

# Index of clinical consequences of untreated dental caries (pufa) in primary dentition of children from north-east Poland

Bagińska J<sup>1,\*</sup>, Rodakowska E<sup>1</sup>, Wilczyńska-Borawska M<sup>1</sup>, Jamiołkowski J<sup>2</sup>

<sup>1</sup> Department of Restorative Dentistry, Medical University of Białystok, Białystok, Poland  
<sup>2</sup> Department of Public Health, Medical University of Białystok, Białystok, Poland

**\* CORRESPONDING AUTHOR:**

Department of Restorative Dentistry,  
Medical University of Białystok,  
ul. M. Skłodowskiej-Curie 24 a  
15-276 Białystok, Poland  
Tel: +48 85 74 85 760  
Fax: +48 85 74 21 774  
Email: jbaginska@wp.pl (Joanna Bagińska)

Received 28.06.2012  
Accepted 21.12.2012  
Advances in Medical Sciences  
Vol. 58(2) 2013 · pp 442-447  
DOI: 10.2478/v10039-012-0075-x  
© Medical University of Białystok, Poland

## ABSTRACT

**Purpose:** The purpose of this study was to evaluate the prevalence and experience of clinical consequences of untreated dental caries in primary dentition in 5 and 7 year-old children from north-east Poland and to find whether there is a correlation between dmft and pufa indices.

**Material/Methods:** Two hundred fifteen children aged 5 and 7 years living in the Podlaskie region were examined in the course of the Polish National Oral Health Survey 2011. Caries prevalence and experience in primary dentition was evaluated according to WHO criteria (dmft index). The clinical consequences of untreated dental caries were assessed by pufa index.

**Results:** The dmft index was  $5.56 \pm 4.45$  in 5-years-old children and  $6.69 \pm 3.14$  in 7-years-olds. The prevalence/experience of pufa index was  $43.4\%/2.20 \pm 3.43$  and  $72.4\%/2.44 \pm 2.22$ , respectively. Children living in rural areas presented a worse dental condition. A statistical analysis revealed a strong relation between dmft and pufa in both age groups.

**Conclusion:** The present study revealed negligence in the dental treatment of children from north-east Poland resulting in the high prevalence and experience of the pufa index in primary dentition. This index is a valuable measurement tool to record the clinical consequences of untreated dental caries.

**Key words:** children, dmft index, primary dentition, pufa index, untreated dental caries

## INTRODUCTION

Caries is one of the most widespread diseases in the world. There are populations with more than 90% of members affected by caries. Particularly children are susceptible to the development of caries lesions. The disease at its advanced stages may influence the health and the quality of life of children, causing pain, sleep and eating difficulties, low BMI, school absence or even hospitalization [1-3]. Undoubtedly, the public costs connected with the treatment of severe caries are higher than in case of early lesions.

The severity of caries is an important factor which is usually omitted in epidemiological surveys based on the DMFT/dmft (Decayed, Missed and Filled Teeth) index. Capital letters are used for permanent dentition, small letters for primary teeth. During last decades DMFT came in for criticism to be a not enough valid tool to diagnose all stages of caries [4-6]. DMFT omits early non-cavitated lesions, but also does not contain information of untreated caries consequences. Data concerning WHO criteria for caries treatment needs [7], where teeth indicated for extraction should be marked, are rarely reported in the literature. For

detecting the full range of caries lesions, International Caries Detection and Assessment System II (ICDAS II) is now most recommended [5,6,8]. It distinguishes three stages in enamel and also three different stages in dentin, but does not deliver any information on odontogenous infections. Obviously, it may lead to the loss of important data, especially as policy and decision makers should be aware of the real dental condition in the population.

In 2010, Monse et al. [9] introduced a new index for detecting the clinical consequences of untreated dental caries. They named it PUFA/pufa index from the first letters of four oral conditions resulting from untreated caries. PUFA/pufa concerns different kinds of pulp and surrounding tissue infections. PUFA/pufa assesses and quantifies various caries complications. According to its authors it is easy and safe to use and the evaluation is short and does not require any additional tools. Data obtained using the PUFA/pufa index should be presented together with DMF/dmf or ICDAS II because PUFA complements them.

