

Forty years of national surveys: An overview of children's dental health from 1973–2013

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VERIFIABLE CPD PAPER

IN BRIEF

- Reviews the main results of the 2013 Children's Dental Health (CDH) Survey.
- Outlines trends in dental disease in children over a 40-year period.
- Illustrates the decline in caries in primary and permanent teeth.
- Predicts the relevance of the number of sound teeth in 15-year-olds affecting adult dental health.
- Summarises attitudinal and behavioural characteristics.

GENERAL

Introduction The first national survey of children's dental health in England and Wales was carried out in 1973. Subsequent surveys, in 1983, 1993 and 2003, included all United Kingdom health departments. The 2013 survey involved England, Wales and Northern Ireland. **Aim** To consider all five surveys, from 1973 to 2013, so as to summarise trends in the dental health of children in the UK over the last 40 years. **Materials and method** The 2013 survey was commissioned by the Health & Social Care Information Centre and all surveys used data collected during dental examinations conducted in schools on a random sample of children by NHS dentists, together with a questionnaire to parents of those children. In 2013, a pupil questionnaire for 12- and 15-year-olds was introduced, to complement information received from parents and carers. **Results** A total of 69,318 children, aged 5–15 years, were involved, from 1973–2013. Caries prevalence has reduced from 72% to 41% in 5-year-olds, and from 97% to 46% in 15-year-olds in 40 years. Changes in periodontal disease, orthodontic treatment, accidental damage to anterior teeth, tooth surface loss and enamel defects, are also summarised. Behavioural and attitudinal characteristics observed in the 2013 report are listed. **Conclusions** Caries is now concentrated in a minority of children. The prevalence of gingivitis has not changed a great deal in 40 years. About half of those children assessed 'in orthodontic need' receive treatment.

INTRODUCTION

The first national survey of children's dental health in England and Wales was carried out in 1973.¹ Subsequent surveys, in 1983,² 1993³ and 2003⁴ involved all four United Kingdom Health Departments. In 2013, Scotland declined to take part.^{5–9} This complicates the reporting somewhat when comparing surveys, but the impact of the absence of Scottish data from the overall figures for the rest of the UK is expected to be small, so in this article we have tended to compare the 2013 figures with the UK overall. The aim of this review is to consider all five surveys, from 1973 to 2013, so as to summarise trends in the dental health of children in the UK over the last forty years. There are now four health systems in the UK and country-specific reports relating to England, Wales and Northern Ireland from the 2013 Children's Dental Health (CDH) survey

have been published separately by the Health and Social Care Information Centre (HSCIC). A total of 13,628 children were sampled in participating schools in 2013, and 9,866 dental examinations were completed.

The ethics requirement for positive parental consent from 5- and 8-year-olds affected the response rate in these age groups. Various weighting adjustments have been undertaken but nevertheless some caution should be exercised when interpreting longer term trends in younger children. For older children the consent requirements were different in that negative consent from parents in advance and positive consent on the day, meant that the response rate was much higher and we can have high levels of confidence when interpreting trends.

DENTAL CARIES

The findings in 1973 gave cause for concern. The mean dmft of 5-year-olds was 4.0. By the age of 8 years, 85% had known decay experience in primary teeth and 65% already had decay in permanent teeth. The mean DMFT of 15-year-olds was 8.4; 97% had experienced decay in their permanent teeth. The oral health of British children was, on the whole, very poor. Subsequent surveys have noted a consistent downward trend in

caries experience. Results for 2013 showed that 31% of 5-year-olds had obvious caries experience, with a mean dmft of 0.9. By the age of 8 years, 46% had caries experience in primary teeth, the mean dmft was 1.4. For 15-year-olds, the mean DMFT was 1.4, and 46% had experienced caries. This important reduction in caries in children, observed in many countries over the last 40 years, indicates that caries is not inevitable, as it may have seemed in 1973, but is an avoidable or preventable disease.

Since 1993 it has become clear that decay into the dentine in 5-year-olds is increasingly concentrated in a minority of the population. In 2013, 31% of 5-year-olds had caries but the mean dft in those 5-year-olds with the disease was 3.0, which represents a considerable burden on these affected children (Table 1, Fig. 1).

