

Caries prevalence in Belgian children: a review

by

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Abstract and keywords

A review of epidemiological surveys on dental caries prevalence, published between 1980 and 2006 in Belgian children, was compiled through a literature search. The number of studies performed in Belgium to date still remains limited, although in recent years more data on caries prevalence have been published. Methodological differences and confounding factors, especially socio-demographic influences, limit national comparisons of caries prevalence data.

Although exact comparisons are difficult, data suggest a decline in caries prevalence in 5-, 7- and 12-year-old Belgian schoolchildren in the last 26 years. In the primary dentition mean dmft¹ values have decreased from 2.66 (1981) to 1.38 (1994) in 5-year-olds and from 4.1 (1983) to 2.24 (1996) in 7-year-olds. A recent 2003 study (1) showed a dmft of 0.83 amongst 2-3 year olds, 50% being cariesfree. In 12-year-olds DMFT

¹ dmft is an index that is used internationally to measure the decayed (d), missing (m) and filled (f) teeth (t) in the deciduous dentition, whereas DMFT is used in the permanent dentition.

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values in the permanent dentition have decreased from 3.9 (1983) to 0.92 (2001). WHO goals for the year 2010 appear to have been almost reached in Flanders, with a recent estimate of 0.92 for DMFT in 12-year-olds and 56% of children being recorded as cariesfree at the age of 5. Continuing efforts are needed to screen the oral health of different age groups but standardised criteria and sampling procedures should be used if benefits are to be gained from national and international comparison. Data are often limited to small selected areas and information representing the entire community of Flanders or Wallonia would be of particular value.

Keywords: *caries prevalence, children, Belgium*

Introduction

During the past three decades many epidemiological studies and reports have demonstrated a dramatic decline in the prevalence of dental caries in children in countries of the Western world (2,3,4,5,6,7,8). WHO goals set for the year 2010 of a maximum mean DMFT² score below 1.0 for 12-year-olds and a target of 90% of children cariesfree at the age of 5, have already been reached in many of these countries. The decline allows a focus on new challenges in dental public health, although disease prevention and health promotion will remain paramount. One of the challenges lies in the fact that, notwithstanding the lower mean caries levels, the disease has become increasingly polarised, with a large amount of disease in a small group of children. About 10 to 15% of the children now experience 50% of all caries lesions and 25 to 30% suffer 75% of lesions (3,4,5). This inequality in oral health seems to be related to socio-economic environmental factors and was found already early in childhood (1).

At the start of the third millennium AD, oral health promotion in children may have many major objectives. These include the further improvement of dental health through adequate fluoride-based programmes, dietary and oral hygiene counselling, the refinement of diagnosis, and early identification of groups at a particular risk of developing caries. For this reason epidemiological surveys remain of primary importance, since the monitoring of oral health allows compilation of information on oral health over time and the identification of high-risk groups at different ages. Epidemiology is also essential in the assess-

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ment of treatment need and in planning care, and in the further development of preventive and curative strategies, the determination of the cost-effectiveness of care and the evaluation and adjustment of treatment methodologies.

The aim of this report is to review studies of caries prevalence in Belgian children reported since 1980 in order to consider changes in disease prevalence and to compare the most recent estimates with established WHO goals for oral health in children by the year 2010.

Material and Methods

Epidemiological studies on caries prevalence in Belgian children, published since 1980, were compiled through a systematically approached search of published literature. The search and selection procedures were based on guidelines adopted from Cochrane (9,10) and were carried out in a series of stages:

1. A www browse. This elicited web-based information provided by governmental authorities, academic centres and dental associations.
2. A literature search on MedHunt and Medline databases. The Medline database was searched using WinSpirs and PubMed. This search used a keyword filter including caries, children and Belgium. The period covered was 1980-2006.
3. Personal contact and hand-searching were used to identify unpublished reports, reports in local journals, non-English-language articles, PhD theses, and abstracts published in abstract books of National and International Conferences.

