Community Dent Oral Epidemiol 2004; 32 (Suppl. 1): 69–73
Printed in the UK. All rights reserved

Community Dentistry and Oral Epidemiology

A European perspective on fluoride use in seven countries

Inga B. Árnadóttir[1], Clare E. Ketley[2], Cor van Loveren[3], Liisa Seppä[4], Judith A. Cochran[5], Mario Polido[6], Thessaly Athanossouli[7], W Peter Holbrook[1] and Denis M. O'Mullane[5]

[1]University of Iceland, Faculty of Odontology, Reykjavik, Iceland, [2]Department of Clinical Dental Sciences, University of Liverpool, Liverpool, UK, [3]Academic Centre for Dentistry Amsterdam, Department of Cariology and Endodontology, Amsterdam, the Netherlands, [4]University of Oulu, Institute of Dentistry, Oulu, Finland, [5]Oral Health Services Research Centre, University College Cork, Ireland, [6]Departmento De Epidemiologia, Instituto Superior De Ciencias Da Caparica, Lisbon, Portugal, [7]Department of Preventive and Community Dentistry, School of Dentistry, University of Athens, Athens, Greece

Árnadottír IB, Ketley CE, van Loveren C, Seppä L, Cochran JA, Polido M, Athanossouli T, Holbrook WP, O'Mullane DM. A European perspective on fluoride use in seven countries. Community Dent Oral Epidemiol 2004; 32 (Suppl. 1): 69–73.

Abstract – *Objectives:* The aim of this study was to collate data on national policies for the use of fluoride in the seven European countries participating in the FLINT project. *Methods:* Policies on the use of fluoride were obtained for each of the study areas. Data collected included the presence of water fluoridation and regulations governing fluoride toothpaste and fluoride supplements. *Results:* In Ireland 74% of the population had a fluoridated water supply but in all the other countries fluoride toothpaste was the principal form of delivering fluoride, usually recommended as a dose of a pea-sized amount. Fluoride supplement use varied considerably between countries. The Netherlands had the clearest regulations covering the use of fluoride supplements and definition of at-risk individuals. Most countries, even if they recognized particular caries-risk did not define the term clearly. In Iceland all children were regarded as being at high risk of developing caries. *Conclusion:* Considerable variation exists between European countries in their policies for fluoride use and no clear definitions of high-caries-risk individuals were found. The results show that there is even a lack of coherent thought and planning within the different countries, let alone between them.

Key words: children; dental fluorosis; fluoride ingestion; toothpaste

Inga B Árnadóttir, Faculty of Odontology, University of Iceland, Vatnsmýrarvegi 16, IS 101 Reykjavik, Iceland
Tel: +354 525 4850
Fax: +354 525 4874
e-mail: iarnad@hi.is

A study of the prevalence of fluorosis, fluoride ingestion and use of fluoride toothpaste in seven European countries was funded under the BIOMED 2 initiative of the European Union. This project was given the acronym 'FLINT' (1). It used highly standardized methods to assess fluorosis and fluoride ingestion in communities that are very different from one another from the north, west and south of Europe. These communities were: Cork, Ireland; the district of Knowsley in Liverpool, UK; Athens, Greece; Reykjavík, Iceland; Oulu, Finland; Haarlem, the Netherlands; and Almada/Setúbal, suburbs of Lisbon in Portugal (2–5). Fluoride is present in the drinking water in Cork. In the other communities fluoride toothpaste and fluoride supplements form the basis of the caries prevention programmes. To compare results and draw meaningful conclusions, it was necessary to record the essential differences and similarities between the seven communities that were investigated in 'Project FLINT', particularly with respect to fluoride policies in the respective communities and to the provision of dental care to the target age groups. The aim of this aspect of the overall study was to collate relevant data from the countries and communities involved in 'Project FLINT'.

