The Romanian National Programme for Caries Prevention: The Experience of Iasi and Constanta Centres, Romania, 2000-2007

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Abstract

Aim: The aim of this is paper is to compare the results after seven years of the national fluoride mouth-rinsing programme (P.N.I.5) for caries prevention in Iasi and Constanta counties, Romania, based on assessment of Decayed, Missing, and Filled Teeth (DMFT), Decayed, Missing, and Filled Surfaces (DMFS), and Significant Caries (SiC) indices in 6- and 12-year-old children at the beginning, mid-point, and end of the programme. ***Methods:*** The paper presents data obtained in cross-sectional studies performed during 2000/2001, 2004, and 2007 in Iasi and Constanta in representative random samples of 6- and 12-year-old children. The ethical committees of both universities granted ethical permission for the studies. All the studies employed the same protocol for the clinical examinations and for recording the results. They were carried out by calibrated examiners, using World Health Organization 1997 criteria to evaluate DMFT, DMFS, and SiC indices, which were then statistically analysed. ***Results:*** Between 2000 and 2007, in Iasi, the mean DMFT/DMFS indices in six-year-old children decreased by 46.67%/50% *(P*<0.05) and the mean SiC index reduced by 18.75% *(P*>0.05). In 12-year-old children, the mean DMFT decreased by 12.15%, the mean DMFS by 16.99%, and the mean SiC by 8.15%. Between 2001 and 2007, in Constanta, the mean DMFT/DMFS and the mean SiC indices in six-year-old children increased by 24.65/25.92 *(P*>0.05) and 28.06% *(P*<0.05), respectively. In 12-year-old children the mean DMFT, DMFS, and SiC decreased by 28.96%, 30.33%, and 16.29% *(P*<0.05), respectively. ***Conclusions:*** After seven years of the school-based fluoride mouth-rinsing programme, the mean DMFT index for 12-year-old children decreased by 12.15% in Iasi and by 28.96% in Constanta, suggesting the efficacy of the National Programme P.N.I.5 in both counties and the need for future community-based caries preventive programmes.

Key Words: National Programme P.N.I.5, Fluoride Mouth-Rinsing Programme, Caries Prevention, Caries Indices.

Introduction

A basic principle of funding public health is to choose between different methods of using resources and to identify the most effective strategies [1]. Because the fundamental elements of health are established in childhood, this age group should be given great importance in terms of preventive programmes. Implementation of oral health programmes in schools has a major role in improving the oral health of children and in the elimination of inequalities in accessing dental services [2,3].

In 1992, in Romania, under the Tempus programme, a study of the oral health of the school population was developed in order to assess the directions and objectives of an oral health programme [4]. The results of this study showed that caries prevalence in the permanent teeth of 12-year-old children was 90% and the mean Decayed, Missing, and Filled Teeth (DMFT) score for these children was 4.1.

In 1997, the Romanian Ministry of Health approved and funded the National Programme for Prevention of Oral Diseases P.N.I.5, in order to order to try to reduce the prevalence of dental caries in the school population in grades 1-4 (between 6 and 11 years of age).

The programme provided primary prevention of dental caries through weekly rinses with a neu-

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tral fluoride solution containing 0.275% sodium fluoride (Fluorostom, produced by the National Institute of Chemical–Pharmaceutical Research, ICCF, Bucharest). At the same time, the programme provided specific methods for health promotion and education for children in order to promote positive oral health behaviour, and supported activities for primary, secondary, and tertiary prevention in the clinical units of dental education (Order No. MSF. 536/3 August 2001).

The programme was scheduled for piloting in four centres in Romania: Bucharest, Iasi, Constanta, and Timisoara. It started in 2000 in Iasi county and in Constanta county in 2001. In Iasi, the initial funding was used to buy kits for oral rinsing. Starting with the 2000-2001 school year, children in classes 1 to 4 rinsed their mouth weekly (on the same day each week, under teacher supervision) with Fluorostom solution (10 ml) for one minute. Funds necessary to carry out the programme were allocated annually. In the 2006-2007 school year, the cost per kit increased and the allocation was made late, with the loss of the first three months of the school year. The funding was stopped for the school year 2009-2010. The number of children included in the programme grew from 8000 in the year 2000 to 12,800 in 2005. It then decreased gradually as the funds were reduced. Children were only included in the programme with the consent of their parents. Each year, meetings were held to inform parents and to promote media interest. Oral health education sessions for teachers, parents, and children were also held.

