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Adult Oral Health Survey 2023:

1. Key trends in oral health among adults in England (1978 – 2023)

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Abstract

The Adult Oral Health Survey 2023 (AOHS 2023) is the latest nationally representative survey of adult oral health in England. The first of six articles in this BDJ focussed issue, this paper provides an overview of the survey methodology and reports major trends in adult oral health, comparing findings with data from previous surveys. The AOHS 2023 was a cross-sectional survey representative of the general adult population aged 16 years and older in England. Data were collected between June 2023 and April 2024. The survey included 2,285 adults, of whom 1,619 also participated in an oral examination.

Since the last clinical survey carried out in 2009, edentulousness rates have fallen substantially, while the mean number of teeth and proportion of adults with a functional dentition have increased. However, untreated caries and oral impacts on quality of life have increased to levels last seen in 1998, reversing previous gains. At the same time, regular dental service access has declined and symptomatic attendance has increased to levels last observed in 1988. Despite the positive finding that English adults are keeping their teeth for longer, the data paint a concerning picture of declining oral health and increasing unmet treatment need over the past fourteen years. In addition to ensuring equitable service access, oral health strategies in England need to focus on prevention and integration of oral health within the wider public health agenda.

Key points

- Edentulousness has fallen substantially, while the mean number of teeth and proportion of adults with a functional dentition have increased.
- Reversing previous gains, untreated caries and oral impacts on quality of life have increased to levels last seen in 1998.
- Reported regular dental attendance has declined and symptomatic attendance increased, with levels now similar to those last observed in 1988.

Introduction

Oral health is an integral component of identity and general health.^{1,2} Nationally representative surveys providing robust epidemiological data are vital to monitor the population's oral health over time. Such data are used to update policy makers and relevant stakeholders on the state of the nation's oral health and trends in oral health inequalities, to inform the planning of services, and to facilitate policy-relevant research.³⁻⁶

The Adult Oral Health Survey 2023 (AOHS 2023)⁷ is the latest nationally representative survey in the series formerly known as the Adult Dental Health Surveys (ADHS). The aim of the AOHS 2023 was to provide information on the condition of adults' teeth and oral health and track changes in population oral health over time.⁸ Unlike previous surveys, which included all or some of the devolved nations of the UK, the AOHS 2023 was limited to England only. The survey was funded by the Office for Health Improvement and Disparities (OHID) within the Department of Health and Social Care (DHSC).

Historically, the first cross-sectional ADHS was conducted in 1968 in England and Wales.⁹ Successive surveys covering all of the UK occurred in 1978, 1988, and 1998.¹⁰⁻¹³ The last of the previous ADHS collecting clinical data was carried out in 2009 in England, Wales and Northern Ireland, not including Scotland.¹⁴ Outside the clinical survey series, the AOHS 2021 was undertaken as an online survey during the COVID pandemic, introducing the name change from 'dental' to 'oral' health survey to acknowledge the global shift towards a more holistic view of oral health that extends beyond the condition of the teeth. Due to its setting during the pandemic and online nature, the AOHS 2021 did not include a clinical examination and is not directly comparable to the rest of the survey series.¹⁵

The articles in this BDJ focussed issue provide an overview of the AOHS 2023 survey, key findings on the state of oral health among English adults and trends over time, and a commentary on policy and research considerations. The current paper briefly introduces the

AOHS 2023 methodology and reports major trends in adult oral health, comparing findings from the AOHS 2023 with data from previous ADHSs for England.

Survey methodology

The AOHS 2023 was commissioned by OHID and conducted by an academic consortium from the University of Birmingham, King's College London, Newcastle University, and University College London, led by the National Centre for Social Research (NatCen). It is a cross-sectional survey representative of the general adult population aged 16 years and older and living in residential households in England. Adults living in institutions (such as care homes, student halls, or prisons) were not eligible for participation. The survey used two-stage random probability sampling and stratification to ensure different population groups and NHS regions were appropriately represented.

