DMFT index, was 76.5%, with prevalence increasing with age. Specifically, the prevalence of dental caries based on the dmft index was lower in children of Group III (66.6%) compared to Group I (79.49%).

Conclusions: The analysis of the oral status among internally displaced children aged 6-11 years revealed higher dental caries prevalence and intensity compared to local children. Notably, children aged 6-7 years showed a high rate of caries in temporary teeth.

KEY WORDS: dental caries, teeth, epidemiology, oral health, internally displaced children, Wartime

Wiad Lek. 2024;77(6):1155-1160. doi: 10.36740/WLek202406107 DOI

INTRODUCTION

On February 24, 2022, Ukraine endured a full-scale attack from the aggressor country, resulting in over 7 million children experiencing irreversible negative impacts on both their mental and physical health, including oral health [1, 2].

According to the statistics from the United Nations High Commissioner for Refugees (2022), the full-scale invasion of Ukraine by the Russian Federation triggered the fastest displacement crisis globally. By the end of 2022, a staggering 11.6 million Ukrainians had been forcibly displaced, with 5.9 million displaced within their own country and another 5.7 million granted refugee status, compelled to flee for their lives. Ukraine is currently grappling with its most significant crisis since the Second World War, with over 17.2 million Ukrainians in dire need of humanitarian assistance [3, 4].

Beyond the direct physical and psychological impact on the population, the consequences of war and armed conflicts extend to various difficulties, often leaving a lasting imprint on society [5, 6]. The imposition of martial law in the country results in limited access to medical care, unstable living conditions, changes in dietary habits, and restricted access to hygiene products – all of the mentioned significantly affect dental health.

One of the aspects demanding attention is the impact of war on the health of internally displaced children who have become casualties of conflicts and hostilities within their country. According to the UNICEF Executive Director, this number reached 4.3 million in Ukraine in the first month of the war, exceeding half of the country's child population [7].

Children who endure military conflicts and become internally displaced encounter specific challenges and adverse health outcomes, including an elevated risk of dental caries. As per the World Health Organization (WHO), dental caries ranks among the most prevalent global health issues. Oral health serves as an indicator for assessing overall health, consequently, dental health is acknowledged as a pivotal factor in sustaining both mental and physical well-being [8].

AIM

The aim of this study is to assess the oral health of this vulnerable group of children as the findings obtained

Table 1. The distribution of children in the study by age and sex

Socio-demographic variables	Age groups							
	Total (N=612)		Group I (n=230)		Group II (n=235)		Group III (n=147)	
	%	n	%	n	%	n	%	n
Boys	52	318	59,6	137	48,52	114	45,58	67
Girls	48	294	40,4	93	51,48	121	54,42	80

Table 2. Indices of dental caries intensity in the children of different age groups

Indices of dental caries intensity	Age groups			
	Total (n=612)	I group (n=230)	II group (n=235)	III group (n=147)
dmft[a]	2,27±0,1	3,12±0,19[d,e]	2,11±0,15[d]	1,19±0,15[e]
dmft+DMFT[b]	2,83±0,12	3,31±0,2[f]	2,7±0,19	2,27±0,22[f]
DMFT[c]	0,56±0,04	0,19±0,04[g h]	0,59±0,07[g]	1,08±0,13[h]

Note:
[a] number of decayed, missing, and filled temporary teeth
[b] average number of destroyed, missing and filled teeth
[c] number of destroyed, missing and filled permanent teeth
[d] p<0,005; t-Student
[e] p<0,005; t-Student
[f] p<0,005; t-Student
[g] p<0,005; t-Student
[h] p<0,005; t-Student

can be applied for elaborating programs and strategies aimed at providing dental care and preventive measures to children affected by armed conflicts and internal displacement. Moreover, the study can serve as a foundation for humanitarian interventions designed to improve the dental health of these children, thereby alleviating the potential adverse effects of martial law on both their dental well-being and overall health.

MATERIALS AND METHODS

Subjects of Study: This epidemiological investigation spanned the initial six months of the full-scale invasion (March 2022 – August 2022). The examination was carried out at the Municipal Children Dental Clinic in Poltava. This study assessed the oral health of 1050 vulnerable children, aged 3 to 17, recently internally displaced by the military conflict in Ukraine. For in-depth analysis, a targeted sample of 612 children aged 6 to 11 years was formed from the initial group. Analysis of the state of health of the oral cavity was carried out by reviewing the patient's medical history.