In Constanta county, the National Programme P.N.I.5 started in September 2001. It was staffed by the Faculty of Dental Medicine of Ovidius University, Constanta (Departments of Paediatric Dentistry, Orthodontics, Oral Health and Dental Management, Preventive Dentistry, Community Dental Health). The programme included children aged between 6 and 11 years from Constanta city (42 schools, including the two special schools) and from other cities and villages (Navodari, Ovidiu, Mangalia, Medgidia, Eforie, Neptun, Basarabi, Cernavodă, Hârşova, Techirghiol, Mihail Kogalniceanu, and Ghindareşti) in the county (29 schools).

At the beginning of each school year, the programme followed the following steps:

1. Approval was obtained from the County School Inspectorate; in order to obtain this consent and also to help the programme's development, the programme director held meetings with teachers of the participating schools.
2. Written, informed consent of the parents for inclusion of their children in the programme was obtained. Parents participated in lessons to teach oral health and were also informed about the benefits and possible risks of the programme.
3. A media programme was held through meetings with television and local newspapers, in order to provide a better understanding of the importance of the programme.
4. A planned allocation of oral health staff (made by a member of the faculty staff and some volunteer students) to the schools covered by the programme.

In 2001, the total number of pupils in Constanta county included in the National Programme P.N.I.5 was 21,200. On every Thursday morning (between 8:00 and 11:00) during the school year, which lasted for 32 weeks, a member of the Faculty of Dental Medicine of the Ovidius University and the teachers at the schools supervised rinsing. Children were restricted from eating and drinking for one hour after rinsing. Funds for the programme were allocated annually. From the school year 2002-2003, the number of children enrolled in the programme began to decrease gradually (15,000 in 2002, 12,000 in 2004, 10,000 in 2007) as the funds reduced. From its inception in 2001, the programme maintained a 90% participation rate. In 2010, funding stopped.

Aim

Given the importance of knowledge of the trends in the oral health of children as a determinant of oral health status of future adult populations, the aim of this paper is to present the results after seven years of running P.N.I.5 in Iasi and Constanta counties, Romania, based on DMFT, Decayed, Missing, and Filled Surfaces (DMFS), and Significant Caries (SiC) scores, which have been evaluated in 6- and 12-year-old children throughout the programme.

Methods

Population and samples

In both Iasi and Constanta, clinical epidemiological cross-sectional studies have been performed on representative samples of schoolchildren from the two counties (α=0.07), selected by multistadial stratified random sampling. This paper reports the epidemiological data obtained in the cross-

sectional studies that were performed in 2000/2001, 2004 and 2007. In order to allow for comparisons to be made, all these studies used the same protocol for the examinations and for recording the results.

Ethical permission

Ethical permission to conduct the studies was given for each year by the Professional Ethical Committees of Grigore T. Popa University of Medicine and Pharmacy, Iasi, and of Ovidius University, Constanta, and by the Ethical Committees of the Medical Colleges of Iasi and Constanta Districts. Written consent was obtained from the Local Public Health Authorities of the cities included in the study, from the local administration authorities, and from the school authorities. The school authorities obtained the written informed consent from the parents of the children who were recruited to the studies.

Clinical examination

In each study, the subjects were examined by trained and calibrated examiners. The calibration of the examiners was carried out in the Faculties of Dental Medicine at Iasi and Constanta, at the beginning of the studies, by the principal investigators (I.D. and C.A). Intra-examiner consistency was assessed by repeating the clinical examinations of 10% of the children, after an interval of ten days from the original examination. Inter-examiner consistency was assessed by double-blind duplicate examination of 10% of children. All the clinical examinations were carried out in the dental offices of the schools by one trained examiner, using a plain mouth mirror, ball-ended dental probe, and sterile gloves, under optimal artificial light. The usual infection-control protocols were followed. The WHO Basic Survey 1997 criteria were used for the caries diagnosis and registration [5]. Dental caries was diagnosed at the caries into dentine (D3) threshold, using a visual method without radiography, fibre-optic transillumination, or compressed air. Enamel and precavitated lesions were excluded. The DMFT and DMFS indices for the permanent teeth and also their components were evaluated following the WHO 1997 protocol [6]. The mean SiC, as the mean value of DMFT for the one-third of the sample with the highest scores [7], was also calculated. In addition, the percentage of subjects with dental caries (DMFT >0), the percentage with untreated decayed teeth (D), and the percentage of caries-free subjects were calculated.