Data were collected between June 2023 and April 2024 through interviews and clinical oral examinations in participants' own homes. In each household, up to two adults were randomly selected to take part. A trained NatCen interviewer administered a structured, face-to-face questionnaire to collect self-reported information on sociodemographic characteristics, oral health related behaviours, perceived treatment need, oral health related quality of life, dental attendance, and attitudes and barriers to care including dental anxiety. All consenting participants who completed the interview (both dentate and edentate) were eligible for an oral examination by a trained and calibrated dental examiner. Interviews were conducted with 2,285 adults. Of those, 3% (70) refused an oral examination and a further 26% (596) could not be examined due to lack of examiner availability in their area, resulting in 1,619 completed oral examinations. Overall, the survey achieved a household response rate of 28%. While lower than for previous surveys in the series, this response is consistent with broader trends in UK surveys.¹⁶ As with past surveys, all estimates were produced using survey weights to account for sampling design and non-response, therefore the results are representative of the adult population of England aged 16 and over.

Ethical approval for the AOHS 2023 was granted by the NatCen internal Research Ethics Committee (NatCen P16782: 4th May 2023), and all participants provided informed consent. More detailed information about the AOHS 2023 design and methodology, including the training and calibration of examiners, can be found in the technical report.⁸

How does the AOHS 2023 compare with previous surveys?

Assessing trends in population oral health requires the repeated collection of comparable data. The AOHS 2023 was a continuation of the ADHS series aiming to balance comparability with previous surveys and the need to introduce important innovations. For the first time in the series, both enamel as well as dentine caries were recorded, allowing the

assessment of caries burden at different detection thresholds including enamel lesions. Criteria for periodontal assessments were updated to align with the 2017 internationally agreed classification,¹⁷ and the Basic Erosive Wear Examination (BEWE)¹⁸ was administered to all participants rather than to a subsample only.⁸ As the AOHS 2023 had a more limited scope than previous surveys and only included England, all trend data reported in this paper are for England only, i.e. across all surveys comparisons only include participants in England. Table 1 provides an overview of all Adult Dental (Oral) Health Surveys since 1968 that included clinical oral examinations. The 1968 survey could not be considered in the analysis of trends, as it did not report separate estimates for England and Wales. Also not included in trends analyses are data from the AOHS 2021 (England), which was carried out during COVID-19 and did not collect clinical data, and is therefore not comparable with the clinical survey series.

Table 1: Adult Dental (Oral) Health Survey series since 1968 (adapted from AOHS 2023 Technical Report)⁸

Survey year	Coverage	Achieved interviews	Achieved oral examinations
1968	England and Wales	2,932	2,658
1978	UK	5,967	3,495
1988	UK	6,825	4,331
1998	UK	6,204	3,187
2009	England, Wales, Northern Ireland	11,380	6,469
2023	England	2,285	1,619

Trends in oral health among adults in England

In this paper, we report trends for key indicators of population oral health that are directly comparable between surveys (edentulousness, number of teeth and functional dentition, dental caries, restored teeth, dental attendance patterns, and oral impacts). Trends in oral health are presented using data figures adapted from the main report,⁷ which also includes the corresponding tables.

Edentulousness and number of teeth

The presence and number of natural teeth have been recorded in the same way for every survey since 1978. In all surveys, the presence of natural teeth (i.e. dentate or edentate status) was self-reported, with those reporting at least one natural tooth present being

classified as dentate. The number of natural teeth present among the dentate was determined through the oral examination. Trends are reported for the proportion of dentate adults with a functional dentition (i.e., retaining 21 or more natural teeth), as well as the mean number of sound teeth present (i.e., teeth that are unrestored and clinically not affected by dental caries or trauma). In terms of age group breakdown, earlier ADHSs considered together in one group all those aged 65 years or older, while from 1998 there were separate age groups for those aged 65 to 74 years and 75 years or older.

Overall, there was a substantial reduction in the proportion of adults with no natural teeth across surveys (28% in 1978, 20% in 1988, 12% in 1998, 6% in 2009, and 2.5% in 2023) and this proportion is now very small (Figure 1A). There were large reductions in edentulousness among those aged 55 to 64 years across the survey series and even larger reductions for the older age groups. Most adults aged 65 years or older were edentate in 1978 (78%) and 1988 (66%), but in 2023 this was just 4% of those aged 65 to 74 years and 11% of those aged 75 years or older (Figure 1A).

Figure 1B depicts relatively large differences between age groups in earlier surveys with respect to the total proportion of adults with a functional dentition, but these differences have narrowed in recent survey years. Whereas in 1978, 74% of dentate adults had at least 21 natural teeth, this proportion increased to 81% in 1988, 83% in 1998 and 86% in both 2009 and 2023. Figure 1B also highlights that the most substantial increases in the proportion of adults with a functional dentition since 1978 were found in participants aged 45 to 54 years (from 51% to 92%) and those aged 55 years and older (from 30% to 68%).