The purpose of this study was to evaluate the prevalence and experience of clinical consequences of untreated dental caries in primary dentition in 5 and 7 year-old children from north-east Poland and to find whether there is a correlation between dmft and pufa indices.

## MATERIALS AND METHODS

### Study Population

The study was conducted in the course of the Polish National Oral Health Survey 2011 in the Podlaskie region, the north-east part of Poland. Two districts were selected: one rural and one urban. Two hundred fifteen randomly chosen children aged 5 and 7 years were examined after obtaining a written permission from their parents or caregivers. The group of 5-year-olds consisted of 99 children, whereas the group of 7-year-olds comprised 116 children. *Tab. 1* presents the composition of the surveyed population according to age, sex and place of residence.

### Oral Examination

The study was carried out by two experienced examiners assisted by a recorder. Examiners were trained and calibrated for the purpose of using dmft and pufa indices. Dental examination was conducted according to WHO guidelines in artificial light, with a dental mirror and a periodontal WHO

probe [7]. For the purpose of this study only deciduous teeth were checked. Caries in individual children was assessed by the dmft index counted as a sum of teeth with cavity (dt), missed due to caries (mt) and treated (ft). In case of removed teeth, only those which at the respective age are not yet physiologically replaced by permanent teeth were included in dmft.

The clinical consequences of untreated dental caries were assessed by the pufa index [9]. In this index “p” means a pulp involvement, e.g. tooth with an open pulp chamber or with an extensive destruction of coronal part with only roots left, “u” means an ulceration of oral mucosa due to sharp edges of a tooth with pulp involvement, “f” is for an active fistula and “a” is for an abscess. Only one, more advanced code per tooth was scored; this gradient was established as follows: ulceration was qualified to be a more advanced stage than pulp involvement, the next level was fistula, and an abscess was qualified as the most advanced stage of the index. Conditions connected with teeth without pulp involvement were not recorded. The assessment of pufa scores was based only on the visual examination without instrumentation.

### Statistical Analysis

Data were analysed with the Statistica 6.0 software. The intra- and inter-examiner reliability was determined using the kappa coefficient. Caries prevalence, e.g. percentage of children with the dmft 1 and above and experience e.g. mean number of dmft was evaluated in the whole sampled population and separately for each group with reference to all children in the particular age group. The prevalence and the experience of pufa were calculated the same way as for the dmft.

Data were analysed using the t-test. Means, standard deviations (SD) and ninety-five percentage confidence intervals (CI) were calculated. The level of statistical significance was established at 5%.

## RESULTS

The intra- and inter-examiner agreement in diagnosis of dmft and pufa codes determined by kappa coefficient showed a good level of reliability. Data concerning intra- and inter-examiner reliability are presented in *Tab. 2*.

The prevalence of caries in primary dentition in the surveyed population was very high: only 14.1% of 5-year-

**Table 1. The composition of the surveyed population according to age, gender and place of residence.**

	Gender		Place of residence	
	boys	girls	urban	rural
5-years-old	55	44	59	40
7-years-old	58	58	71	45
total	113	102	130	85

**Table 2.** Intra- and inter-examiner reliability determined by kappa coefficient.

	dmft	dt	mt	ft	pufa	p	u	f	a
Intra-examiner 1	0.66	0.65	1.0	1.0	0.76	0.65	-	0.47	-
Intra-examiner 2	0.88	0.88	1.0	1.0	1.0	1.0	-	1.0	-
Inter-examiner	0.77	0.76	1.0	1.0	0.87	0.87	-	1.0	-

**Table 3.** The prevalence and experience of dental caries (dmft index) and the clinical consequences of untreated dental caries (pufa index) (mean, SD- standard deviation and CI – 95% confidence intervals) in the examined population (\*t-test).