The following information was considered as essential for articles to be included in the review: information on sampling, study design, diagnostic criteria for measuring caries prevalence and calibration procedure. Next, the assessment of studies to be included was carried out using the guidelines of the British Association for Study of Community Dentistry (BASCD) (11,12). The different caries studies were evaluated with respect to methodologies used and the availability of dmft/DMFT data in specific age groups. In the case of intervention cohort studies, only base line data or, if available, data for control groups were used. Data for children with special needs were excluded. If available, reviews were included. Finally, to determine trends in the prevalence of dental caries in Belgium and to allow comparisons with other countries, results were chronologically confined to different age groups.

Evaluation of the data

Studies selected based on the initial inclusion criteria of this review are summarised in Table 1 (Truin et al. (6); Staelens (16); De Vis (17); Kohl and Buttner (19); Kohl (20); Vanobbergen (18); Van Nieuwenhuysen (21); Van Nieuwenhuysen et al. (22); Declerck and Goffin (24); Marks et al. (13); Bolin et al. (14); Bolin (15); Vanobbergen et al. (27); Declerck et al. (28); Declerck et al. (29); Vanobbergen et al. (30); Carvalho et al. (25); Van Nieuwenhuysen et al. (23); Carvalho et al. (31); Vanobbergen J. et al. (32); Willems et al. (1); Observatoire de la Santé du Hainaut (33)). Most were confined to particular age groups and were limited to local samples. One study was part of a Europe-based screening in which the national sample was not particularly representative, neither in size nor geographical spread (13-15), one study reported baseline and final results of a longitudinal study on a representative sample for Flanders (27-30), and one study was an overview (6).

The report made by Staelens (16) was the result of school examinations performed between 1969 and 1973, and was carried out without standardised criteria for caries diagnosis. A large number of dentist-examiners participated in this project without receiving any particular training programme, nor were any calibration procedures undertaken to reach an agreement or an acceptable level of reliability. The sample was restricted to a single province (East-Flanders) and selection was made without recourse to existing well-defined criteria for stratification and sampling. The results were also difficult to interpret since caries prevalence, expressed in terms of percentage of cariesfree children or dmf averages, was reported irrespective of age group. Study results are therefore difficult to compare with those of other reports. In contrast, in the study reported by De Vis (17) standardised and widely accepted criteria were used for diagnosing caries. Particular attention was paid to the intra-examiner reliability. However, although the level of agreement reached was high, the methodology differs from those used by other authors. The sample (n=504) was selected in only one city and thus not representative of the whole country. As in the study of Staelens, there was no clear evidence of stratification and sampling and no information about caries prevalence or dmf average for specific age groups was reported.

The aim of the study by Vanobbergen et al. (18) was to evaluate the effect of a 7-year preventive primary school programme, based on four strategies: motivation and oral health counselling, daily tooth brushing, weekly fluoride rinsing (0.2% NaF) on school premises and clinical exam-

ination three times a year. In this study standardised and widely accepted criteria were employed to determine caries prevalence although the sample ($n=300$) was limited and restricted to the rural city of Deinze. Ten dentist-examiners participated in this project. One weakness of the study was the lack of attention paid to training and calibration during the investigation. Inter- and intra-examiner reliability measures were determined only at baseline. However, the baseline results and the findings for age-matched control groups may be used for comparison with other studies.

Kohl (19,20) reported data on caries prevalence, registered using well-defined, standardised criteria. The sample was again limited, being confined to the cities of Liège and Flémalle. No criteria for stratification or sampling were reported and the report did not mention any specific training or calibration programme. Percentages of cariesfree children as well as dmf averages are reported for specific age groups.

In the study of Van Nieuwenhuysen et al. (21,22) a large number of children was examined between October 1983 and May 1986. Sampling procedures were not according to defined criteria and the study was restricted to the areas of Brussels and Mouscron. Data were collected using standardised and widely accepted criteria, inter- and intra-reproducibility were recorded and high kappa values reported. This study has been continued with a smaller sample of 12-year-olds, located in Brussels, employing the same examination conditions (23). Results could not be used for comparisons as the reported dmft/DMFT average included enamel lesions whereas other studies have more often been confined to caries involving dentine.

Declerck et al. (24) included 3534 5-year-old and 4162 12-year-old children in their study, representing 5% of the target population. The sample was selected at random in the five Dutch-speaking provinces of Belgium. Data on caries prevalence and gingival condition were recorded using standardised and widely accepted criteria. A training and calibration programme preceded the study, but was not described in the final report and no data were made available on reproducibility of diagnosis and clinical examination.