The mean number of natural teeth per person increased between the 1978 and 2023 survey years from 23.3 teeth in 1978 to 25.9 teeth in 2023. Increases occurred across all age groups; however, the rate of increase has slowed over time.

The mean number of teeth in dentate adults with unrestored coronal surfaces that were clinically unaffected by decay or trauma was 15.6 in 1998, 18.0 in 2009, and 19.6 in 2023. The largest increase in the mean number of teeth was observed among 45- to 54-year-olds, from 15.2 to 19.6 teeth (an increase of 4.4 teeth).

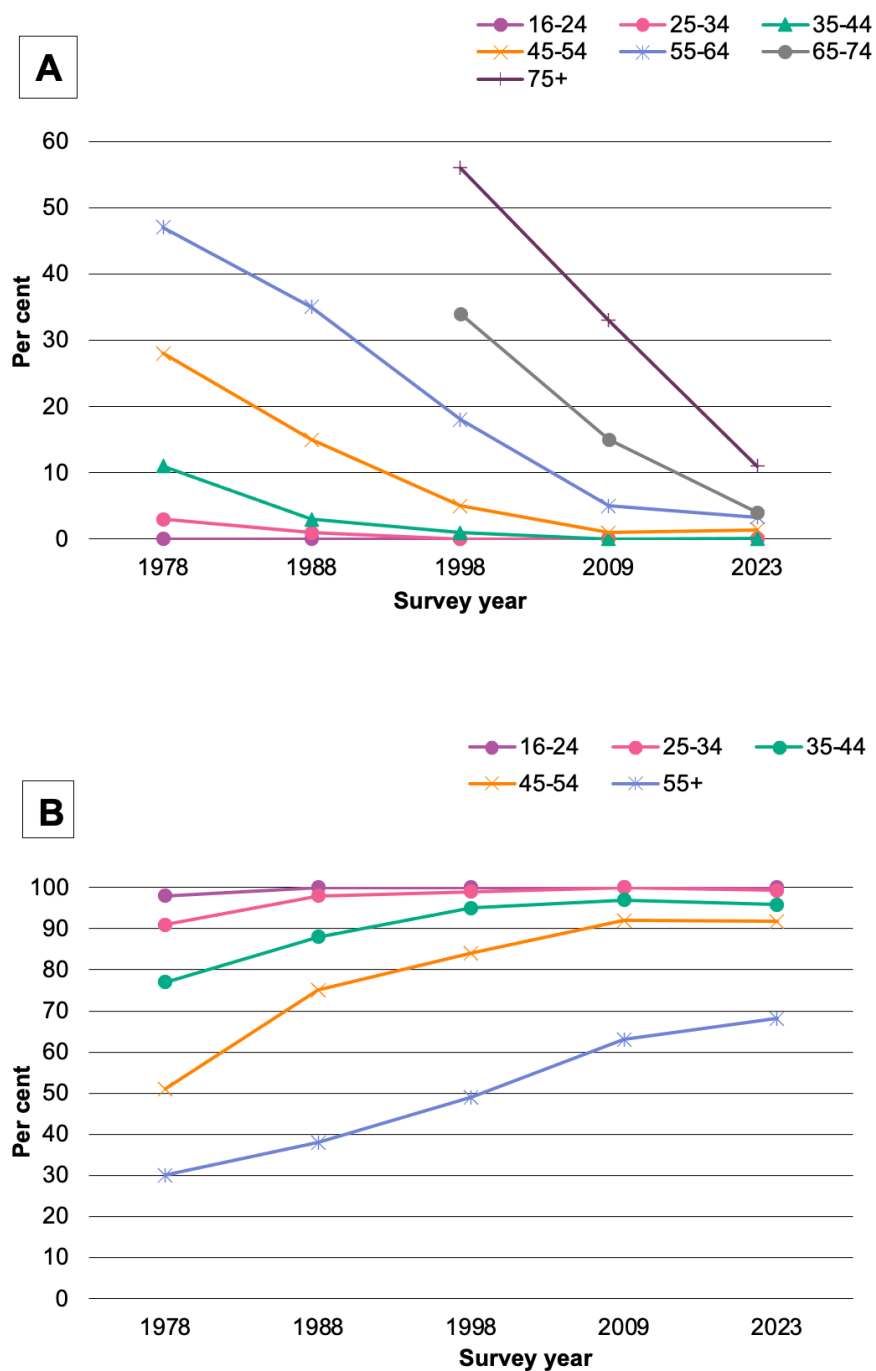


Figure 1. Trends in the percentage of edentate adults (self-reported) **(A)** and the proportion of dentate adults with 21 or more natural teeth (clinically examined) **(B)**, by age group in England, 1978 to 2023.

