

Prevalence and severity of dental caries in 5- and 12-year old children in the Veneto Region (Italy)

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Objectives: To evaluate the occurrence of dental caries among 5- and 12-year-old children in Northeastern Italy and to compare dental status between immigrants and native-born children. **Basic research design and participants:** A cross-sectional survey of 260 5-year-olds and 862 12-year-olds was carried out between October 2003 and May 2004. Dental caries were diagnosed at the caries into dentine (D3) threshold. Differences in dental health status were compared between immigrant and native-born children for both age groups. **Results:** Among 5-year-old children, mean dmft was 1.45 (SD=2.69), SiC=4.31, 65.8% had no caries. Immigrant 5-year-olds (6.2%) scored more poorly than their Italian counterparts: mean dmft was 5.12 (vs. 1.21; $p<0.001$) and only 25.0% were caries free (vs. 68.4%; $p<0.001$). Among 12-year-olds, mean DMFT was 1.44 (SD=2.00), SiC=3.88, 55.1% had DMFT=0; 5.6% also had poorer dental status: mean DMFT was 3.23 (vs. 1.33; $p<0.001$), SiC=6.69 (vs. 3.66), and only 17.1% had DMFT=0 (vs. 56.8%). **Conclusions:** The prevalence of dental caries and care obtained for both age groups are similar to those of other industrialised countries. When our results for 12-year-olds were compared with those of two previous surveys (1984 and 1994), a major decline in the prevalence of dental caries was observed. Being immigrant was a strong determinant in caries occurrence.

Key words: children, dental caries, immigrants, Italy, prevalence

Introduction

The reported dramatic decline of dental caries in children and adolescents living in industrialised countries, which started in the 1960s (Glass, 1982; Marthaler *et al.*, 1996, Petersson and Bratthall, 1996; Petersen, 2003, Marthaler, 2004) is not well documented in Italy. During the 1995 ORCA Symposium Italy was reported to be “the only large populous Western continental country for which a decline remains to be demonstrated” (Marthaler *et al.*, 1996). This statement is still valid.

Since 1996, few papers have been published in the international literature on the occurrence of dental caries in Italian preschool and school children (Angelillo *et al.*, 1999; Petti *et al.*, 2000; Campus *et al.*, 2001), and no papers have discussed epidemiological trends. On the website of the WHO Oral Health Country/Area Profile Programme (<http://www.whocollab.od.mah.se>), the most recent data are from 1996 and are based on surveys published in the Italian literature. To date only one report of a pathfinder survey on 12-year-olds has been published. (Falcolini *et al.*, 1998).

Little is known also about the oral health status of immigrant people in Italy. Immigration towards Italy is a recent social phenomenon that started at the end of 1980s when people from Africa, Asia, Eastern Europe and South America began to immigrate to our country, inverting a secular trend in which Italians emigrated. According to the latest national census (www.istat.it), today immigrants account for 2.5% of the overall population. Only recently has Italy begun to tackle the

issues of social integration and health status of different immigrant groups.

To document the prevalence and severity of dental caries in Italian children, we carried out a cross-sectional epidemiological survey of preschoolers (5-year-olds) and adolescents (12-year-olds) living in Northeastern Italy. The study of preschool children was carried out within a local oral health-promotion activity entitled “From mother to child”; this programme is carried out in three educational periods, involving pregnant women during ante-natal courses, new mothers attending with their children for the 12-month vaccinations, and children attending nursery school. One important objective of our study was to obtain baseline data on the dental status of immigrant children. Another objective was to estimate epidemiological trends by comparison with our previous surveys of the local area.

Subjects and methods

The study was carried out between October 2003 and May 2004 in northern Padua Province, centrally located in Veneto Region. The concentration of fluoride in the drinking water of this area was 0.07 ppm/l (Miotti *et al.*, 1985).