Statistical analysis

Data were analysed using statistical software: Microsoft Excel (Microsoft Corporation, Redmond, USA) and SPSS version 12 for Windows (SPSS Inc, Chicago, USA). The intra- and inter-examiner reliability were tested using kappa statistics. Descriptive statistics was used for analysis of caries indices. One-sample t-test was used for testing inter-group variations (the results in Iasi in 2000 versus the results in 2007 and the results in Constanta in 2001 versus the results in 2007).

Results

The intra- and inter-reliability of examiners for DMFT and DMFS assessment was higher than 0.83 (almost perfect agreement). It should be stressed that the results reported in this paper relate solely to permanent teeth in the six-year-old children; dmft and dmfs are not reported.

Iasi

In Iasi, between 2000 and 2007, the prevalence of dental caries in permanent teeth showed a downward trend in both 6- and 12-year-old children. There was also a significant increase *(P*<0.05) in the percentage of children with caries-free permanent teeth—5.5% in six-year-old children *(Table 1)* and 9.9% in 12-year-old children *(Table 2).* The caries indices scores decreased steadily in both age groups during the study. For six-year-old children, the scores registered in 2000, 2004, and 2007 for the mean DMFT were 0.30±0.54, 0.19±0.48, and 0.16±0.46, respectively. For the mean DMFS, they were 0.32±0.54, 0.21±0.56, and 0.16±0.46, respectively. For the mean SiC, they were 0.62±0.93, 0.64±0.75, and 0.52±0.75 *(Table 1).* For 12-year-old children, the caries indices scores registered in the same years for the mean DMFT were: 2.55±1.78, 2.35±1.61, and 2.24±1.87. For the mean DMFS, they were 4.53±3.25, 3.89±3.31, and 3.76±3.49. For the mean SiC, they were 4.78±2.18, 4.51±1.67, and 4.39±1.35 *(Table 2).* The prevalence of dental caries decreased by 3.6% between 2000 and 2004 and by another 1.93% between 2004 and 2007 for six-year-old children. For 12-year-old children, the prevalence of dental caries in the same periods fell by 4.64% and 5.24%, respectively.

Between 2000 and 2007, caries experience indices declined in both age groups. In six-year-old children, the mean DMFT and DMFS decreased by 46.67% and 50% *(P*<0.05). Over the same period, the mean SiC index reduced by 18.75% *(P*>0.05) *(Table 1).* Also over the same period, in 12-year-

Table 1. *Prevalence of Dental Caries in Permanent Teeth of Six-Year-Old Children in Iasi, Romania, Between 2000/2001 and 2007, Under Running P.N.I.5 (Values are Expressed as Mean±S.D.)*

County	**Iasi**				
Year	**2000**	**2004**	**2007**	**Trend (increase, decrease)/ measure of changes (%)**	***P-value* (*t*-test)**
No. of subjects (n)	335	315	284	-	-
Mean age (months)	75.32±3.15	76.28±3.18	76.15±2.14	-	-
Mean DMFT	0.30±0.54	0.19±0.48	0.16±0.46	↓ 46.67%	*P*<0.05
Mean DT	0.29±0.62 (97% of DMFT)	0.18±0.42 (94.73% of DMFT)	0.15±0.45 (93.75% of DMFT)	↓ (48.27%)	*P*<0.05
Mean MT	0.00	0.00	0.00	-	-
Mean FT	0.002±0.15 (0.67% of DMFT)	0.003±0.27 (1.66% of DMFT)	0.01±0.11 (6.66% of DMFT)	↑ (400%)	ns
Mean SiC	0.64±0.75	0.61±0.84	0.52±0.75	↓ (18.75%)	ns
% with DMFT>0 (n)	18.19 (n=61)	14.60 (n=46)	12.67 (n=36)	↓ (5.52%)	*P*<0.05
% with D>0 (n)	17.31 (n=58)	13.33 (n=42)	10.56 (n=30)	↓ (6.75%)	*P*<0.05
% caries free (n)	81.80 (n=274)	85.40 (n=269)	87.32 (n=248)	↑ (5.52%)	*P*<0.05
Mean DMFS	0.32±0.54	0.21±0.56	0.16±0.46	↓ (50%)	*P*<0.05
Mean DS	0.31±0.62	0.20±0.57	0.15±0.45	↓ (51.61%)	*P*<0.05
Mean MS	0.00	0.00	0.00	-	-
Mean FS	0.01±0.12	0.01±0.01	0.01±0.11	-	-