Materials and methods

Data, official wherever possible, were obtained from the relevant authorities, including national or community-health authorities, importers and Customs, in each country or community with respect to fluoride policy, use of fluoride products, organization of dental health and, particularly, preventive dental-health matters in the respective communities. At the planning stage of the project the information required was decided upon. The team of investigators in each country translated the questions into the relevant language for submission to the authorities in their country. Collection of these data was in

the hands of each national team of investigators. Information was also sought on official policy concerning fluorosis as both a public-health matter and one for the individuals concerned. In Finland the information was obtained from the National Agency for Welfare and Health, in Greece the information came from the Ministry of Health supplemented with some research conducted by the dental school in the University of Athens. For Iceland, Ireland, the Netherlands, Portugal and the UK the information came from the respective Ministries of Health.

The questionnaire asked about the national policy with respect to fluoride use in the respective country including specific questions on: water fluoridation; fluoride rinsing programmes; amount of fluoride toothpaste used annually per capita; the concentration of fluoride in toothpastes on sale and the recommended dosage for children; use of fluoride supplements, especially fluoride tablets. A specific question was asked about awareness of the problem of fluorosis in the study countries and specifically about the known presence of fluorosis in the study communities. Further questions were aimed at discovering the nature of the dental health services for children in each country.

Results and Discussion

An overview of the fluoride policies in each country is given in Table 1. Ireland was the only country of the seven investigated with fluoridation of the public water supplies that reached 73% of the population. In England, approximately 10% of the population received fluoridated water. Fluoridation of water supplies is still an important component of the UK Government's Oral Health Strategy (6), and the British Dental Association has proposed that coverage should be increased to 25% of the population, targeting those areas with caries levels above the UK mean (7). Nevertheless, no new fluoridation schemes have been introduced since the mid-1970s. In other countries, there was no water fluoridation except from some isolated areas where the water contains natural fluoride. In Finland approximately 4% of the population receives water that is naturally fluoridated. Schemes of water fluoridation in Finland and the Netherlands have been stopped on the grounds that participation in this health measure was compulsory.

In all countries regular use of fluoride toothpaste was seen as the cornerstone of fluoride

Table 1. Fluoride availability in the seven study areas

	Fluoridated water (natural or artificial) % of population covered		Fluoride toothpaste		Supplements	Rinses		
	Nationwide	Population	% of total sales	G/capita/yr	Tablets	At home	At school	Other
Ireland	73	100	95	270 (1994)	N/A	0.05% NaF available	Fortnightly 0.2% NaF. Approx 30 000 pupils participate in these programmes	N/A
England	10	0	95		Children at risk	>7 year of age 0.05% and 0.2% NaF available	No specific policy	Milk fluoridation (33 000 children)
Greece	Sporadic	0	95–100	270	Children at risk	0.05% NaF available	Not organized	F-chewing gum F dental floss
Iceland	0	0	98	350	Children at risk	0.05% NaF available	Twice monthly 0.2% NaF up to 12 yr	Not available
Finland	4	0	99	188	Children at risk	0.05% NaF available	Not organized	F-chewing gum available
the Netherlands	0	0	98	250	Children at risk	Not recommended for children 0.05% NaF available	No specific policy	Not available
Portugal	0	0			Children at risk		Twice monthly, 0.2% NaF	

Table 2. Specific dosing recommendations for toothpaste in the seven study areas

Country	Age group		
	Infants	Children	Adults
Ireland	Supervised brushing Pea-sized amount	Supervised brushing Pea-sized amount	1000–1500 ppm At least twice daily
England	<6 years: <600 ppm a small pea-sized amount. Those at high risk of caries: 1000 ppm	1000–1450 ppm	1000–1450 ppm
Greece	No official recommendations but pedodontists recommend no more than 500 ppm <2 years: smear >2 years: pea-sized amount	>2 years: pea-sized amount No recommendation on concentration	
Iceland	1000 ppm pea-sized amount	1000 ppm pea-sized amount	1000 ppm twice daily
Finland	1000 ppm pea-sized amount, when the first primary molars Have erupted	1000–1450 ppm pea-sized amount twice daily	1450 ppm twice daily
the Netherlands	Till second birthday once a day 500 ppm Till fifth birthday twice a day 500 ppm	1000–1450 ppm twice daily	1000–1450 ppm twice daily
Portugal	From 1 year pea-sized amount (500 ppm)	Pea-sized amount	