Within the 'Children's dental health in Europe' surveys (13,14) particular attention was paid to the training and calibration of the examiners who were spread over all the participating countries. Detailed data on calibration exercises and recalibration have been published (15). All data were collected using standardised and/or well-studied criteria. A weakness of this study was the fact that the samples in the different

TABLE 1.
Caries prevalence surveys in Belgian children
(publication period: 1980-2004)

<i>Reference</i>	<i>Year of investigation</i>	<i>Topic</i>	<i>Sample size / location</i>	<i>Age category (years)</i>	<i>Reported sampling criteria</i>	<i>Study design</i>	<i>Standardised methods</i>	<i>Reported calibration</i>	<i>Remarks</i>
Staelens A. 1982	1969-1973	Caries	5600 / East-Flanders	6-12	None	Longitudinal	None	None	
De Vis H. 1988	1980	Caries, occlusal and functional conditions	504 / East-Flanders	3-6	At random stratified	Cross-sectional	Yes	Intra-examiner reliability tests	
Kohl J et al. 1984	1983	Caries, plaque	109 / Liège 113 / Liège	7 12	None	Cross-sectional	Yes	None	
Kohl J	1983	Caries	- / Flémalle	5	None	Cross-sectional	Yes	None	
Vanobbergen J. 1989	1981-1988	Caries, gingival condition	300 / Deinze	6-12	Total municipal population	Prospective cohort	Yes	Inter-examiner reliability at baseline	Evaluation of a dental preventive primary school programme
Van Nieuwenhuysen JP et al. 1992	1983-1989	Caries, fluorosis	3237 / Brussels-Moeskroen	5-21	None	Cross-sectional	Yes	Intra-examiner reliability tests	
Declerck D et al. 1992	1989-1991	Caries, gingival condition, oral health habits	534 / Flanders 4162 / Flanders	5 12	At random	Cross-sectional	Yes	Inter-examiner reliability tests m	
Truin GJ et al. 1994	1983-1991	Caries	-	5-7 11-13	Yes	Review	Yes-		
Bolin AK et al. 1996	1994	Caries	200 / Ghent 200 / Ghent	5 12	At random	Cross-sectional	Yes	Intra- and inter-examiner reliability tests	Inter-European collaborative survey
Carvalho JC et al. 1998	1995	Oral hygiene, gingival condition, caries, dental anomalies, fluorosis, malocclusion, traumata,	750 / Leuven	3-5	None	Cross-sectional	Yes	Intra-examiner reliability tests	
Vanobbergen J et al. 1998	1996	Oral hygiene, gingival condition, caries, dental anomalies, fluorosis, traumata,	4351 / Flanders	7	Stratified cluster sampling	Prospective cohort	Yes	Intra- and inter-examiner reliability tests	Baseline results
Van Nieuwenhuysen et al. JP. 1999	1998	Caries	496 / Brussels	12	None	Cross-sectional	Yes	Intra- and inter-examiner reliability tests	
Carvalho JC et al. 2004	1983-1998	Caries, socioeconomic factors	1983 : 396 1998 : 473 / Brussels	6	At random		Yes	Intra- and inter-examiner reliability tests	
Vanobbergen J et al. 2004	1996-2001	Caries, plaque, gingival condition, oral health habits, dental attendance, dental trauma, toothache	3291/ Flanders	7-12	Stratified cluster without replacement	Prospective cohort	Yes	Intra- and inter-examiner reliability tests	Signal-Tandmobiel® project
Willems et al. 2005	2003	Caries, oral hygiene, demographic and socioeconomic factors	384/ Flanders	2-3	None	Cross-sectional	Yes	Intra- and inter-examiner reliability tests	
Observatoire de la Santé du Hainaut	2005-2006	Health habits, oral health habits, oral hygiene, caries, orthodontic indices	1180/Hainaut	10-12 13-14 15-18	None	Cross-sectional	Yes	None	

countries were small and not representative of the whole country. This was however inherent to the design of the project.