At the beginning of the study, we registered a total of 2,396 5-year-old children attending nursery school and 2,379 12-year-old children attending public middle schools. We randomly recruited (all students in one classroom) 300 5-year-olds (12.5% of total) and 900 12-year-olds (37.8%). School authorities were respon-

sible for obtaining informed consent from parents of each child recruited. Examinations were carried out in the school buildings by one trained dentist (A.B.) using plain mouth mirrors and dental probes under artificial light and observing usual infection-control protocols, with the child sitting in an ordinary upright chair. We adhered to the guidelines of the British Association for the Study of Community Dentistry (BASCD) for collecting epidemiological data (Pitts *et al.*, 1997)

Dental caries was diagnosed at the caries into dentine (D3) threshold using a visual method. Missing deciduous teeth, except incisors, were assumed to have been extracted because of caries. Care index percentages were also determined ($ft/dmft \times 100$ for 5-year-olds, $FT/DMFT \times 100$ for 12-year-olds). Finally, to assess individuals with the highest caries load in each group, we calculated significant caries index (SiC), determined as mean value of DMFT (or dmft) for the one-third of the sample with the highest scores.

Intra-examiner reliability was determined by re-examining a randomly selected subset of children (10% of each group) approximately one month later. Subgroup analyses were performed by distinguishing children on the basis of their immigrant status, determined according to birthplace; this information was requested from parents when they signed the consent forms.

Statistical analyses

Cohen's kappa was calculated to assess intra-rater reliability. In subgroup analyses (immigrant vs. native born children), Student's *t* test was used to compare dmft and DMFT scores while chi-square analysis with Yates' correction for continuity for unpaired samples was used to test differences in percentage of caries-free children. A value of $p < 0.05$ was considered significant.

Results

Of the 300 5-year-old children contacted, parents of 260 consented (87%); of the 900 12-year-olds contacted, parents of 862 children (96%) consented. Approximately one month later, a subset of these children (50 5-year-olds and 150 12-year-olds) was re-examined; intra-rater reliability was excellent (Cohen's $\kappa = 0.88$).

Caries prevalence and dental health status

Amongst 5-year-olds (Table 1), 171 children (65.8%) were free of caries. The mean dmft was 1.45 (± 2.69), while SiC was 4.31. No children had missing teeth. The care index was low (5.5%). In this group, 16 (6.2%) were immigrants (foreign-born). In view of the small number in this group comparisons with the native population is not warranted.

Among 12-year-olds (Table 2), 475 children (55.1%) had DMFT=0. The mean DMFT was 1.44 ($SD = 2.00$). Care index (57.6%) was substantially higher than that for preschoolers. SiC was 3.88 and only one child was missing a tooth. In this group, 48 children (5.6%) were immigrants. The mean DMFT for immigrants (3.23 ± 1.17) was significantly higher ($p < 0.001$) than that of 814 native-born children (1.33 ± 1.86); SiC was also higher (6.69 vs. 3.66). Furthermore, care index for immigrant children was notably lower (36.2% vs. 60.9%).

We assessed the prevalence and severity of dental caries in 12-year-olds in the same local region on two occasions during the last two decades (Table 3). In the 1985 survey (Miotti and Ferro, 1987), three dentists visited 103 children at school, recording data according to WHO criteria; inter-examiner reliability was not assessed and statistical analysis was limited. The 1994 investigation (Ferro *et al.*, 1995) was performed by one

Table 1. Prevalence of dental caries in 260 5-year-old children, by country of birth. Values are expressed as mean \pm standard deviation (95% confidence interval) unless otherwise indicated.

	Total (n = 260)	Native-born (n = 244)	Immigrants (n = 16)
Age, months	64.9 \pm 3.3	64.9 \pm 3.2	65.9 \pm 3.7
dmft	1.45 \pm 2.69 (CI 0.33)	1.21 \pm 2.41 (CI 0.3)	5.12 \pm 3.98 (CI 1.95)*
d3t	1.36 \pm 2.69 (CI 0.32)	1.12 \pm 2.33 (CI 0.29)	5.00 \pm 3.92 (CI 1.92)
mt	0	0	0
ft	0.09 \pm 0.58 (CI 0.07)	0.09 \pm 0.59 (CI 0.07)	0.12 \pm 0.50 (CI 0.24)
Caries free, n (%)	171 (65.8)	167 (68.4)	4 (25.0)**
dmft in subset of children with dmft > 0	4.19 \pm 3.09 (CI 0.64)	3.83 \pm 2.91 (CI 0.65)	6.83 \pm 2.98 (CI 1.68)
Children with dt > 0, n (%)	86 (33.1)	74 (30.3)	12 (75.0)
d3t in subset of children with dt > 0	3.98 \pm 3.10 (CI 0.64)	3.56 \pm 2.92 (CI 0.65)	6.67 \pm 2.96 (CI 1.67)
SiC	4.31	ND	ND
Care index	5.5%	8.3%	2.6%

dmft, diseased, missing and filled deciduous teeth; SiC, significant caries index; ND, not determined; CI, 95% confidence interval; * $p < 0.001$ vs. native-born children on Student's *t* test; ** $p < 0.001$ vs. native-born children on chi-square test