DMFT: Decayed, Missing and Filled permanent Teeth; DT: mean number of decayed teeth; MT: mean number of missing teeth; FT: mean number of filled teeth; SiC: Significant Caries Index; %DMFT: percentage with dental caries; %D: percentage with untreated decayed teeth; DMFS: Decayed, Missing and Filled Surfaces; DS: mean number of decayed surfaces; FS: mean number of filled surfaces; ↑: increase; ↓: decrease.

old children in Iasi, the mean DMFT index decreased by 12.15%, the mean DMFS by 16.99%, and the mean SiC by 8.15% *(Table 2).* For six-year-old children, between 2000 and 2007 the mean DT index decreased by 48.27% and the mean DS by 51.61% *(P*<0.05); for this age group, the missing indices (MT/MS) were zero throughout the whole period. For 12-year-old children, the mean DT/DS and MT/MS indices decreased by 29.72%/29.58% *(P*>0.05) and 82.35%/80.00% *(P*<0.05) *(Table 2).* The mean FT index increased by 400% in the six-year-old children *(Table 1)* and by 275% in the 12-year-old children *(Table 2);* the mean FS index remained constant in six-year-old children *(Table 1)* and increased by 119.56% in 12-year-old children (*Table 2).*

Constanta

In Constanta, for six-year-old children the caries indices scores for permanent teeth registered in 2001, 2004, and 2007 were as follows: for the mean DMFT 0.73±0.96, 0.77±0.98, and 0.91±1.30; for the mean DMFS 1.08±1.48, 1.22±1.62, and 1.36±2.18; and for the mean SiC 1.96±0.56, 2.03±0.50, and 2.51±1.02 *(Table 3).* The caries indices scores registered in the same years for 12-year-old children were as follows: for the mean DMFT 4.66±3.15, 3.65±2.69, and 3.31±3.04; for the mean DMFS 7.45±5.45, 5.81±4.55, and 5.19±5.29; and for the mean SiC 7.98±2.03, 6.62±1.31, and 6.68±2.52 *(Table 4).* For the six-year-old children, between 2001 and 2007 the caries prevalence of permanent teeth increased slightly by 0.36%, and the caries-free percentage increased by only 0.27% (*P*>0.05). The mean DMFT/DMFS and the mean SiC indices in six-year-old children registered a constant increment by 24.65%/25.92% (*P*>0.05) and 28.06% (*P*<0.05), respectively. In the same period, the mean DT and DS indices increased by 25% and 24.03% (*P*>0.05); the mean FT and FS also increased by 66.66% and 250% *(Table 3).*

In 12-year-old children, the caries prevalence decreased from a mean DMFT of 4.66 in 2001 to 3.31 in 2007 (*P*>0.05) and the caries-free percentage increased by 3.3% *(Table 4).* Over the same period, the caries experience indices' mean DMFT,

Table 2. *Prevalence of Dental Caries in Permanent Teeth of 12-Year-Old Children in Iasi, Romania, Between 2000/2001 and 2007, Under Running P.N.I.5 Period (Values are Expressed as Mean±S.D.)*

County	**Iasi**				
Year	**2000**	**2004**	**2007**	**Trend (increase, decrease)/ measure of changes (%)**	***P-value* (*t*-test)**
No. of subjects (n)	326	348	262	-	-
Age (months)	148.22±3.18	149.23±3.21	148.69±3.22	-	-
DMFT	2.55±1.78	2.35±1.61	2.24±1.87	↓ (12.15%)	ns
DT	2.22±2.98 (87.15% of DMFT)	1.81±2.73 (77.37% of DMFT)	1.56±2.41 (69.68% of DMFT)	↓ (29.72%)	ns
MT	0.17±0.28 (6.67% of DMFT)	0.08±0.27 (3.59% of DMFT)	0.03±0.19 (1.33% of DMFT)	↓ (82.35%)	*P*<0.05
FT	0.16±0.22 (6.27% of DMFT)	0.45±0.88 (19.53% of DMFT)	0.60±1.21 (26.86% of DMFT)	↑ (275%)	*P*<0.05
SiC	4.78±2.18	4.51±1.67	4.39±1.35	↓ (8.15%)	ns
% with DMFT >0 (n)	78.22 (n=255)	73.56 (n=256)	68.32 (n=179)	↓ (9.90%)	*P*<0.05
% with D>0 (n)	75.76 (n=247)	62.64 (n=218)	54.20 (n=142)	↓ (21.56%)	*P*<0.05
% caries free (n)	21.78 (n=71)	26.44 (n=92)	31.68 (n=83)	↑ (9.90%)	*P*<0.05
DMFS	4.53±3.25	3.89±3.31	3.76±3.49	↓ (16.99%)	ns
DS	3.82±3.78	3.01±3.74	2.69±2.68	↓ (29.58%)	ns
MS	0.25±0.81	0.14±1.0	0.05±0.50	↓ (80.00%)	*P*<0.05
FS	0.46±0.63	0.76±1.45	1.01±1.75	↑ (119.56%)	*P*<0.05