The data on caries described here need to be seen in the context of changes in diagnostic criteria. The diagnosis of caries has evolved according to the thinking current at the time of the survey. In 1973 the difficulty of variation in diagnosis when using a 'sharp' probe in a 'sticky' fissure, leading to possible over diagnosis, resulted in a 'blunt' probe (0.4 mm in diameter) being used and the threshold for diagnosis of caries was a cavitated lesion. In 2003, a more refined set of criteria involving

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Refereed Paper

Accepted 13 August 2015

DOI: 10.1038/sj.bdj.2015.723

©British Dental Journal 2015; 219: 281–285

visual examination, was employed allowing the detection of caries at an earlier 'visual' stage, when a lesion can be seen through the enamel. This led to a more complete assessment and consequently to an increase in the lesions counted. In 2013 enamel caries was also recorded, giving a more complete picture than ever before. For the sake of comparison with previous surveys, Figures 1 and 2 do not include enamel caries.

Nevertheless, in all the surveys, the majority of the DMFT index was (and still is) the F component, reflecting the cumulative diagnoses made by many thousands of dentists making their own decisions about the presence of caries in their child patients. Such decisions have also doubtless changed with time, teaching and technology. The restorative index (F/DMF \times 100) varied between 68–83% in 15-year-olds between 1973 and 2003. In 2013, the corresponding figures were 57% for 15-year-olds and 11% for 5-year-olds. In terms of untreated decay in 2013, 28% of 5-year-olds had untreated decay; only 8% had fillings in otherwise sound teeth. Approximately 21% of the decay experience in dentine in 15-year-olds was untreated caries.

The addition of enamel caries added an extra dimension in 2013 and allowed an indication of the extent of caries activity that extended beyond children with lesions into dentine. In both 5- and 15-year-olds the addition of enamel caries meant that there was an increase in the proportion of children with signs of caries activity; a 16 percentage point increase in 5-year-olds and a 27 percentage point increase in 15-year-olds. This took the proportion with diagnosable lesions up to around 50% overall in both age groups. As enamel lesions are reversible and a marker of risk these data are an indication of further preventive opportunity.

The 2013 survey reported that 42% of 15-year-olds had obvious decay experience. The downward trend in dentine caries in permanent teeth was most obvious between 1973 and 1983 but the rate of decline has continued but slowed between 2003 and 2013. The mean dft/DMFT figures are now substantially affected by the large number of children with no obvious decay experience so mean dft/DMFT data should now be viewed alongside the proportion of children with no caries experience. The burden of decay in those children with decay experience, for 15-year-old children, is down from a very high DMFT of 8.7 per affected child in 1973. Improvements have been seen at every survey, although the rate of decline slowed between 2003 (3.4) and 2013 (3.0) (Table 2, Fig. 2).

The use of fissure sealants as a caries preventive measure was assessed for the first time in the 1983 CDH survey, when 2% of

Table 1 Caries experience (obvious decay into dentine i.e. cavitated) in 5-year-old children in England and Wales (1973), UK (1983, 1993 and 2003) and England, Wales and Northern Ireland (2013)

	1973	1983	1993	2003	2013
Percent with decay	72	52	46	43	26
Mean dft	4.0	1.8	1.7	1.6	0.7
Mean dft in children with caries (dft>0)	5.5	3.5	3.7	3.5	2.8