	Total	5-year-old	7-year-old	p*
dmft prevalence	90.7%	85.9%	94.8%	-
	mean ± SD CI	mean ± SD CI	mean ± SD CI	
dmft	6.17 ± 3.78 5.66-6.67	5.56 ± 4.45 4.68-6.43	6.69 ± 3.14 6.12-7.26	<b>0.032</b>
dt	5.07 ± 3.75 4.57-5.57	4.90 ± 4.26 4.06-5.74	5.22 ± 3.25 4.63-5.81	0.547
mt	0.55 ± 1.17 0.39-0.7	0.19 ± 0.83 0.03-0.35	0.86 ± 1.33 0.62-1.1	<b>&lt;0.001</b>
ft	0.54 ± 1.2 0.38-0.7	0.46 ± 1.16 0.23-0.69	0.61 ± 1.24 0.38-0.84	0.371
no. of deciduous teeth	15.86 ± 3.91 15.34-16.38	19.06 ± 2.48 18.57-19.55	13.12 ± 2.61 12.65-13.60	<b>&lt;0.001</b>
pufa prevalence	59.1%	43.4%	72.4%	-
	mean ± SD CI	mean ± SD CI	mean ± SD CI	
pufa	2.33 ± 2.84 1.95-2.71	2.20 ± 3.43 1.52-2.88	2.44 ± 2.22 2.04-2.84	0.555
p	2.23 ± 2.75 1.86-2.6	2.13 ± 3.35 1.47-2.79	2.31 ± 2.14 2.31-2.14	0.647
u	0.00 ± 0.07 -0.01-0.01	0.00	0.01 ± 0.09 -0.01-0.03	0.357
f	0.10 ± 0.34 0.05-0.15	0.07 ± 0.33 0.01-0.14	0.12 ± 0.35 0.06-0.18	0.283
a	0.00	0.00	0.00	-

old children and 5.2% of 7-year-olds were caries-free. *Tab. 3* presents the experience of caries in the examined population. We have observed that older children had a statistically significantly higher dmft (6.69±3.14) than the younger group (5.56±4.45). The greatest difference was observed according to the number of missed teeth (mt); this component increased from 0.19 in younger children to 0.86 in older ones.

Almost a half of 5-year-old children (43.4%) had at least one tooth with pufa > 0, whereas such scores were observed in 72.4% of surveyed 7-year-olds. The pufa index was higher in the older group than in the younger one, respectively 2.44±2.22 and 2.20±3.43 (*Tab. 3*), however, those differences were not statistically significant. The majority of teeth were classified as pulp involvement (p). We have also found 5 children aged 5 with pus releasing fistula (f), two of them had

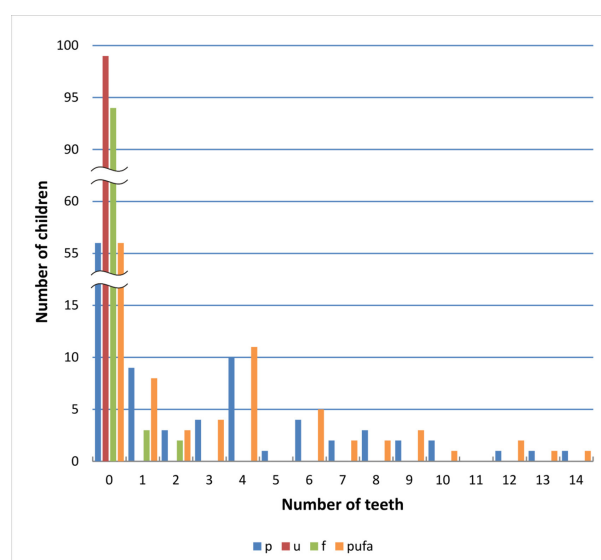
two teeth each with this diagnosis. The mean number of teeth with fistula in evaluated 5-year-old children was 0.07±0.33. The study revealed also 13 children aged 7 with pus releasing fistula (f) (one child had two teeth with fistula) and one 7-year-old child had an ulceration of oral mucosa (u). We have not observed any children with abscess (a). *Fig. 1* and *Fig. 2* present the frequency distribution of pufa components in the particular age groups. *Fig. 3* and *Fig. 4* present the relation between the caries experience (dmft) and the pufa index in the study population.

An analysis of data according to place of residence and gender revealed that children living in rural areas had worse dental condition concerning both caries and clinical consequences of untreated caries (*Tab. 4*).