The study of Carvalho et al. (25) was confined to the municipality of Leuven. No sampling procedure was described in the report. Clinical examination using standardised criteria was carried out by one examiner and duplicate recordings were made on 10% of the sample. Non-cavitated early active lesions were included in the dmf scores in order to assess the need of non-interventional treatment procedures. Because of the differences in criteria, this study again could not be used for a comparison. A recent report included both cavitated and non-cavitated lesions (26).

Shortcomings in previous studies and the need for broader-based and standardised information provided one factor prompting the setup of the longitudinal Signal Tandmobiel® project in 1996 (27,28,29,30). The most important objective of this project was to screen the oral health condition of primary schoolchildren in Flanders between ages of 7 and 12, both cross-sectionally and longitudinally. A stratified cluster sample of 5000 schoolchildren born in 1989 was followed for a period of 6 years (1996-2001). Examinations were carried out in a mobile dental clinic by a team of trained dentists and auxiliary personnel. Standardised criteria were used. The examiners are calibrated at baseline and at regular intervals during the project. The partners in this project were: the dental departments of the Catholic University of Leuven, University of Ghent and Free University of Brussels, the Youth Health Department of the Catholic University of Leuven, the Biostatistical Centre for Clinical Trials of the Catholic University of Leuven, the Working Group for Oral Health Care of the Flemish Dental Association and the Flemish Association for Youth Health Care. The project was financed by an industrial partner: LeverElida (Unilever). Baseline results on 7-year-olds based on an effective sample size of 4351 children are currently available and have been included as relevant to the objectives of this paper.

Carvalho et al. (31) took a closer look at a probable dental caries decline in Belgian 6-year-olds by means of a cross-sectional study on 1st grade schoolchildren. Two samples were randomly drawn, one in 1983 (n=533) and one in 1998 (n=496) in connection with Brussels children's compulsory regular medical checkup. Caries and socio-economic factors were recorded using standardised criteria. The examinations were performed under standardised conditions in the same room equipped with dental chair and dental lamp. One examiner examined cohort 1983; the intra-examiner reliability showed a kappa of 0.92. Two examiners carried out the examinations in cohort 1998; the reported

inter- and intra-examiner reliability scores were high (kappa 0.93 / 0.94-0.96). Reported dmft scores comprised enamel lesions and in 1998 non-cavitated active lesions were included.

A 6 year study by Vanobbergen et al. (32) investigated the effect of an oral health education programme in primary schoolchildren. This programme was part of the Signal Tandmobiel® project, a both cross-sectional and longitudinal collaborative project combining the registration of oral health data and oral health promotion. The intervention group comprised 3291 children with a mean age of 7.1 years (SD 0.43). Every year these children were examined clinically using a mobile dental clinic. The samples were drawn using a technique of stratified cluster without replacement. Sixteen dentists were selected from a larger group of candidate-examiners and these were calibrated to the agreed criteria. The obtained level of agreement between the examiners and the benchmark examiner over the different years remained good to excellent. The dental examinations were conducted following standardised and widely accepted criteria as recommended by the WHO report on oral health surveys. Decay was recorded at the level of cavitation. Data collected from a clinical examination in 676 12-year old children were included as control group.

The relationship between early childhood caries and socioeconomic status was explored in the 2005 study of Willems et al. (1). In this cross-sectional study 384 young inner-city children (24-35 months old) were examined by 2 trained clinicians experienced in pediatric dentistry. The clinicians were trained and calibrated on the survey diagnostic criteria. Calibration for the diagnosis of caries was carried out prior to the survey. Standardised criteria were used for the dental examinations. These examinations were carried out during the free preventive consultations offered by Child & Family (C&F), a Flemish public agency whose purpose is to monitor and to promote the welfare and health of all children from their birth up to the age of 3 years. All children aged between 24 and 35 months, attending the final consultation at 1 of the 12 baby clinics of C&F were included in the study.

The study of the Observatoire de la Santé du Hainaut (33) outlines several contributing factors of possible oral health problems, the most frequent being caries, amongst primary and secondary schoolchildren of the province of Hainaut (Wallonia). Partners in this project were: Observatoire de la Santé du Hainaut, the School Health Centres and the Oral Health Foundation. During this study 1180 children and youngsters between the ages of 12 and 18 from private schools, public schools and

municipal schools were examined in the school health centre. This was done during the compulsory regular medical checkup. The sample is reported to be representative for the children in the province of Hainaut. A possible weakness in this study was the fact that the clinical oral examination had to be integrated in the overall medical checkup and thus on average only 10 minutes per pupil could be spent. No data were reported on training and calibration of examiners. A mobile dental chair was used together with a frontal LED light (23,000 lux) for illumination of the oral cavity.