Table 2. Prevalence of dental caries in 862 12-year-old adolescents, by country of birth. Values are expressed as mean \pm standard deviation (95% confidence interval) unless otherwise indicated

	<i>Total</i> (<i>n</i> = 862)	<i>Native-born</i> (<i>n</i> = 814)	<i>Immigrants</i> (<i>n</i> = 48)
Age, years	11.96 \pm 0.41	11.93 \pm 0.41	12.5 \pm 0.74
DMFT	1.44 \pm 2.00 (CI 0.13)	1.33 \pm 1.86 (CI 0.13)	3.23 \pm 1.17 (CI 0.9)*
DT	0.61 \pm 1.40 (CI 0.09)	0.52 \pm 1.24 (CI 0.09)	2.04 \pm 2.67 (CI 0.76)
MT	<0.01	0	0.02 \pm 0.14 (CI 0.04)
FT	0.83 \pm 1.47 (CI 0.09)	0.80 \pm 1.43 (CI 0.1)	1.17 \pm 1.99 (CI 0.56)
Children with DMFT=0, n (%) ²	475 (55.1)	462 (56.8)	13 (27.0)
Children with DMFT>0, n (%)	387 (44.9)	352 (43.2)	35 (83)
DMFT for children with DMFT>0	3.19 \pm 1.81 (CI 0.18)	3.07 \pm 1.61 (CI 0.17)	4.43 \pm 2.90 (CI 0.96)
Children with DT>0, n (%)	195 (22.6)	168 (20.6)	27 (56.3)
DT for children with DT>0	2.67 \pm 1.77 (CI 0.25)	2.52 \pm 1.55 (CI 0.23)	3.63 \pm 2.63 (CI 0.99)
Children with sealed teeth, n (%)	338 (39.2)	333 (40.9)	5 (10.4)
Sealed teeth	1.37 \pm 2.09 (CI 0.14)	1.43 \pm 2.12 (CI 0.15)	0.33 \pm 0.99 (CI 0.28)
SiC	3.88	3.66	6.69
Care index	57.6%	60.9%	36.2%

DMFT, diseased, missing and filled permanent teeth; SiC, significant caries index; CI, 95% confidence interval;
* p <0.001 vs. native-born children on Student's t test

Table 3. Time trends in mean DMFT (SD) of 12-year-old children in Veneto Region, Italy.

<i>Reference</i>	<i>Year of survey</i>	<i>Subjects, n</i>	<i>DMFT</i>	<i>DT</i>	<i>MT</i>	<i>FT</i>	<i>Children with DMFT=0, n (%)</i>
Miotti and Ferro, 1987	1985	103	4.59	2.21	0.33	2.04	26 (25)
Ferro <i>et al.</i> , 1995	1994	306	2.2 (2.4)	0.8 (1.5)	0	1.4 (2.0)	107 (35)
Current study	2003-04	862	1.44 (2.00)	0.61 (1.4)	0	0.83 (1.47)	475 (55.1)

Table 4. Comparison of regional Italian data on dental status of 12 year-olds

	<i>Veneto, Northeastern Italy</i>	<i>Catanzaro, Southern Italy (low fluoride)</i>	<i>Naples, Southern Italy (high fluoride)</i>	<i>Sassari, Sardinia</i>
<i>Reference</i>	<i>Current study</i>	<i>Angelillo et al., 1999</i>	<i>Angelillo et al., 1999</i>	<i>Campus et al., 2001</i>
Year of survey	2003-04	1997	1997	1997-98
Total, n	862	461	553	403
Boys, n	440	233	277	198
Girls, n	422	228	276	205
DMFT	1.44 \pm 2.00	1.5 \pm 1.9	1.4 \pm 1.7	NR
DMFT, boys	1.39 \pm 1.97	1.5	1.4	2.4 \pm 2.5
DMFT, girls	1.48 \pm 2.01	1.6	1.5	2.3 \pm 2.8
Children with DMFT=0, %	55.1	48.4	46.8	NR

NR, not reported

trained dental examiner, with excellent reliability between repeat measurements (Cohen's $\kappa=0.94$). Despite the methodological and statistical deficiencies of the first survey, the combined data indicate a major decline in dental caries in 12-year-olds, living in the Veneto region: mean DMFT index declined from 4.59 to 1.44, and the percentage of children with DMFT=0 increased from 25% to over 55%.