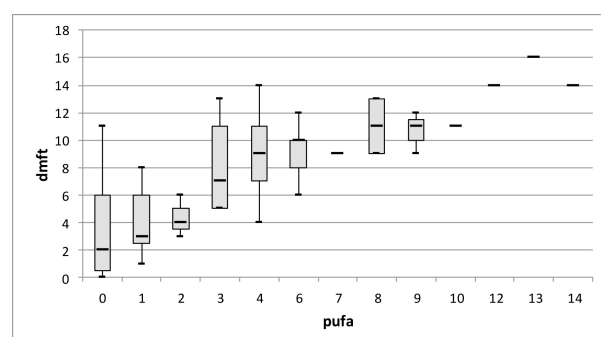
**Table 4.** The prevalence and experience of dental caries (dmft index) and the clinical consequences of untreated dental caries (pufa index) (mean, SD - standard deviation and CI - 95% confidence intervals) in the examined population (\*t-test) according to gender and place of residence.

	dmft			pufa		
	boys mean $\pm$ SD CI	girls mean $\pm$ SD CI	p*	boys mean $\pm$ SD CI	girls mean $\pm$ SD CI	p*
5-year-old	6.11 $\pm$ 4.79 4.84-7.38	4.86 $\pm$ 3.67 3.78-5.94	0.146	2.73 $\pm$ 3.82 1.72-3.74	1.55 $\pm$ 2.77 0.73-2.37	0.078
7-year-old	6.50 $\pm$ 3.08 5.52-7.48	6.88 $\pm$ 3.22 6.05-7.71	0.518	2.31 $\pm$ 2.26 1.73-2.89	2.57 $\pm$ 2.20 2.0-3.14	0.533
total	6.31 $\pm$ 3.99 5.57-7.05	6.01 $\pm$ 3.55 5.32-6.7	0.563	2.51 $\pm$ 3.11 1.94-3.08	2.13 $\pm$ 2.50 1.64-2.61	0.321
	urban mean $\pm$ SD CI	rural mean $\pm$ SD CI	p*	urban mean $\pm$ SD CI	rural mean $\pm$ SD CI	p*
5-year-old	4.86 $\pm$ 4.39 3.71-6.01	6.63 $\pm$ 4.11 5.36-7.9	<b>0.043</b>	1.86 $\pm$ 3.43 0.98-2.73	2.70 $\pm$ 3.42 1.64-3.76	0.236
7-year-old	5.79 $\pm$ 3.0 5.09-6.49	8.11 $\pm$ 2.85 7.28-8.94	<b>&lt;0.001</b>	1.92 $\pm$ 2.16 1.41-2.42	3.27 $\pm$ 2.08 2.66-3.88	<b>&lt;0.001</b>
total	5.35 $\pm$ 3.71 4.71-5.99	7.41 $\pm$ 3.56 6.65-8.17	<b>&lt;0.001</b>	1.89 $\pm$ 2.80 1.41-2.37	3.0 $\pm$ 2.79 2.41-3.6	<b>&lt;0.005</b>

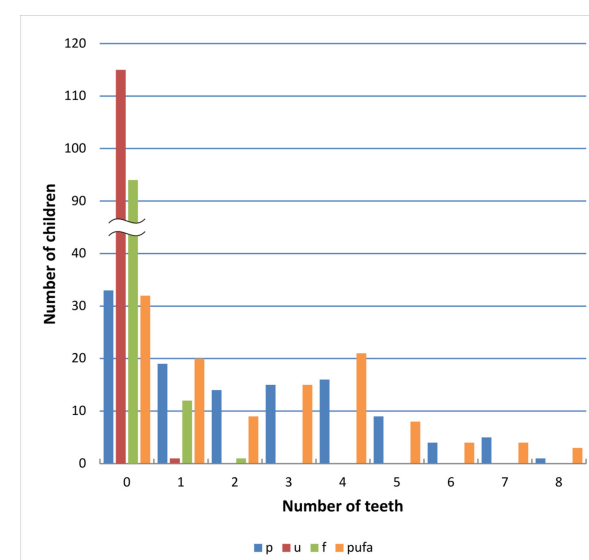
**Figure 1.** Distribution of the pufa components in examined 5-year-old children.