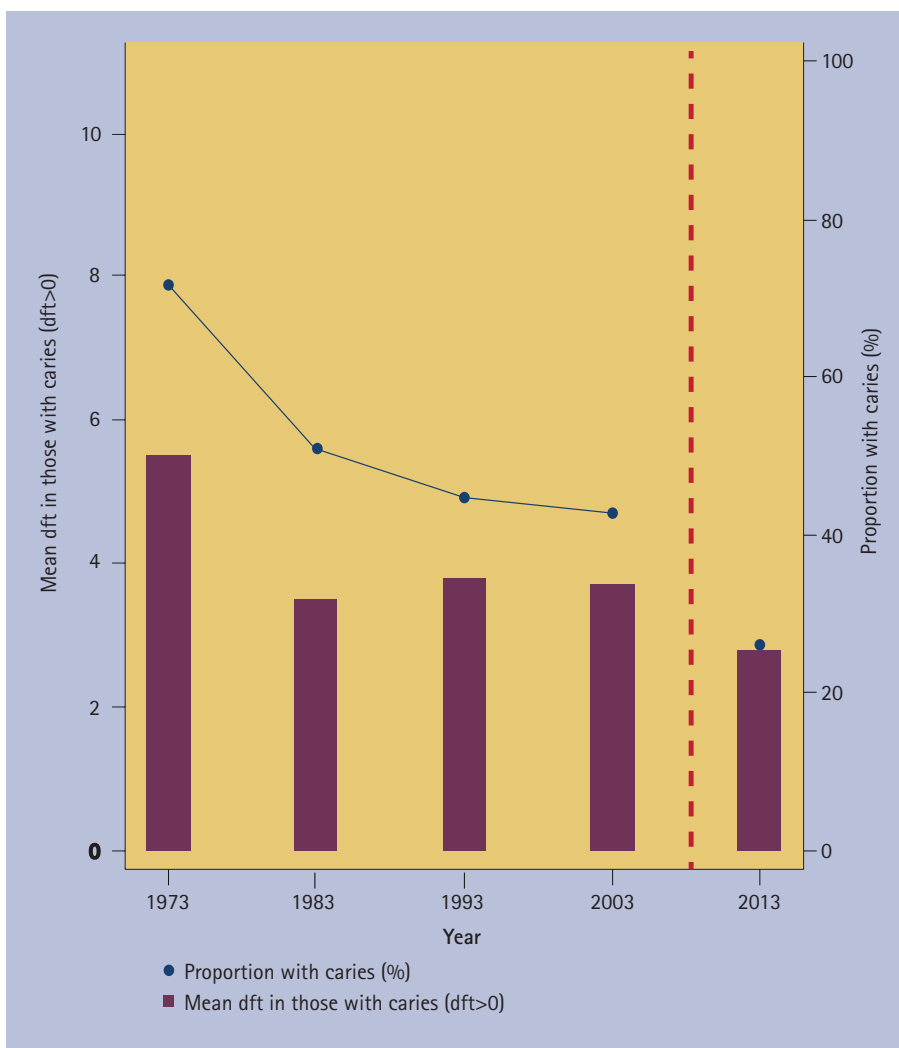


Fig. 1 Caries experience (obvious decay into dentine i.e. cavitated) in 5-year-old children: National Surveys 1973–2013. The red dashed vertical line highlights constraints in trend analysis due partly to changes in geographic survey coverage and consent methodology

15-year-olds had sealants on permanent teeth. The 1993 survey reported that the presence of sealants on 15-year-old children had increased to 36%. The proportion fell slightly to 30% in 2003. In 2013, differences were observed among the countries involved; sealants were recorded in 22% of 15-year-olds in England, 28% in Wales and 34% in Northern Ireland.

PROVISION OF GENERAL ANAESTHESIA AND SEDATION

In 1973, 33% of 15-year-old children had experienced one or more permanent teeth

extracted for decay. Forty years later, only 6% had experience of permanent teeth extracted due to decay. Mothers were asked if their child had 'gas' at the dental surgery in 1973 and 1983. Nineteen percent of 5-year-olds and 58% of 15-year-olds had received 'gas' for dental treatment in 1973. Later the question was changed to 'general anaesthetic'. Forty years on, the comparable figures for general anaesthesia had fallen to 3% for 5-year-olds and 10% for 15-year-olds (in addition, 24% of 15-year-olds said they had sedation before treatment). Response issues to the questionnaire for 5-year-olds mean we

Table 2 Caries experience (obvious decay into dentine i.e. cavitated) in 15-year-old children in England and Wales (1973), UK (1983, 1993 and 2003) and England, Wales and Northern Ireland (2013)

	1973	1983	1993	2003	2013
Percent with decay	97	93	63	49	42
Mean DMFT	8.4	5.9	2.5	1.6	1.2
Mean DMFT in children with caries (DMFT>0)	8.7	6.3	4.0	3.2	2.9