DMFT, Decayed, Missing and Filled permanent Teeth; DT, mean number of decayed teeth; MT, mean number of missing teeth; FT, mean number of filled teeth; SiC, Significant Caries Index; %DMFT, percentage with dental caries; %D, percentage with untreated decayed teeth; DMFS, Decayed, Missing and Filled Surfaces; DS, mean number of decayed surfaces; FS, mean number of filled surfaces; ↑, increase; ↓, decrease.

DMFS, and SiC decreased by 28.96%, 30.33%, and 16.29% (*P*<0.05), respectively. The mean DT/DS caries indices decreased from 30.00% to 36.72% (*P*<0.05), and the missing tooth indices mean MT/MS decreased by 15.38%/14.92% (*P*>0.05). The mean filling index FS increased by 28.57% (*P*>0.05).

Discussion

In 1992, it was reported that in Romanian six-year-old children there was a prevalence of dental caries of 15.00% for permanent teeth and the mean DMFT and DMFS index values were 0.9±0.1 and 1.3±0.1, respectively; the corresponding values for 12-year-old children were a 91% prevalence of dental caries, 4.1±0.2 for the mean DMFT, and 6.5±0.3 for the mean DMFS [4]. Compared with these data, between 1992 and 2000 the oral-dental health of children in Iasi has undergone significant changes, as follows: at the age of six years, a 3.2% increase in prevalence of dental caries in permanent teeth, a 66.66% reduction in the mean DMFT index, and a 75.38% reduction of the mean DMFS index; at the age of 12 years, a 12.78% reduction in prevalence of dental caries, a 37.8% reduction of the mean DMFT index, and 30.3% of the mean DMFS index [8].

Taking the same 1992 data reported for Romania, a study carried out in Constanta county in 2001, just before starting P.N.I.5, reported that six-year-old children had a prevalence of dental caries in permanent teeth 26.47% higher and mean DMFT and DMFS indices that were 18.88% and 16.92% lower than those in the 1992 Romanian study [9]. For 12-year-old children in Constanta, between 1992 and 2001 there was a 10.48% drop in prevalence of dental caries but at the same time, the mean DMFT and DMFS increased by 13.65% and 14.61%, respectively.

The baseline data for caries in 6- and 12-year-old children in Iasi and Constanta at the beginning of the in P.N.I.5 project indicated that caries prevalence and caries indices were higher in Constanta county than in Iasi county in the years 2000 to

Table 3. *Prevalence of Dental Caries in Permanent Teeth of Six-Year-Old Children in Constanta, Romania, Between 2000/2001 and 2007, Under Running P.N.I.5 (Values are Expressed as Mean±S.D.)*