Discussion

Deciduous dentition

Some reports have suggested that the trend towards a decline in caries in primary teeth has tapered off (Marthaler, 2004). In England and Wales, this trend ended in 1983 (Downer, 1994). Likewise, in Swiss children of the Canton of Zurich, an end to this trend became evident in 1988: In the first Swiss survey of 1964, mean dmft was 7.6; in 1988, 1992, 1996 and 2000 mean dmft values ranged between 1.5 and 1.8, indicating a stable period (Marthaler, 2004). In contrast to these studies, some recent reports suggested that the prevalence of dental caries has increased slightly (Rugg-Gunn, 2001; Birkeland and Haugejorden, 2002). For example, in Norway, the prevalence of caries among 5-year-old children increased from 30.8% to 38.9% over a 4-year period (1997-2001) and mean dmft increased from 1.1 to 1.5 (Birkeland and Haugejorden, 2002). Due to lack of data on Italian 5-year-olds, the trend in caries prevalence in deciduous dentition in our country is not known.

Marthaler, suggested the hypothesis that there is a threshold beyond which an improvement in caries levels in a population is difficult. In the primary dentition he, tentatively, propounded that the average dmft at age five years is rarely below 1.5 and children caries free is rarely above 60% (Marthaler, 2002).

Permanent dentition

In the last five years, two other studies on the prevalence and severity of dental caries in Italian 12-year-olds have been published in the English-language medical literature (Angelillo et al 1999; Campus et al 2001) (Table 4). While our study was a descriptive, cross-sectional epidemiological investigation, the others analysed correlations between dental caries prevalence and local characteristics, in particular the concentration of fluoride in drinking water in two areas of Southern Italy (Angelillo et al., 1999) and the socio-economic conditions and behaviour of an island population in Sardinia (Campus et al., 2001). DMFT scores reported in the present paper are comparable to those for Southern Italy. In contrast, mean gender-specific DMFT scores from Sardinia are higher than our values by 55% (girls) and 73% (boys). European figures on caries prevalence in 12-year-olds are available from the WHO Oral Health Country/Area Profile Programme (<http://www.whocolab.od.mah.se>) and from numerous recent papers (Pitts et al., 2002; Ivankoviæ et al., 2003; Pieper and Schulte, 2004; de Almeida et al., 2003; Poulsen and Malling Pedersen, 2002). Overall, the prevalence rate for Northeastern Italians reported here is in line with those of other countries.

Immigrant children

Oral health in immigrant schoolchildren living in developed countries is poor (Dhawan and Bedi, 2001). During the past few years in Italy, the immigrant population from non-western countries (particularly China, former Yugoslavia and countries of North Africa and Eastern Europe) has grown steadily. While at a national level, immigrants represent 2.5% of the total population, we observed a greater concentration of immigrants in this study: 6.2% of 5-year-olds and 5.6% of 12-year-olds. There is no doubt that the percentage of legal as well as illegal immigrants will increase in the short-term (Marthaler, 2004).

The present study revealed huge disparities in caries levels amongst 12 year-olds between immigrant and native-born children, being considerably worse in immigrants than in Italian-born children. Regarding 12-year-olds, the percentage of immigrants with DMFT=0 was about one-third that for Italians (27.0% vs. 56.8%), immigrants had four times as many decayed teeth (D3T, 2.04 vs. 0.52), only 10.4% had at least one sealed tooth (vs. 40.9%), and SiC was almost twice as high among immigrants (6.69 vs. 3.66).