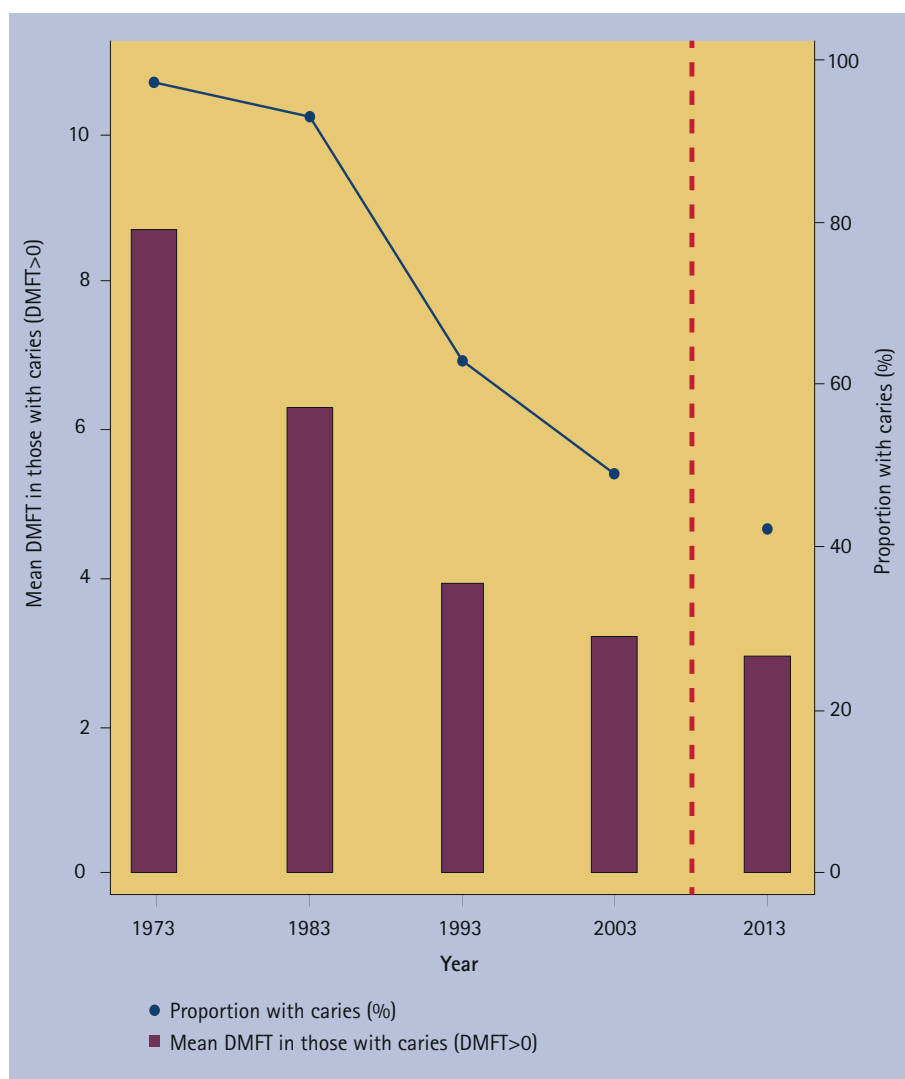


Fig. 2 Caries experience (obvious decay into dentine i.e. cavitated) in 15-year-old children: National Surveys 1973–2013. The red dashed vertical line highlights constraints in trend analysis due partly to changes in geographic survey coverage and consent methodology

should be a little cautious about this figure and in this most recent survey the 15-year-olds answered the question themselves so this may not be an exact comparison, but the reduction is clear over this long timescale. General anaesthetics (GAs) are now provided in a hospital setting and are very much safer, but also much more expensive. Ten percent is still unacceptably high both in terms of the experience of the child and the costs, but the changes in the child's experiences since 1973 are enormous. The 2013 survey suggested differences among the countries

in the provision of GAs. For the 15-year-olds, the figure was 10% in England and 21% in Wales.

NUMBER OF SOUND TEETH AS A PREDICTOR OF ADULT DENTAL HEALTH NEEDS

Over the years, attention has focused on the number of teeth required to maintain a 'functional dentition' in adulthood; (adopted by the WHO in 1982 as 21 or more standing natural teeth¹⁰). As the foundations of adult dental health are laid down in childhood,

the number of standing teeth, particularly sound untreated teeth, is an important characteristic to be considered, because it is a predictor of restorative need in the future.¹¹ The 2013 CDH survey found that 15-year-old children had, on average, 26.6 standing sound teeth. The 15-year-old children in 2013 will be 20 years of age in 2018, fifty years after the first adult dental health survey in 1968.¹² This compares with 16.3 sound teeth in 16–24-year-olds 50 years ago. Today's children have a real opportunity to keep most of their teeth for life (Fig. 3) if they can continue to minimise the risk of dental caries and manage the risk of periodontal diseases as they age.