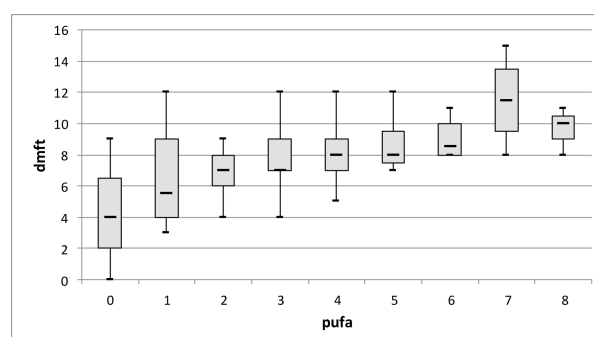
**Figure 3.** Relation between the pufa scores and the dmft index in examined 5-year-old children.



**Figure 2.** Distribution of the pufa components in examined 7-year-old children.



**Figure 4.** Relation between the pufa scores and the dmft index in examined 7-year-old children.



## DISCUSSION

We decided to evaluate the population of early school children from the north-east part of Poland because we suspected that their oral condition in the aspects of caries and clinical consequences of untreated dental caries might be poor. Previous epidemiological studies revealed that Polish population is severely affected by the caries disease [10-13]. Moreover, people living in the Podlaskie area often presented worse oral condition than those from other parts of Poland [12-14]. PUFA/pufa is especially recommended in high-caries prevalence populations [1]. The present study is the first in Poland and probably the first in Europe in which pufa index was used; no reports of such survey exist as yet. Probably, in developed countries, untreated caries is not such an urgent problem like in low- and middle-income regions.

Our assumptions were proved by the data analysis – the prevalence and the experience of dmft and pufa were high in the surveyed population. We also observed that along with the age the percentage of children with caries and odontogenic infections increased, especially according to the pufa index which almost doubled during a two-year period. The progress of disease was detected despite the fact that the mean number of deciduous teeth was lower in the older group due to physiological exchange of dentition. In 5-year-old children the mean number of teeth with caries was 4.9 and the mean number of filled teeth was 0.46; in older children those components were 5.22 and 0.6. It means that less than 10% of affected teeth were cured. Such high level of the caries disease is caused by inadequate oral hygiene habits and sugar-rich diet observed in children from the Podlaskie region [14,15]. Another reason may be parents' poor awareness of the importance of caries treatment in deciduous teeth. An extensive nationwide survey of Polish parents of small children revealed that they were not aware of such necessity [12]. In addition, the pricing system for dental procedures established by the Polish National Health Fund does not encourage dentists to undertake the treatment of small children. Our study also proved the rule that people living in rural areas present a worse dental condition.

Only limited data are available in the literature on the clinical consequences of untreated dental caries. The PUFA/pufa index was assessed in the Philippines and in Brazil [1-3,9]. The prevalence of pufa in Filipino 6-year-olds was 84% and the mean pufa score was 3.4 [3]. The Brazilian study concerning 6- to 7-year-old children revealed that 23.7% of them had pufa>0 and that its severity per child was 1.7 [1]. The results obtained by surveyed Polish children placed them between their Filipino and Brazilian peers; however, these findings cannot be directly compared because of small differences in the age of studied samples. High scores regarding pufa can be explained by the lack of dental treatment which, together with other caries risk factors, results in a rapid progression of caries lesions up to pulp involvement and

further complications. A statistical analysis proved a strong relation between dmft and pufa in both age groups.

It is advantageous to show PUFA/pufa combined with DMFT/dmft or ICDAS II, so it is possible to find how many teeth were lost due to caries. However, in some studies, data concerning caries experience were not presented, so no information of the number of extracted teeth was given [1]. Teeth with pulp or periapical inflammation are very often treated by extraction, especially in primary dentition. In the 21st century, extraction should not be regarded as caries treatment, but rather as another consequence of the caries disease. Premature loss of teeth undoubtedly influences the quality of life of children and their families [2]. The present study showed that the mean number of missed teeth increased with age more than other two components of the dmft index. A sum of teeth with pulp involvement, ulceration, fistula and abscess seems to be not complete to describe all adverse caries consequences. In our opinion, in the further development of the PUFA/pufa index, teeth missed due to caries should be considered as one more code. Of course, further studies should be conducted to evaluate whether including missed teeth component in PUFA/pufa index is as advantageous as expected. Another proposal based on the PUFA index is the Caries Assessment Spectrum and Treatment index - an epidemiological tool which covers the total spectrum of the caries process from a healthy tooth via tooth with fissure sealant, restoration, and carious lesions at different stages of development, up to extracted tooth [4]. The authors thereof have limited the consequences of untreated caries to two codes: pulp involvement and abscess/fistula. According to them, the ulceration of oral mucosa is very rare, and there is no need to differentiate an abscess from a pus realising fistula because they are only a phase of the same infection [4].