County	**Iasi**				
Year	**2000**	**2004**	**2007**	**Trend (increase, decrease)/measure of changes (%)**	***P-value* (*t*-test)**
No. of subjects (n)	622	481	163	-	-
Mean age (months)	77.65±2.99	76.38±3.32	73.6±3.9	-	-
Mean DMFT	0.73±0.96	0.77±0.98	0.91±1.30	↑ (24.65%)	ns
Mean DT	0.72±0.95 (98.63% of DMFT)	0.74±0.96 (98.64% of DMFT)	0.90±1.29 (98.66% of DMFT)	↑ (25.00%)	ns
Mean MT	0.00	0.00	0.00	-	-
Mean FT	0.006±0.8 (0.82% of DMFT)	0.02±0.16 (1.36% of DMFT)	0.01±0.11 (1.34% of DMFT)	↑ (66.66%)	ns
Mean SiC	1.96±0.56	2.03±0.50	2.51±1.02	↑ (28.06%)	*P*<0.05
% with DMFT >0 (n)	41.47 (n=258)	42.17% (n=203)	41.11 (n=67)	↑ (0.36%)	ns
% with D>0 (n)	41.47 (n=258)	41.60% (n=200)	41.11 (n=67)	↑ (0.36%)	ns
% caries free (n)	58.53 (n=364)	57.83% (n=278)	58.89 (n=96)	↑ (0.36%)	ns
Mean DMFS	1.08±1.48	1.22±1.62	1.36±2.18	↑ (25.92%)	ns
Mean DS	1.04±1.42	1.14±1.54	1.29±2.02	↑ (24.03%)	ns
Mean MS	0.00	0.00	0.00	-	-
Mean FS	0.02±0.21	0.05±0.34	0.07±0.43	↑ (250%)	ns

DMFT, Decayed, Missing and Filled permanent Teeth; DT, mean number of decayed teeth; MT, mean number of missing teeth; FT, mean number of filled teeth; SiC, Significant Caries Index; %DMFT, percentage with dental caries; %D, percentage with untreated decayed teeth; DMFS, Decayed, Missing and Filled Surfaces; DS, mean number of decayed surfaces; FS, mean number of filled surfaces; ↑, increase; ↓, decrease.

Table 4. *Prevalence of Dental Caries in Permanent Teeth of 12-Year-Old Children in Constanta, Romania, Between 2000/2001 and 2007, Under Running P.N.I.5 Period (Values Are Expressed as Mean±S.D.)*

County	**Iasi**				
Year	**2000**	**2004**	**2007**	**Trend (increase, decrease)/measure of changes (%)**	***P-value* (*t*-test)**
No. of subjects (n)	683	670	259	-	-
Age (months)	150.78±3.84	150.83±3.83	144.37±3.4	-	-
DMFT	4.66±3.15	3.65±2.69	3.31±3.04	↓ (28.96%)	*P*<0.05
DT	4.20±3.01 (90.12% of DMFT)	3.21±2.59 (87.94% of DMFT)	2.94±2.94 (88.71% of DMFT)	↓ (30%)	*P*<0.05
MT	0.13±0.43 (2.78% of DMFT)	0.09±0.34 (2.46% of DMFT)	0.11±0.41 (3.61% of DMFT)	↓ (15.38%)	ns
FT	0.33±0.74 (7.09% of DMFT)	0.36±0.73 (9.86% of DMFT)	0.25±0.67 (7.68% of DMFT)	↓ (24.24%)	ns
SiC	7.98±2.03	6.62±1.31	6.68±2.52	↓ (16.29%)	*P*<0.05
% with DMFT >0 (n)	80.52% (n=550)	76.70% (n=514)	77.22 (n=200)	↓ (3.30%)	ns
% with D>0 (n)	79.50 (n=543)	73.49% (n=492)	71.81 (n=186)	↓ (7.69%)	ns
% caries free (n)	19.47% (n=133)	23.29% (n=156)	22.77 (n=59)	↑ (3.30%)	ns
DMFS	7.45±5.45	5.81±4.55	5.19±5.29	↓ (30.33%)	*P*<0.05
DS	6.29±4.75	4.81±4.03	3.98±4.06	↓ 36.72%)	*P*<0.05
MS	0.67±2.17	0.47±1.73	0.57±2.06	↓ (14.92%)	ns
FS	0.49±1.09	0.54±1.09	0.63±1.26	↑ (28.57%)	ns

DMFT, Decayed, Missing and Filled permanent Teeth; DT, mean number of decayed teeth; MT, mean number of missing teeth; FT, mean number of filled teeth; SiC, Significant Caries Index; %DMFT, percentage with dental caries; %D, percentage with untreated decayed teeth; DMFS, Decayed, Missing and Filled Surfaces; DS, mean number of decayed surfaces; FS, mean number of filled surfaces; ↑, increase; ↓, decrease.

2001. In six-year-old children in Constanta, dental caries prevalence was 23.27% higher, the mean DMFT index was 143.33% higher, and the mean DMFS index was 237.5% higher than in Iasi county. In 12-year-old children, caries prevalence was 2.3% higher, the mean DMFT index was 82.74% higher, and the mean DMFS index was 64.45% higher in Constanta compared to Iasi ($P<0.05$).