References

- Angelillo, I.F., Torre, I., Nobile, C.G.A. and Villari P. (1999): Caries and fluorosis prevalence in communities with different concentrations of fluoride in the water. *Caries Research* **33**, 114-122.
- Birkeland, J.M. and Haugejorden, O. (2002): Reversal of the caries decline among Norwegian children. *Caries Research* **36**, 174-222.
- Campus, G., Lumbau, A., Lai, S., Solinas, G. and Castiglia, P. (2001): Socio-economic and behavioural factors related to caries in twelve-year-old Sardinian children. *Caries Research* **35**, 427-434.
- de Almeida, C.M., Petersen, P.E., André, S.J. and Toscano, A. (2003): Changing oral health status of 6- and 12-year-old schoolchildren in Portugal. *Community Dental Health* **20**, 211-216.
- Dhawan N, Bedi R (2001) Transcultural oral health care: 6. The oral health of minority ethnic groups in the United Kingdom: a review. *Dental Update* **2001** **28**, 30-34.
- Downer, M.C. (1994): Caries prevalence in the United Kingdom. *International Dental Journal* **44**, 365-370.
- Falcolini, G., Favero, G.A., Ferro, R., Ghirlanda, C., Olivi, R., Strohmenger, L., Saran G. and Cagliani, M. (1998): Prevalence of dental caries in Italy a survey co-ordinated by the Working Group of Preventive Dentistry of SIOI. *Community Dental Health* **15**, Abstract No 11, 195.
- Ferro, R., Smania, P.A. and Isola A. (1995): Prevalenza della carie nella Regione Veneto nel 1994 in una popolazione compresa fra i 4 ed i 12 anni. *Epidemiologia della Regione Veneto*, pp 12-20. *Regione Veneto: ULSS 15*.
- Glass, R.L. (1982): The First International Conference on the Declining Prevalence of Dental Caries. Introduction. *Journal of Dental Research* **61** (special issue), 1304.
- Ivankoviæ, A., Lukiaë, I.K., Ivankoviæ, Z., Radiaë, A., Vukiaë, I. and Šimiaë, A. (2003): Dental caries in postwar Bosnia and Herzegovina. *Community Dental and Oral Epidemiology* **31**, 100-104.
- Marthaler, T.M., O'Mullane, D.M. and Vrbic, V. (1996): The prevalence of dental caries in Europe 1990-1995. *Caries Research* **30** (4), 237-255

- Marthaler, T.M. (2002): Dentistry between pathology and cosmetics. *Community Dental and Oral Epidemiology* **30**, 3-15.
- Marthaler, T.M. (2004): Changes in dental caries 1953-2003. *Caries Research* **38**, 173-181.
- Miotti, F., Ferro, R., Pilati, G. and Grassi, L. (1985): Mappa fluorimetrica delle acque potabili del territorio dell'ULSS 19 Mediobrenta. *Giornale di Stomatologia ed Ortognatodonzia* **3**, 72-77.
- Miotti, F. and Ferro, R. (1987): Valutazione dello stato dento-parodontale e utilizzazione del CPITN in una popolazione dai 3 ai 12 anni. *Mondo Odontostomatologico* **5**, 29-35.
- Petersen, P.E. (2003): The world oral health 2003: continuous improvement of oral health in the 21st century - the approach of the WHO Global Oral Health Programme. *Community Dental and Oral Epidemiology* **31** (suppl. 1), 3-24.
- Petersson, G.H. and Bratthall, D. (1996): The caries decline: a review of reviews. *European Journal of Oral Sciences* **104**, 436-443.
- Petti, S., Cairella, G. and Tarsitani, G. (2000): Rampant early childhood dental decay: an example from Italy. *Journal of Public Health Dentistry* **60** (3), 159-66.
- Pieper, K. and Schulte, A.G. (2004): The decline in dental caries among 12-year-old children in Germany between 1994 and 2000. *Community Dental Health* **21**, 199-206.
- Pitts, N.B., Evans, D.J., and Pine, C.M. (1997): British Association for the study of Community Dentistry (BASCD) diagnostic criteria for caries prevalence surveys-1996/1997.. *Community Dental Health* **14**(supplement),6-9.
- Pitts, N.B., Evans, D.J., Nugent, Z.J. and Pine, C.M. (2002): The dental caries experience of 12-year-old children in England and Wales. Surveys coordinated by the British association for the study of community dentistry in 2000/2001. *Community Dental Health* **19**, 46-53.
- Poulsen S. and Malling Pedersen M. (2002): Dental caries in Danish children: 1988-2001. *European Journal of Paediatric Dentistry* **4**,195-198.
- Rugg-Gunn, A. (2001): Founders' and Benefactors' lecture 2001. Preventing and preventable: the enigma of dental caries. *British Dental Journal* **191** (9), 478-482, 485-488.