Dental caries (obvious decay)

Obvious decay, measured in a comparable way in 1998, 2009 and 2023, includes any clinically visible, primary or secondary decay of coronal surfaces that has progressed into the dentine, either cavitated or non-cavitated.⁸ It also includes decay with pulpal involvement. Trend data for obvious decay by age group among dentate adults are shown in Figure 2. Between 1998 and 2009, the prevalence of obvious decay had declined sharply for all age groups. However, between 2009 and 2023 this trend was reversed with obvious decay increasing among all age groups. For some age groups, this reversal resulted in caries levels similar to those last seen in 1998. For the 35 to 44 years and 65 to 74 years age groups, prevalence was even higher in 2023 than in 1998. The increase in obvious decay was considerable also for the adult English population as a whole: following an overall reduction of 18 percentage points between 1998 and 2009, between 2009 and 2023 the prevalence of obvious decay has increased by 13 percentage points.

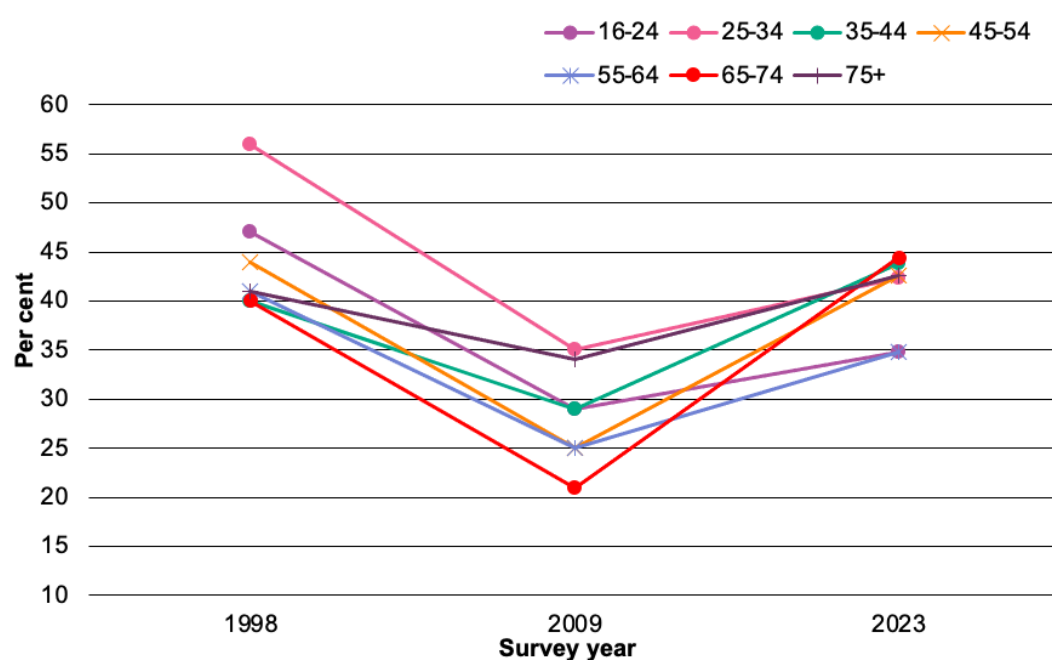


Figure 2. Trends in the percentage of dentate adults with obvious decay (coronal surfaces only, primary and secondary decay), by age group, in England, 1998 to 2023.

Restored teeth

Figure 3 shows the mean number of restored teeth that were otherwise unaffected by decay, by age group, for the 1998, 2009, and 2023 survey years. From 1998 to 2009, the mean number of restored teeth declined for the four younger age groups and increased for those

aged 55 and older. Further declines were observed between 2009 to 2023 for all age groups except those aged 65 and older, for whom there was no change. However, as seen in Figure 2, the prevalence of obvious decay had increased from 2009 to 2023 for all age groups.