At the same time, comparing data from the years 2000-2001 for the mean DMFT in 12-year-old children in other European counties, it can be seen that for Iasi, the mean DMFT in 2000 appeared to be lower than the reported figures for Belarus (2.7), Bulgaria (4.4), Hungary (3.3), Latvia (3.9), Lithuania (3.6), and Poland (3.8), but higher than in the Nordic countries—Denmark (0.9), Finland (1.2), Norway (1.5), and Sweden (1.00)—and other developed countries of Europe—Belgium (1.1), Germany (1.2), Greece (2.2), Italy (1.5), Spain (1.1), Switzerland (0.9), and the United Kingdom (0.9). Unfortunately, the corresponding scores in 2001 in Constanta county were higher than all values reported for Europe at that time [10]. However, close examination of the relevant database [10] indicates that many of these data were not collected in 2000 or 2001 but in earlier years, thus direct comparisons are difficult.

In Iasi county between 2000 and 2007, during the P.N.I.5 project, all the variables that were assessed improved in both the 6- and 12-year-old children. The most significant changes were a significant decrease in dental caries prevalence in both groups and an increasing percentage of caries-free children. Although dental caries' prevalence reduction was the aim for both age groups, this decrease was 79% higher for the 12-year-old children than for the six-year-old children. At the same time, in the county of Iasi the indices of caries experience had a tendency to decline. The mean DMFT and DMFS indices declined in both age groups but this decline was statistically significant only in six-year-old children.

A more detailed analysis of the indices for dental caries suggested that in Iasi county there was a statistically significant decrease in the average number of decayed teeth/tooth surfaces (DT/DS) in the six-year-old children, and also a significant decline of the average number of teeth/tooth surfaces extracted as a result of caries (MT/MS) in the 12-year-old children. Last but not least, one of the most important trends observed in Iasi county between 2000 and 2007 was the increment in the mean filling indices FT/FS; the differences between minimum (recorded in 2000) and maximum (recorded in 2007) FT values were statistically significant ($P<0.05$) in the 12-year-old children. However, the largest share of caries experience indices is given by the number of cavities and not by the number of fillings. In this respect, there was a positive trend between 2000 and 2007 as the ratio of filled to carious teeth improved, and there was a decrease in the number of carious and extracted teeth. Based on the percentages recorded in 2000 for 12-year-old children when the percentage of caries-free children was 21.78% and decayed teeth accounted for 87.15% of the total DMFT index, the missing teeth 6.67%, and the filled teeth 6.27%, there was a good improvement by 2007 because caries-free children had increased by 9.9%, and within the DMFT index, 69.68% were decayed teeth, 1.33% were missing teeth, and 26.86% were filled. These data suggest the beneficial effect of P.N.I.5 in Iasi.

In Constanta county, the changes in caries prevalence and experience during 2001-2007 when the P.N.1.5. project was in operation were only favourable in the 12-year-old children who participated in the fluoride programme, but not in the six-year-old children. The indicators for caries suggested that there had been no improvement among the six-year-old children. Indeed, there appeared to have been a deterioration as far as caries in their permanent teeth was concerned. Although in the period 2001-2007, the percentage of six-year-old children with caries-free permanent teeth remained constant at just under 59%, the mean DMFT, DMFS, and SiC indices at this age increased steadily during the entire period. At the same time, significant increases were recorded for the DT/DS indices. There was a very small increase in the mean filling indices, FT/FS.

However, by 2007, FT represented just over 1% of the total DMFT, so in real terms it was insignificant and the vast majority of carious first molars in Constanta were probably not being filled. The pattern of caries in the 12-year-old children from Constanta was much more positive. Over the six years from 2001 to 2007, there appeared to have been a decreasing prevalence of dental caries and an increase in the percentage of caries-free 12-year-old children, together with a continuing and significant decline in the mean DMFT, DMFS, and SiC indices.

The decrease in the mean DMFT, DMFS, and

SiC indices between 2001 and 2007 suggested that the P.N.1.5 project was having a very positive effect on 12-year-old children in Constanta county.