Data Collection: To comprehensively assess the dental health of participants, information on the following aspects was gathered for each child: sex, age, number of temporary and permanent teeth affected by dental caries, presence of malocclusion, and number of extracted teeth.

Clinical examination: A standardized dental examination, adhering to the widely recognized WHO oral health assessment methodology, was conducted by a single researcher under consistent conditions to ensure accurate data collection [9]. This examination focused on two key indices: dmft (number of decayed, missing, and filled temporary teeth) and DMFT (number of decayed, missing, and filled permanent teeth). For each child, the number of teeth affected by caries was meticulously recorded and subsequently analyzed for each age group. The caries prevalence index, which represents the percentage of children having decayed teeth within each age group, was calculated. Additionally, the presence of malocclusion was documented for each participant.

STATISTICAL ANALYSIS

The collected data were entered into an Excel database. Data analysis, including both descriptive and inferential statistics, was performed using SPSS v.23. The t-Student was applied to ascertain statistically significant differences between the investigated variables.

ETHICAL CONSIDERATIONS

The official approval for collecting data and process information concerning children was granted by the

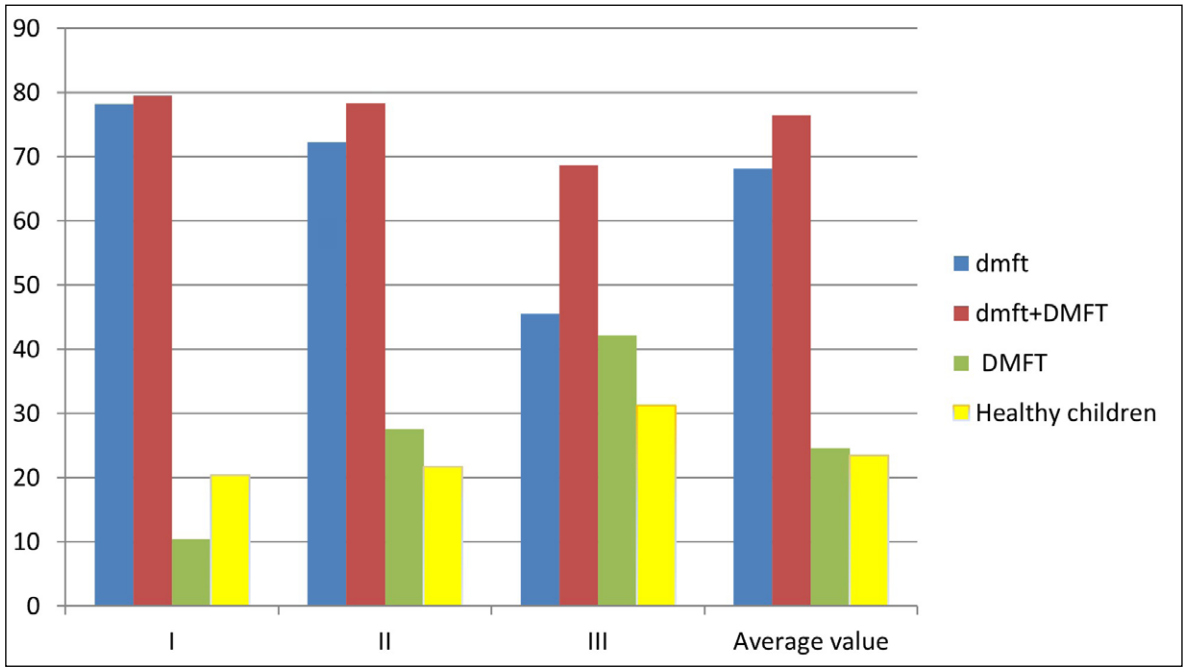

Fig. 1. Indices of dental caries prevalence in the children of different age groups.

Ethics Committee of Poltava State Medical University (No. 224). Stringent measures were implemented to guarantee the confidentiality of personal data. The entire research process adhered to the fundamental principles of ethical science, upholding the highest standards of integrity and respect.

RESULTS

According to the data obtained, the majority of children had previously resided in the Kharkiv region (56.4%) and the Donetsk region (36.1%).

The examined patients were categorized into three age groups based on socio-demographic factors: Group I (6-7 years), Group II (8-9 years), and Group III (10-11 years) (see Table 1). In the first and second groups, the number of children was nearly identical (38.4% and 37.6%), whereas the third group had a slightly lower representation (24%). Of all those examined, 52% (n=318) were boys, and 48% (n=294) were girls. The average age of the sample was 8.5±0.76 years.