## CONCLUSIONS

The present study revealed negligence in the dental treatment of children from north-east Poland resulting in the high prevalence and experience of the pufa index in primary dentition. This index is a valuable measurement tool to record the clinical consequences of untreated dental caries.

## REFERENCES

1. Figueiredo MJ, de Amorim RG, Leal SC, Mulder J, Frencken JE. Prevalence and severity of clinical consequences of untreated dentine carious lesions in children from a deprived area of Brazil. *Caries Res.* 2011;45(5):435-42.
2. Leal SC, Bronkhorst EM, Fan M, Frencken JE. Untreated cavitated dentine lesions: impact on children's quality of life. *Caries Res.* 2012;46(2):102-6.

3. Benzian H, Monse B, Heinrich-Weltzien R, Hobdell M, Mulder J, van Palenstein Helder W. Untreated severe dental decay: a neglected determinant of low Body Mass Index in 12-year-old Filipino children. *BMC Public Health*. 2011 Jul 13;11:558.
4. Frencken JE, de Amorim RG, Faber J, Leal SC. The Caries Assessment Spectrum and Treatment (CAST) index: rational and development. *Int Dent J*. 2011 Jun;61(3):117-23.
5. Ismail AI. Visual and visuo-tactile detection of dental caries. *J Dent Res*. 2004;83 Spec No C:C56-66.
6. Honkala E, Runnel R, Honkala S, Olak J, Vahlberg T, Saag M, Mäkinen KK. Measuring Dental Caries in the Mixed Dentition by ICDAS. *Int J Dent*. 2011;2011:150424.
7. World Health Organization. Oral Health Surveys: Basic Methods. 4th ed. Geneva: World Health Organization; 1997. Chapter 5, Assessment Form; p. 21-52.
8. International Caries Detection and Assessment System (ICDAS) Coordinating Committee. Appendix: Criteria Manual. International Caries Detection and Assessment System (ICDAS II) [Internet]. Baltimore, Maryland, USA; 2005 Mar [revised 2009 July; cited 2013 May 8]. Available from: <http://www.icdas.org/uploads/ICDAS%20Criteria%20Document%20corrected%202013.pdf>.
9. Monse B, Heinrich-Weltzien R, Benzian H, Holmgren C, van Palenstein Helder W. PUFA--an index of clinical consequences of untreated dental caries. *Community Dent Oral Epidemiol*. 2010 Feb;38(1):77-82.
10. Jańczuk Z. Oral health of Polish children and WHO/FDI goals for the year 2000. *Community Dent Oral Epidemiol*. 1989 Apr;17(2):75-8.
11. Künzel W. Trends in caries experience of 12-year-old children in east European countries. *Int J Paediatr Dent*. 1996 Dec;6(4):221-6.
12. Szatko F, Wierzbicka M, Dybizbanska E, Struzycka I, Iwanicka-Frankowska E. Oral health of Polish three-year-olds and mothers' oral health-related knowledge. *Community Dent Health*. 2004 Jun;21(2):175-80.
13. Jodkowska E. The condition of dentition status of adults Polish citizens in years 1998-2009. *Przegl Epidemiol*. 2010;64(4):571-6. Polish.
14. Bagińska J, Stokowska W. Nawyki żywieniowe a intensywność próchnicy wczesnej u małych dzieci [Dietary habits and early childhood caries intensity among young children]. *Wiad Lek*. 2006;59(1-2):5-9. Polish.
15. Bagińska J, Rodakowska E. Knowledge and practice of caries prevention in mothers from Białystok, Poland. *IJCRIMPH* 2012;4(4):257-66.