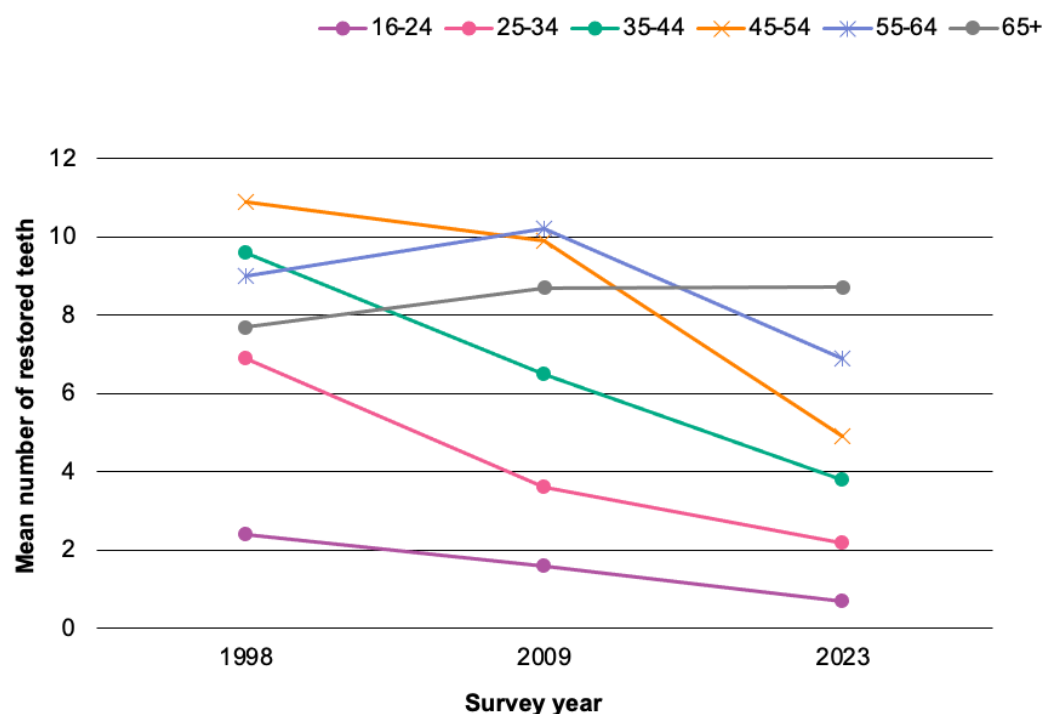


Figure 3. Trends in the mean number of teeth restored, but otherwise unaffected by decay, by age group among dentate adults in England, 1998 to 2023.

Reported dental attendance

Participants' usual pattern of dental attendance was self-reported as part of the interview component of AOHS 2023. Between 1978 and 1998 there was an increase in the proportion of adults reporting they attended for a regular check-up (44% in 1978 to 60% in 1998), with very little change by 2009 (61%). However, between 2009 and 2023, for the first time since 1978 a decrease was observed, with regular attendance falling by nine percentage points to 52% of dentate adults. Conversely, for adults reporting they attended only when having trouble with their mouth, teeth or dentures, the sustained decrease seen from 1978 (42%) to 2009 (27%) was reversed for the first time, with an increase by eight percentage points to 35% in 2023 (Figure 4).