Discussion

Table 2 summarises information from studies remaining after the final selection according to the criteria described above in the materials and methods.

It is apparent that the number of studies performed in Belgium in the last 26 years is limited and information is not representative of the country as a whole. Methodological difference and confounding factors, especially socio-demographic influences, limit national comparisons of caries prevalence data. In consequence, only an approximation can be made of trends between 1980 and 2006 in Belgium. The dmft/DMFT values among 5-year-olds, 7-year- and 12-year-olds, obtained in relatively comparable data sets (table 2), suggest a decrease in caries prevalence in these age groups during the period 1981-2001. As Belgium is a federal state with separate authorities for health promotion and disease prevention, epidemiological research is increasingly conducted separately in two communities (Flanders and Wallonia). In Flanders, the northern part of Belgium, the data set (24,30) suggests that some of the WHO criteria for the year 2010 have been attained. According to these criteria children in Flanders belong to the moderate, or even low, caries experience category. 56% to 59% of 5-year-old Flemish children are caries-free and 12-year-old children have an average DMFT of 1 (control group). Results of the Signal Tandmobiel® project confirm the skewed distribution and polarisation of caries prevalence in Belgian children as seen in other European studies. Recent estimates suggest that amongst 7-year-olds in Flanders 44% of children are caries-free and 50% of caries lesions are confined to 15.2 % of the children (27,28,29,30).

Conclusion

Despite a lack of sufficient available comparable data, the selected surveys reviewed in this report suggest a decline in caries prevalence in 5-, 7- and 12-year-old Belgian children. Results show that at least for

TABLE 2.
Final selection of comparable epidemiological caries surveys in Belgium
published between 1980 and 2006

<i>Reference</i>	<i>Municipality</i>	<i>Year (investig.)</i>	<i>Children (n)</i>	<i>dmft</i>	<i>% caries- free</i>	<i>DMFT</i>	<i>% caries- free</i>
2-3 years old							
Willems et al.	Flanders	2003	384	0.83	50%		
5 years old							
Vanobbergen	Deinze	1981	300	2.66	32%		
Kohl	Flémalle	1983	-		43%		
Declerck et al.	Flanders	1989-1991	3534	1.65	59%		
Bolin et al.	Ghent	1994	200	1.38	56%		
6 years old							
Carvalho et al.	Brussels	1998	473	2.39	47.50%		
7 years old							
Kohl & Buttner	Liège	1983	109	4.1	26		
Vanobbergen, Declerck et al.	Flanders	1996	4351	2.24	44%	0.16	89.7%
10-12 years old							
Observatoire de la Santé du Hainaut	Wallonia	2005-2006	1180	2.61	40%		
12 years old							
Carvalho et al.	Brussels	1983	583			7.5	4%
Kohl & Buttner	Liège	1983	113			3.9	12%
Vanobbergen	Deinze	1986	300 (control)			3.24	17%
Declerck et al.	Flanders	1998-1991	4162			2.72	25%
Bolin et al.	Ghent	1994	200			1.93	37.5%
Carvalho et al.	Brussels	1998	496			1.6	50%
Vanobbergen et al.	Flanders	2004	676 (control)			1	58.7%
13-14 years old							
Observatoire de la Santé du Hainaut	Wallonia	2005-2006	1180			3.66	38%
15-18 years old							
Observatoire de la Santé du Hainaut	Wallonia	2005-2006	1180			4.88	28%

Flanders the WHO goals for the year 2010 have partially been reached. Results of the Signal Tandmobiel® project confirm that there has been a polarisation of disease, with a significant amount of caries being confined to a small group of children. There remains a need for continuing efforts to screen the oral health status of different age groups and to

identify high risk groups. If this is to be used to best effect, collection and presentation of data should be standardised and studies carried out according to well defined and recognised criteria.

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