PERIODONTAL DISEASE IN CHILDREN

The measurement of conditions related to periodontal disease has developed over the years but is always a little difficult to interpret for children. In 1973 'debris' was measured rather than plaque. The percentage of children with plaque or 'debris' (50–60% in 15-year-olds), calculus (32–39%) and gingivitis (48–52%) hardly changed between 1973 and 2003. The corresponding figures for 15-year-olds in 2013 were broadly similar: 50% (plaque), 46% (calculus) and 50% (gum inflammation). In 1983 and 1993 a WHO pattern periodontal probe was used in 15-year-old children only, and found that the prevalence of periodontal pocketing was 9–10%. In 2013, a modified basic periodontal examination (BPE) assessment to identify pocketing was undertaken. A small number of 15-year-olds (4%) had shallow pockets (greater than 3.5 mm but less than 5 mm) but given the recent eruption of many teeth, some of these may have been false pockets rather than loss of attachment.

In both 5-year-old and 15-year-old children, the proportion reportedly brushing twice a day has increased from 55–65% in 1973 to 81% in 2013. The increase in activity is welcome but there is still much work to be done before oral health education to children is translated into obviously improved plaque control and periodontal health.

ORTHODONTIC CONDITION OF CHILDREN

Different methods have been used to assess the orthodontic condition of children over the last 40 years. Estimating the total need for orthodontic treatment from national surveys has been difficult. Furthermore, there is considerable variation between professional and lay perceptions of need. It is not possible to provide perfect comparisons, but if the proportions of children who have either had an appliance in the past or were under treatment at the time of the survey are

added together, then 30% of 15-year-olds in 1993 and 32% in 2003 had received orthodontic treatment. The 2013 survey reported that 36% of 15-year-olds had 'a brace fitted or adjusted'.

The use of fixed appliances has increased markedly since 1993. In 1973 only removable appliances were worn at the time of the survey; by 2003, 83% of orthodontic treatment in 12–15-year-old children involved fixed appliances. Rather surprisingly, the proportion of 15-year-olds who have had permanent teeth extracted for orthodontic reasons hardly changed at all between 1973 (21%) and 2003 (22%). The corresponding figure for 2013 has not yet been reported although with 21% of 15-year-olds having had a permanent tooth extracted and 6% having had a tooth extracted for caries; it is likely that at the very least 15% have had a tooth extracted for orthodontic reasons. This does suggest a slight reduction in recent years though. Nevertheless, results for 2003 and 2013 suggest that the biggest reason for extracting permanent teeth in children is not for advanced caries, but for orthodontic treatment.

In the 2003 survey, a calculation was made that the overall treatment need was 43% at 15 years of age.¹³ As 21% of 15-year-olds were regarded as still in need of orthodontic treatment, as assessed by a modified IOTN (Index of Orthodontic Treatment Need), the authors concluded that about half the treatment need was being met. The 2013 survey found an almost identical figure (20%) but that there was a marked difference between those who were eligible for free school meals (lower income families, 32%), and those children not eligible for free school meals (17%).⁸ Given these differences, there are policy implications concerning the most appropriate way of delivering orthodontic care to those in need in the UK. The interaction between child, parent and professional is a complex but important consideration.

ACCIDENTAL DAMAGE TO ANTERIOR TEETH

Accidental damage to anterior teeth has declined since 1983, both in boys and in girls. In 1983, 33% of boys and 19% of girls had damaged their anterior teeth. The results for 2003 reported that accidental damage occurred in 16% of boys and 10% of girls. In 2013, 11% of boys and 8% of girls had damaged anterior teeth. Possible reasons for this include the widespread use of mouth guards in contact sport, better playground design and possibly a change in activity patterns of children.