supplementation, not least in those countries without natural or artificial fluoridation of the water supplies. Use of fluoride-containing toothpaste was almost universal among subjects from each participating country. The amount of fluoride toothpaste sold per person per year varied widely between countries but this may be accounted for by differences in data collection and criteria used in the different countries (Table 1). In most countries toothpastes with a variety of fluoride concentrations were available. Only in England and the Netherlands, however, were toothpastes with low fluoride concentrations advised for infants (Table 2). In the other countries, toothpaste with 1000 ppm F or more were advised from the eruption of the first teeth, but for the infants the amount of toothpaste suggested to be used was limited to a pea size.

In most of the countries, additional fluoride supplements were only advised for children at particular risk of developing caries, although definitions of such risk were not usually available. Twice-monthly fluoride-rinsing programmes in schools have been implemented in Iceland and Portugal. In Iceland this programme has been shown to reach 75% of children aged 6–12 years and 58% received the recommended schedule of a fluoride rinse twice a month with 0.2% NaF (8). Use of fluoride tablets varies from country to country (Table 3) although all countries

Table 3. Recommended use of fluoride tablets (mg F/day) in the seven study areas

Country	Age group							
	6 month/eruption 1°molar–1 year		1–2 years	2–3 years	3–4 years	4–5 years	5–6 years	>6 years
Ireland[a]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
England[b]	0.25	0.25	0.25	0.50	0.50	0.50	1.00	
Greece[c]	0.25	0.25	0.5	0.75	0.75	1.00	1.00	
Iceland	0.25	0.25	0.25	0.25	2 × 0.25	2 × 0.25	4 × 0.25	
Finland[d]	0.25	0.25	0.25	2 × 0.25	2 × 0.25	2 × 0.25	3 × 0.25	
the Netherlands[e]	—	—	—	—	—	—	—	
Portugal[f]								
<0.3 ppm F/H_2O	0.25	0.25	2 × 0.25	2 × 0.25	4 × 0.25	4 × 0.25	4 × 0.25	
0.3–0.7 ppm F/H_2O	0	0	0.25	0.25	2 × 0.25	2 × 0.25	2 × 0.25	

[a]Not recommended because of widespread availability of water fluoridation.
[b]Only recommended for those considered to be at high risk; in areas where water F concentration is >0.3 ppm the dosage should be lowered accordingly.
[c]Recently paedodontists recommend the use only for high-risk children: 6 months to 3 years: 0.25 mg; 3–6 years: 2 × 0.25 mg.
[d]In Finland fluoride lozenges are preferred over tablets.
[e]Until 1998 30% of children used fluoride tablets and all children used 250 ppm toothpaste. Since 1998 all children use toothpaste with 500 ppm F and tablets no longer advised except on an individual basis.
[f]Dose of tablets depends on the level of fluoride in the drinking water.

Table 4. Definition of categories of children requiring fluoride supplements

Country	Definition of risk category
Ireland	N/A
England	Children at high risk living in an area with <0.3 ppm F/H_2O. Fluoride supplements not considered to be a public-health measure
Greece	Children living in an area with <0.3 ppm F/H_2O
Iceland	All children under 12 years
Finland	Children living in an area with <0.4 ppm F/H_2O
the Netherlands	Two new (white spot) lesions since previous routine visit
Portugal	Children living in an area with <0.3 ppm F/H_2O

Table 5. Fluoride treatments available in the dental office in the seven study areas

Country	Treatments
Ireland	Fluoride varnish and gel for use on high-risk children
England	Fluoride varnish and gel for use on high-risk children
Greece	No information
Iceland	Fluoride varnish till the age of 12 years: twice a year for high-risk children, others once a year
Finland	Fluoride varnish for high-risk children once or twice a year
the Netherlands	Application of varnish, gel, or fluid when caries activity (two new, white-spot, lesions since previous routine visit) is observed; not under the age of 6 years
Portugal	No information