A comparison of dental caries in 6- and 12-year-old children from Iasi and Constanta between 2000/2001 and 2007, made on the basis of the results of this study, shows that, in the absence of community measures of caries prevention other than P.N.I.5, there were different trends in Iasi (positive) and in Constanta (negative). In the 12-year-old children, there was an improvement in both counties. The results of this study suggest that the weekly use of the 0.275% sodium fluoride mouthrinse programme in elementary schools for 6-7 years led to significantly decreased dental caries in the 12-year-old children. The six-year-old children of 2000 or 2001 became the 12-year-old children of 2007 and had benefited from the fluoride rinsing for the entire period between 2000/2001 and 2007. This was not the case for the six-year-old children who were assessed in 2004 and 2007, so it is perhaps unsurprising that there was little difference in the caries indicators for the six-year-old children in Constanta, because they had not been rinsing for very long when they were examined. The mean DMFT, DMFS, and SiC indices in the 12-year-old children decreased (improved) in both counties, but were twice as great in Constanta as in Iasi. This result echoes that of a previous study [11], which highlighted the importance of the caries status of individuals before they start a mouth-rinsing programme; people with a high level of caries (as in Constanta) gain the most advantage and exhibit the maximum reduction in caries.

The decrease in the mean DMFT index of 12-year-old children was 12.15% in Iasi and 28.96% in Constanta. These results are in accordance with previous international studies [12-25]. Most of these studies date from the time before the decline in the prevalence of caries was fully recognised in economically developed countries. They indicated that periodic use of fluoride mouthrinses can reduce caries increments in children by 20%-35% over 2-3 years [26]. The percentage of caries reduction in Constanta is also close to the results suggested in a review article of Twetman *et al.* (2004), who reported nearly a 30% reduction in caries [27]. Other studies have reported various other percentage reductions in DMFT, such as 54.1% in the Ripa *et al.* (1983) study following a six-year programme [14], 14.2% in the Louw *et al.* (1995) study following a three-year programme of using a sodium fluoride mouthrinse [20], 86% in the Kobayashi *et al.* (1995) study following a long-term programme [21], and 15% in the Chikte *et al.* (1996) study following a three-year programme of using a sodium fluoride mouthrinse [28]. On the other hand, in this study the number of caries-free children increased by only 9.9% in Iasi and by only 3.3% in Constanta, after the seven-year programme of using a fluoride mouthrinse. The increase in caries-free children in other reports varies from 23% following a six-year programme of using a fluoride mouthrinse in 12-year-old children [15] to 60% following a long-term programme of using a fluoride mouthrinse [22], suggesting that the P.N.I.5 project in Iasi and Constanta mainly decreased the severity of dental caries and, to a lesser extent, its frequency.

Even if there are some differences between the cited studies and this study, especially regarding the age of starting the programme, the level of fluoride in drinking water, the socio-economic status of subjects, and the dental caries levels of the individuals prior to initiation of the fluoride programme will all influence the outcomes. Nevertheless, the results of the P.N.I.5 project are still valuable because the level of fluoride in drinking water is low in both districts and the prevalence of caries was high in 12-year-old children when the project started. The results should be comparable because the same protocol was used throughout the project and the periodic re-examinations gave high Kappa values.

P.N.I.5 in both Iasi and Constanta was clearly effective in decreasing the caries indices in 12-year-old children. They were worse in Constanta at the start of the project than in Iasi. By 2007, in spite of considerable improvement, the caries indices remained at significantly higher values in Constanta than in Iasi. In Iasi, the WHO target for the year 2000—that the DMFT for 12-year-old children should be no higher than 3.0 [29]—was achieved in time. In Constanta, although there have been significant improvements, it was not achieved by 2007, after seven years of the P.N.I.5 project. Nevertheless, the fluoride-rinsing project P.N.I.5 did result in significant improvements in both districts.

Conclusions

- The National Programme P.N.I.5 started from different baselines for caries in the two districts; as a result, after seven years the

decrease in caries was higher in Constanta county where the baseline prevalence was higher.

- After seven years of fluoride mouth-rinsing programme, the mean DMFT index for 12-year-old children age groups decreased by 12.15% in Iasi and by 28.96% in Constanta.
- This study clearly demonstrated the efficacy of running the National Programme P.N.I.5 of fluoride mouth-rinsing in Iasi and Constanta.
- It also demonstrated the need for future free community-directed caries preventive and oral health promotion programmes, in order to improve the oral health status in Romania and to achieve the WHO goals for oral health.

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Disclosing competing interest

The authors of this article declare that there are no potential conflicting interests regarding this research.

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