The treatment of traumatised anterior teeth has developed enormously over the

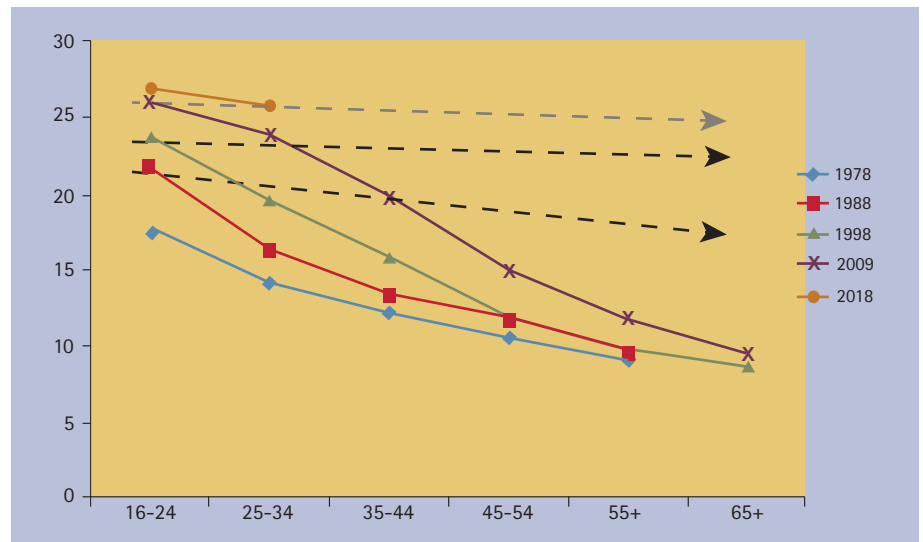


Fig. 3 Changes in number of sound teeth by age 1968–2018 (Projection based on number of sound teeth in 15-year-olds in 2013). For 1978–1998 the oldest age group is 55+ years. For 2009, the oldest age group is 65+ years. The arrows represent the approximate trajectory for the number of sound and untreated teeth, over a 50-year period after White *et al.*¹¹

last 40 years, prompted in particular by the work of Andreasen and colleagues.¹⁴ The unsightly metal and basket crowns of 40 years ago are now a thing of the past with the developments in adhesive restorative materials. The 2003 survey reported that, for 15-year-old children the rate of fracture of enamel and enamel plus dentine was 34.1 per 1,000 upper central incisors. Of these, 18.2 had received treatment in the form of an acid etch composite or permanent replacement. Ten years later, trauma to upper central incisors involving enamel only and enamel plus dentine had reduced to 31.3 with 9.6 per thousand being treated.

TOOTH SURFACE LOSS

The consumption of acidic drinks is widely considered to be a major factor in the development of erosion in children. The presence of erosion on the labial and palatal surfaces of upper incisors was included for the first time in 1993. An assessment of tooth surface loss (TSL) of first permanent molars was added to the examination in 2003. In 1993, 52% of 5-year-olds and 27% of 12-year-olds examined had TSL recorded. Ten years later it was reported that there had been an increase in the proportion of children with TSL in virtually every age group. The most obvious deterioration was among 15-year-olds where there had been a six point percentage rise in the prevalence of TSL palatally (33% in 2003 compared with 27% in 1993). By 2013, 44% of 15-year-olds showed evidence of tooth surface loss on the palatal surface of incisors and 31% had TSL on the occlusal surfaces of first permanent molars. TSL

involved mostly enamel only; only 4% of 15-year-olds had TSL involving dentine (or pulp) on the palatal surface of incisors or the occlusal surface of molars.

The danger of TSL to the child population is that the condition is irreversible and unless the causes are addressed it may continue into adulthood.¹⁵ Effective detection, prevention and early intervention are important if a lifetime of restorative procedures is to be avoided.¹⁶ The findings of the 2013 survey confirm these observations, and emphasise the importance of incorporating an assessment of TSL into every dental examination. Although the prevalence of very severe wear is quite low, the lifetime impact is potentially very serious.