had recommendations that tablets should only be advised for children at risk. Authorities in Iceland have been reported as categorizing all children as being at high risk of developing caries (9). This was based on the finding of a high prevalence of dental caries but the policy was not changed following the rapid decline in caries seen in Iceland (9, 10). The Netherlands identifies children at particular risk if two new white-spot lesions have developed since the last routine dental check-up. In the UK risk is defined as disability affecting dental care, medical compromise, children with numerous new or recurrent carious lesions, irregular attenders, those with poor dietary control and/or taking sweetened medicines and those receiving little assistance with tooth brushing (11). In the other participating countries the at-risk group was not specified or only poorly defined (Table 4), the principal criterion being a low level of fluoride in the drinking water. It is not clear if the reason for this categorization of 'risk' is because of the low level of fluoride in the drinking water or because of known trends of caries in the particular population. No regulations or recommendations seem to be in place in the study countries with respect to: particular age groups, known levels of caries; dietary factors; socioeconomic conditions; or lifestyle factors. Table 5 lists the fluoride treatments available to the child from the dental team but although various fluoride treatments were available in most countries policies for their use were the exception. Wang (9) found that official guidelines on fluoride use indeed influenced dental practitioners and thus it is essential that carefully constructed guidelines built on scientific principles should be available to the clinician. These should take into account the circumstances particular to each country, district or sector of the population.

Acknowledgements

We are grateful to the following people: Anna-Maria Oila and Erja Komminaho (Finland); Helen Mamai-Homata and Haroula Koletsi-Kounari (Greece); Halla Sigurjóns (Iceland); Eileen MacSweeney and Theresa O'Mahony (Ireland); Annemarie van Leeuwen (the Netherlands); Eduardo Barros Fernandes and Leonor Sanches (Portugal); and Mike Lennon and Julia West (UK).

References

1. O'Mullane DM, Cochran JA, Whelton HP. Fluoride ingestion from toothpaste: background to European Union-funded multicentre project. Community Dent Oral Epidemiol 2004;32 (Suppl. 1):5–8.
2. Cochran JA, Ketley CE, Sanches L, Mamai-Homata E, Oila A-M, Árnadottír IB, et al. A standardized photographic method for evaluating enamel opacities including fluorosis. Community Dent Oral Epidemiol 2004;32 (Suppl. 1):19–27.
3. Cochran JA, Ketley CE, Arnadóttir IB, Fernandes B, Koletsi-Kounari H, Oila A-M, et al. A comparison of the prevalence of fluorosis in 8-year-old children from seven European study sites using a standardized methodology. Community Dent Oral Epidemiol 2004;32 (Suppl. 1):28–33.

4. Cochran JA, Ketley CE, Duckworth RM, van Loveren C, Holbrook WP, Seppä L, et al. Development of a standardized method for comparing fluoride ingested from toothpaste by 1.5–3.5-year-old children in seven European countries. Part 1: Field work. Community Dent Oral Epidemiol 2004;32 (Suppl. 1):39–46.
5. Cochran JA, Ketley CE, Duckworth RM, van Loveren C, Holbrook WP, Seppä L, et al. Development of a standardized method for comparing fluoride ingested from toothpaste by 1.5–3.5-year-old children in seven European countries. Part 2: Ingestion results. Community Dent Oral Epidemiol 2004;32 (Suppl. 1):47–53.
6. Department of Health. An Oral Health Strategy for England. London: HMSO; 1994.
7. British. Dental Association. Manifesto for Dentistry. London: British Dental Association; 1996. p. 9.
8. Águstsdóttir H, Ólafsdóttir JL, Ólafsdóttir BE. Könnun á tannfræðslu og flúorskólun í grunnskólum. Icelandic Dent J 2001;19:32–3.
9. Wang NJ. Government policies on fluoride utilization in the Nordic countries. Acta Odont Scand 1999; 57:342–7.
10. Bjarnason S, Finnbogason SY, Holbrook P, Köhler B. Caries experience in Icelandic 12-year-old urban children 1984 and 1991. Community Dent Oral Epidemiol 1994;21:194–7.
11. Holt RD, Nunn JH, Rock WP, Page J. Fluoride dietary supplements and fluoride toothpastes for children. Int J Paediatr Dent 1996;6:139–42.