The analysis of findings on dental status within the studied age groups revealed a notably high average prevalence of dental caries at 76.5% that is 468 out of 612 children had at least one decayed, filled, or missing tooth due to caries and its complications (Fig. 1).

The study indicated that the prevalence of dental caries in temporary teeth was lower in children of Group III (66.6%) compared to those in Group I (79.49%). Notably, there was a systematic increase in the prevalence of caries in permanent teeth in alignment with age: Group I – 10.43%, Group II – 27.6%, and Group III – 42.17%. The highest percentage of children with completely healthy teeth, making up a share of 31.29%, was observed in Group III, while Groups I and II showed comparable figures at 20.43% and 21.7%, respectively. 32.67% of the children included in the study had their temporary teeth extracted due to complicated caries; 48.38% of the children were diagnosed to have malocclusion.

The findings *obtained* in the medical *examination of* the children have shown that the average caries intensity slightly decreases with advancing age within the study groups (Table 2). Notably, the highest incidence has been recorded in group I, amounting to 3.31±0.2, while the lowest has been found in group III, averaging 2.27±0.22 ($p<0,05$). The tendency in caries intensity for temporary teeth, as indicated by the dmft index, mirrors a similar pattern: group I displays the highest index at 3.12 ± 0.19, whereas the lowest index was observed in group III at 1.19 ± 0.15 ($p<0.05$). In contrast, the caries intensity based on the DMFT index followed an opposite trajectory, growing with the age of the children within the groups and demonstrating a statistically significant difference ($p<0.05$).

No statistically significant differences were found when analyzing dental health indicators among the groups of children by gender.

DISCUSSION

This epidemiological study aimed to assess the dental health status in children internally displaced within the

country grappling with hostilities, specifically within the first six months after the commencement of a full-scale invasion. The military aggression initiated by the Russian Federation against Ukraine began in February 2014, starting with the annexation of Crimea and escalating into a full-scale invasion on 24 February 2024.

The Poltava region is among the areas in Ukraine that has accommodated a substantial number of internally displaced persons (IDPs) due to ongoing hostilities. Since the commencement of hostilities, over 200,000 IDPs have sought refuge in the region, with more than 48,000 of them being children. A notable portion of these individuals was evacuated during the initial months of the full-scale invasion, and Poltava hosted a quarter of all IDPs, who had arrived in the region [10].

The analysis of the life histories obtained from the surveyed children who took temporary shelter in Poltava, has revealed that they had been predominantly displaced from the eastern and southern territories or border areas known as active hostilities zones. The majority of the children originated from the Kharkiv and Donetsk regions.

Due to the full-scale aggression and invasion of Ukraine, there is a discernible and rapid decline in the oral health among internally displaced children that is evident not only in the prevalence rates of dental caries, but also in its intensity. These observations are supported by data from studies on the dental health of these age groups conducted prior to the onset of full-scale hostilities.

We conducted a micro-analysis of the oral health status in children aged 6-11 years, with the primary objective being a comparison of oral health indicators in these study groups with data obtained before the full-scale invasion, specifically those published on the basis of examinations of children, born and lived Poltava. According to L.F. Kaskova et al. [11] who reported about investigating caries indicators in 223 children aged 7-12 years in Poltava in 2019, the average intensity of dental caries in temporary teeth was significantly lower compared to our findings obtained in the internally displaced children, in particular, 1.45±0.14 vs. 2.27±0.1, respectively. However, the above mentioned researchers revealed a higher intensity of dental caries in permanent teeth in the local children (1.06±0.1) in comparison to our findings obtained form the internally displaced children (0.56±0.04).

Our results regarding the average caries prevalence were significantly higher in the internally displaced children aged 7 years, namely 76.46%, compared to 53.45% among children resided in Poltava. The intensity of the dental caries process, in terms of temporary teeth in children of this age who permanently resided in Poltava, was significantly lower (1.62±0.25) than the findings we found in the internally displaced children (3.12±0.19). However, no significant difference was found in the intensity of dental caries in permanent teeth between 7-year-old residents of Poltava and the internally displaced children, 0.21±0.05 and 0.19±0.04, respectively.