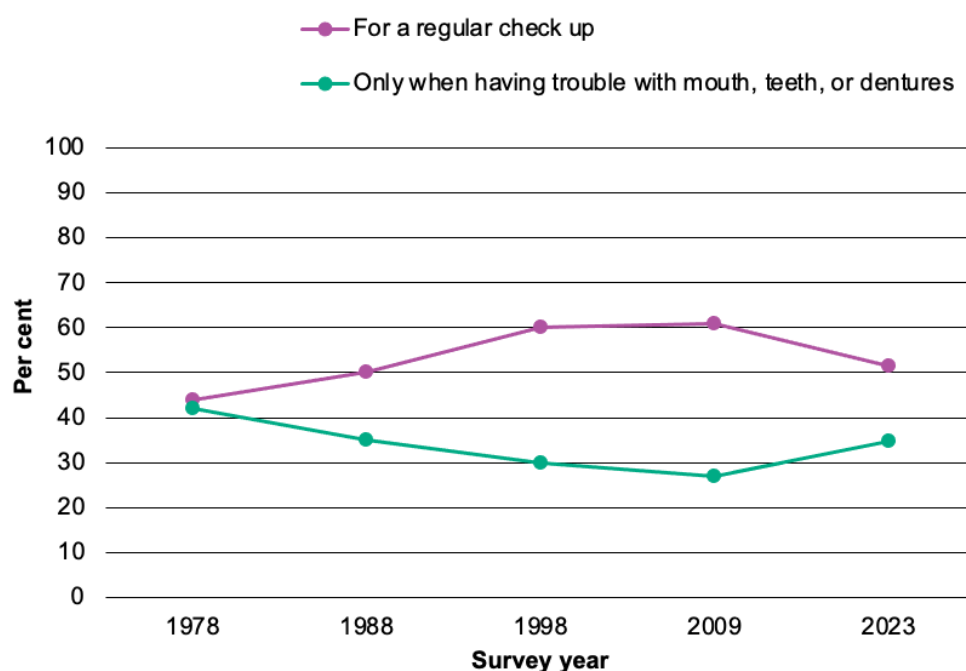


Figure 4. Trends in the usual pattern of dental attendance (self-reported), in England, 1978 to 2023.

Oral health related quality of life

Two widely used and validated oral health related quality of life measures have been employed in the series. The Oral Health Impact Profile (OHIP-14),¹⁹ assessing the frequency of a range of oral impacts, was first included in the ADHS 1998 for dentate adults only. The Oral Impacts on Daily Performances (OIDP)²⁰ instrument was first introduced in the ADHS 2009 to assess the severity of oral impacts on key aspects of daily life (such as eating, smiling, cleaning teeth, speaking). Trends are presented for both measures in Figure 5 and refer to the prevalence of self-reported oral impacts among dentate adults.

For the OHIP-14, 49% of dentate adults in 2023 reported at least one oral impact occasionally, fairly often, or very often in the previous 12 months. This was similar to the respective estimate for 1998 (51%), and higher by 10 percentage points compared to 2009 (when the respective estimate was 39%). Similarly, for the OIDP an increase of 10 percentage points was recorded in the proportion of dentate adults who reported at least one oral impact between 2009 (33%) and 2023 (43%) (Figure 5). Higher prevalence in 2023, compared to 2009, was observed across all specific oral impacts, such as problems smiling, laughing and showing teeth without embarrassment (16% in 2009 and 24% in 2023),

difficulty eating (21% in 2009 and 26% in 2023), and difficulty cleaning teeth (14% in 2009 and 19% in 2023).

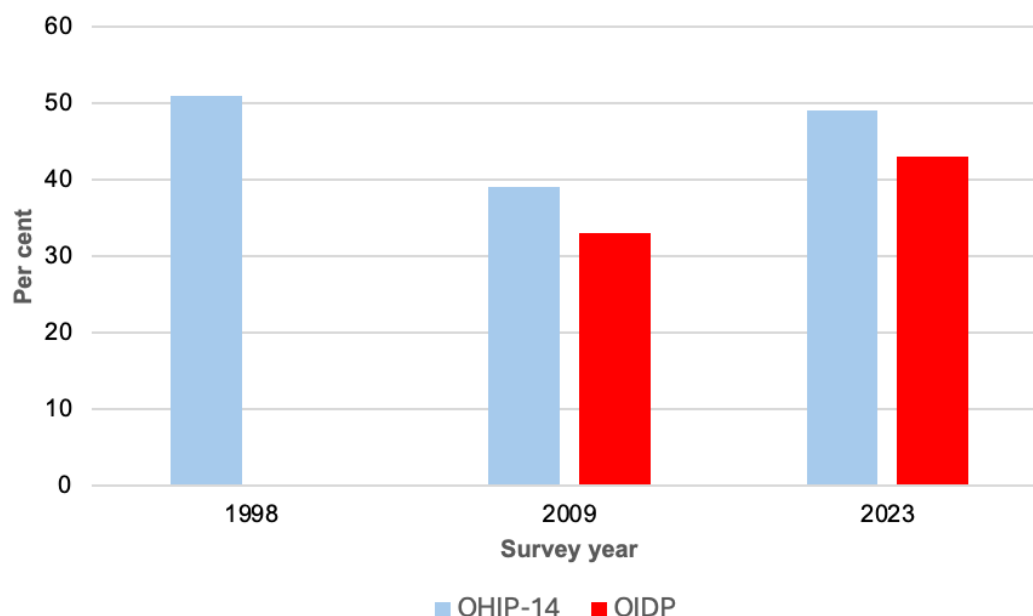


Figure 5. Trends in the proportion of dentate adults reporting ‘at least one oral impact’ in the past 12 months, measured by OHIP-14 (1998 to 2023) and OIDP (2009 and 2023).