THE PREVALENCE OF ENAMEL DEFECTS

Developmental defects of enamel were measured on the upper incisors, canines and first premolars of 12-year-olds. Just over one quarter (28%) of the examined children had one or more enamel defects. As in 2003, the most common defects were demarcated (19%) or diffuse opacities (15%); all of the defects were rare. Compared with 2003, the observed proportion of 12-year-olds presenting with any enamel defects was lower by seven percentage points.⁶

BEHAVIOUR, ATTITUDES AND ATTENDANCE PATTERNS

One of the strengths of the Children's Dental Health Survey is the range of behavioural and attitudinal information collected about the children taking part in the dental examination. A major innovation of the 2013 survey was the introduction of the pupil

Table 3 Some perceptions and behaviours: self-reported findings in 15 year old children (CDHS, 2013)

15 year olds who:	Per cent
Received information on oral health from:	
dentist, hygienist or dental nurse	91
family members	88
Rated their general health good/very good	88
Reported attendance at dentist for a check-up	82
Brushed teeth twice a day or more	81
Rated their dental health good/very good	74
Had any dental problems in last 3 months	66
Satisfied with appearance of teeth	60
Consumed sugary drinks 4 or more times a day	14
Were currently smoking	11
Self-rated dental anxiety: 'Extreme'	10
Consumed smoothies 4 or more times a day	4

questionnaire for 12- and 15-year-olds to complement the questionnaire sent to parents and carers of all age groups.⁵ The main findings for 15-year-olds are summarised in Table 3. Importantly, 91% of parents overall were satisfied with the last dental practice visited with their children. Eighty-three per cent of parents also reported that they had no difficulty in obtaining NHS dental services for their children (see Table 3).

Children's attendance patterns in 1973, 1983 and 1993 were assessed in three categories: 'regular'; 'occasional' and 'only when having trouble with teeth'. The 2013 survey combined 'regular check-up' and 'occasional check-up' into one category 'for a check-up'. Using this method for all five surveys, Table 4 shows that for both 5-year-olds and 15-year-olds, there has been an increase over time in the proportion of children reported as attending for a check-up (see Table 4).

The percentage of 5-year-olds in the UK who had visited the dentist by the age of two years increased from 7% in 1983 to 31% in 2003. There is little evidence of a change since 2003, with 30% of 5-year-olds first attending by two years of age in 2013.

CONCLUSIONS

Results from the 2013 Children's Dental Health Survey have been reviewed alongside

Table 4 Parent-reported pattern of child dental attendance 1973 to 2013. England and Wales (1973), U.K. (1983, 1993 and 2003) and England, Wales and Northern Ireland (2013)

		1973	1983	1993	2003 ⁱ	2013 ⁱⁱ
5 year olds	For a check-up	47	72	76	68	89
	Only when having trouble with teeth	53	28	24	32	5
15 year olds	For a check-up	67	78	78	78	92
	Only when having trouble with teeth	33	22	21	21	7

Notes: ⁱData taken from CDH Survey 2003 Summary Report. ⁱⁱData taken from CDH Survey 2013 Report 1. *Never been to the dentist' category excluded.

relevant findings from the previous four surveys spanning a 40-year period, giving a remarkable historical context. The prevalence of caries has reduced in both primary and permanent dentitions since 1973, but caries into dentine is now concentrated in a minority of the child population, where the burden is still considerable. The need to prevent enamel lesions progressing into dental caries is emphasised in the 2003 and 2013 surveys and data on enamel caries in 2013 indicates the scale of opportunity to do this. The periodontal and orthodontic conditions of children, together with information on accidental damage to teeth, have been considered in each of the surveys since 1973. Assessments of tooth surface loss and enamel defects, introduced in 1993, have been developed further in 2003 and 2013. Behavioural and attitudinal information about the children taking part in the dental surveys has been collected by means of a questionnaire to parents in every survey and provides a rich source of information, supplemented in 2013 with a pupil questionnaire to 12- and 15-year-old children.

Acknowledgements

The immense contribution of the Office for National Statistics to the development of dental epidemiology over 45 years in the UK is recognised and appreciated, and particularly Tom Anderson and his team for the 2013 survey. The huge contributions in thought and action from the dental and academic consortium members from the Universities of Birmingham and Cardiff, King's College London and University College London as well as Liz Fuller from NatCen have been pivotal to this paper. Professor Jimmy Steele at Newcastle University also contributed considerably to this paper. Grateful thanks go to the dentists and dental nurses who have carried out the examinations and acted as recorders for all the surveys. Thanks particularly go to the children who were examined and the parents who completed questionnaires about the children's dental background.

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