According to our data, the prevalence of dental caries in the deciduous teeth of the temporary displaced children (76.64%) exceeds the findings (51.72%) obtained from 272 children aged 6 – 11 years who resided in Poltava and its suburbs in 2020. The overall average dental caries prevalence among children aged 6 – 11 years also demonstrates a notable contrast: 61.85% in pre-war period versus 76.7% in internally displaced children. Moreover, the prevalence of caries in temporary teeth (68.14%) and permanent teeth (24.67%) of the temporary displaced children is significantly higher compared to the children in Poltava (52.59% and 19.63%, respectively). The data on the average caries intensity also indicate a decline in caries resistance among the internally displaced children, 2.83±0.12, compared to 1.5±0.12 obtained from the children in 2020 [12]. We can suggest that the higher intensity of dental caries in temporary teeth among the internally displaced children may be associated with a greater frequency of caries exacerbations due to stress and adverse living conditions.

According to Skrypnykov P.M., et al. [13] 2023, who conducted a study on the oral health of IDPs seeking dental care at the Municipal Dental Clinic in Poltava during the first 7 months of full-scale aggression, a similar pattern emerges among the adult population. Consequently, IDPs experienced 1.8 times more exacerbations of dental diseases compared to Poltava residents. The research indicates that the hygiene index was one and a half times higher in IDPs, with 100% prevalence of caries among all surveyed patients, and a majority presenting with complicated dental caries. In the group seeking dental care, the IDP subgroup was found to have a higher incidence of exacerbations in periodontal diseases. The researchers attribute these findings to the living conditions of displaced persons, who have to reside in schools, kindergartens, shelters, and the subway environments. Thus, inadequate nutrition and hygiene, coupled with the exacerbation of systemic diseases, were identified as factors adversely impacting oral health.

The dental care in the regions near the military conflict zone was already facing significant challenges prior to the full-scale aggression on 24.02.2022 caused by the wartime destruction of medical facilities, restricted access to medications and equipment, a shortage of quali-

fied dental professionals, as well as constraints in funding and logistics. An analysis of dental care in frontline cities, particularly in Donetsk Oblast where hostilities have been ongoing since 2014, reveals a substantial annual decline in the number of teeth treated for both uncomplicated and complicated caries. Examining the trend in the proportion of teeth treated for uncomplicated caries in relation to the total number of dental visits, a noticeable downward trajectory emerges. In 2018, the rate stood at 42.5%, decreasing to 41.2% in 2019, and further dropping to 36.9% and 30.9% in 2020 and 2021, respectively. This pattern is mirrored in the proportion of teeth treated for complicated caries relative to all dental visits in the population of Donetsk Oblast. The percentages ranged from 24.2% in 2018 and 25% in 2019 to 28.4% and 31.8% in 2020 and 2021 [14]. The observed dynamics suggest a decline in the accessibility and timeliness of dental care, highlighting inefficiencies within the dental care system in wartime as a whole [15].

When comparing our findings with similar studies on oral health indicators in post-conflict countries, it is noteworthy that the prevalence of dental caries in children in these regions is even higher. For instance, Bahaa A. A. et al. [16] (2018) reported an almost 90% prevalence of dental caries in Syrian children, while Rasmia Huew et al. [17] (2011) indicated a figure of about 60% in Libya. Additionally, Al-Haddad K.A. et al. [18] (2010) found that only 4% of children in Yemen were caries-free. The elevated prevalence of dental caries in children in these countries is attributed to the factors such as limited access to hygiene products, restricted opportunities for quality health care, and insufficient attention to dental health during times of crisis. These findings underscore the high relevance of thorough monitoring and improving oral health in post-conflict regions, since even in the period following the cessation of hostilities, rebuilding healthcare infrastructure and social systems is a complex process that demands time and resources. This transition period can have a significant impact on the overall health of children, including their oral health.

CONCLUSIONS

The analysis of the oral health status in internally displaced children aged 6 -11 years has revealed a significant prevalence of dental caries, with an average rate of 76.47% among the participants of the study. The highest prevalence of dental caries in temporary teeth was identified in the 6-7 years age group, reaching 79.56%; the average index of dental caries intensity was 2.83, indicating a high level of caries within the study groups.

The findings obtained from this study not only create a basis for future research but also offer valuable insights for discussions and comparisons of scientific data in this field. Moreover, our study results can contribute to the development of effective strategies aimed at preserving and enhancing the dental health of internally displaced children in wartime conditions through the elaboration and implementation of proactive programs for the prevention, early detection, and treatment of caries.

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The research is a fragment of the National Development Program of the State Medical University: «Improvement of prognosis, diagnosis, treatment and prevention of dental and periodontal diseases in children, taking into account exogenous and endogenous risk factors» (state registration number: 0122U000204).

CONFLICT OF INTEREST

The Authors declare no conflict of interest

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RECEIVED: 09.02.2024
ACCEPTED: 21.05.2024