Discussion

The AOHS 2023 provides high-quality, nationally representative, and timely data on the state of adult oral health in England. Together with its predecessors, these surveys enable the evaluation of trends over time and assessment of population needs, and can provide valuable input to assist with the planning of oral health services. Fourteen years since the last clinical survey, the current data reveal a highly concerning increase in untreated dental caries and oral impacts on quality of life to levels last seen in 1998, representing an almost complete reversal of previous gains. The mean number of restored teeth has fallen for most age groups. At the same time, reported regular dental service access has declined while symptomatic attendance has increased to similar proportions observed 35 years ago in the 1988 survey. There are positive developments as well. Over the last 45 years, edentulousness has further declined and is now relatively rare. The mean number of teeth overall, as well as the mean number of sound teeth and proportion of adults with a functional dentition have all increased further, documenting a major transformation whereby English adults are keeping their teeth for much longer than previous generations, in line with global trends in oral health.

Taken together, these findings highlight an unacceptably high degree of unmet treatment needs for the adult population in England, with higher rates of untreated dental caries and lower rates of restorations. Considering also the retention of more teeth into very old ages, these findings also suggest a long-term need to maintain dentate mouths in an ageing population, with clear implications for service provision and dental training programmes.^{21,22} This concern is further amplified by the downward trend in regular and increase in symptomatic dental attendance. As the data were collected in 2023, the observed patterns might be partly explained by the enduring impact of the COVID-19 pandemic on access to dental services, as services had not fully recovered by that time (and still have not).²³ However, while the availability and accessibility of dental care are critical to address population needs, the lack of services does not itself cause disease. Oral diseases such as dental caries and periodontal disease are largely preventable and their main causes are known. They are the common risk factors shared with other chronic diseases and include diets high in sugar, tobacco, and alcohol, as well as their underlying social and commercial determinants.^{2,24}

It is therefore imperative to integrate oral health within a wider public health strategy in line with a Common Risk Factor Approach,²⁴ strengthening prevention and addressing the root causes of oral diseases through a sensible combination of upstream, midstream and downstream interventions.²⁵ The UK sugar levy is one example of a highly successful upstream approach that has led to reductions in the hospitalisation of children for tooth extractions, as well as reductions in childhood obesity.^{26,27} Its proposed extension to milk-based sugary drinks is a welcome development. Expanding community water fluoridation, as planned for the North East of England,²⁸ is another population-based approach that also has the potential to reduce oral health inequalities.^{29,30} For dental teams, the Delivering Better Oral Health (DBOH) toolkit provides recommendations for the provision of evidence-based prevention activities in the dental practice.³¹

The following papers in this focussed issue report on the findings of the AOHS 2023 by theme, providing more detailed descriptions of clinical, subjective, behavioural, and dental service-related outcomes by socio-demographic characteristics,^(ref papers 2-5) with the final paper in the series offering an in-depth discussion of implications for policy and practice.^(ref paper 6)

Conclusions

The AOHS 2023 highlights an alarming reversal of the previously observed steady improvements in adult caries and reported dental attendance in England. A positive finding is that English adults are keeping their teeth for much longer than previous generations, which

also has implications for future demand on dental services. The findings underscore the critical importance of epidemiological data, as well as the need for equitable service access and integration of oral health within a wider public health strategy.

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Ethics declaration (competing interests)

The authors declare no conflicts of interest. Ethical approval for the AOHS 2023 was granted by the NatCen internal Research Ethics Committee (NatCen P16782: 4th May 2023), and all participants provided informed consent.

Data availability statement

The data tables containing the estimates reported in this paper are published as part of the main report⁷ and can be found here: <https://www.gov.uk/government/statistics/adult-oral-health-survey-2023>. The full dataset is available to UK Data Service (UKDS) registered users subject to the UKDS End User Licence Agreement: <https://ukdataservice.ac.uk/>

Authorship contributions

AH and RDH are joint first authors. AH, RDH and GT conceptualised the manuscript content and led drafting of the paper. Alongside AH, RDH and GT, GVAD, JEG, KJ, FM, AJM and NBP contributed substantially to survey design, development of methods, data collection and analysis whilst improving manuscript drafts. All authors agree the final version of this manuscript for publication.

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