SOCIOECONOMIC AND ETHNIC STATUS OF 2 AND 3-YEAR-OLDS UNDERGOING DENTAL EXTRACTIONS UNDER GENERAL ANAESTHESIA (DGA) IN WOLVERHAMPTON 2011-2016

Introduction

Despite significant improvements in the oral health of the UK population there still remains a high prevalence of dental caries in children with no significant reduction in dental disease of the under 5s[1] including children as young as 2 and 3 having teeth removed due to dental decay. The first national survey of 3- year-olds carried out by Public Health England in 2013[2] has shown that 12% of 3 year-olds surveyed had evidence of dental decay with an average number of 3.07 decayed, missing and filled teeth ($d_3$mft). Due to their young age, any children of 2 and 3 years requiring dental extractions are invariably admitted to hospital for a dental general anaesthetic (DGA) which included 7,926 children under 5 years in 2015-16 with estimated costs to the National Health Service (NHS) of £7.8 million annually.[3] Whilst the risks of mortality is very low which is reported to be 1 in 250,000, morbidities are more common occurring in 40-90% of children receiving a DGA including pain, nausea and bleeding[4]. In addition to these physical impacts, recent research[5] has shown that anxiety can have an important negative psychological impact from a child's perspective both pre and peri-operatively but interestingly children receiving a DGA also reported positive psychological outcomes post-operatively such as satisfaction that their dental problem had been resolved.

Whilst the cause of the decay can be attributed most commonly to the frequent consumption of sugar in food and drinks,[6] a number of other variables are also involved including referral pathways, preventive strategies and the demographic profile of children attending DGA such as age, sex, ethnicity and socioeconomic background. Studies on these variables can help identify trends which can be used to facilitate future planning of healthcare and target oral health prevention.

The association between dental caries in children and social deprivation is well documented with children from deprived backgrounds more likely to have experienced tooth decay than those from more affluent areas. The 2013 Oral Health Survey of three-year-olds[2] showed that 19% of the prevalence of decay was due to deprivation whereas the 2017 Oral Health Survey of five-year-olds showed that prevalence among the most deprived children was higher at 33%.[7] Children from deprived backgrounds are also more likely to require hospital admissions for dental extractions than children from more affluent areas.[8] Inequalities in dental decay prevalence is also known to be associated with ethnicity. Studies have shown that in some ethnic minority groups it is more pronounced in pre-school children than in any other group.[9.]

Wolverhampton has a multi-ethnic population of 250,000 and is in the 6% most deprived authorities in the UK.[10] Deprivation is disproportionate across the city with a marked disparity between residents in affluent wards compared with those from less affluent wards in the East and South East of the city where there is high unemployment. Approximately 400-450 children per annum present to New Cross Hospital, Wolverhampton for a DGA due to caries including children as young as 2 and 3 years which is concerning raising important public health issues. The aim of this study is to investigate the importance of socioeconomic and ethnicity risk factors in the development of dental caries in young children of 2 and 3 years who attended New Cross Hospital, Wolverhampton for dental extractions

Method

This retrospective study examined hospital records of 2 and 3- year-olds who received a DGA at New Cross Hospital, Wolverhampton over a 6 year period 2011-2016. Data relating to the child's, age, sex and teeth extracted was obtained from the Theatre Register and details of postcodes of residence and ethnicity from the electronic patients notes. The DGA service at New Cross offers only an exodontia service (under inhalational GA) accepting children from 2-16 years of age referred mainly from general dental practitioners (GDPs), general medical practitioners (GMPs), and also from the Special Care Dental Service with a few patients referred from the paediatric department within the hospital.

Children were seen for a pre-operative assessment by a Senior Dental Officer (NS) who shares the role of operating dentist with another Senior Dental Officer (RH). Although neither dentist is a specialist in paediatric dentistry both are very experienced clinicians and have been undertaking the DGA activity for many years. At the pre-assessment appointment administrative and clinical details relating to each patient were recorded. ASA I patients and ASA II patients with controlled medical conditions were treated as out-patients. Patients with complex medical conditions were referred to the Maxillofacial Department at New Cross or to Birmingham Children's Hospital.

The teeth were examined visually using a mouth mirror and operating light for clinical caries. Intra-oral radiographs were used whenever possible although this was not generally tolerated by 2 and 3-year-olds treated. To avoid repeat GAs, all carious and symptomatic teeth were extracted as recommended in the "Guidelines for the use of General Anaesthesia in Paediatric Dentistry".[11] Parents were advised on their child's oral health before and after the DGA and of the importance of seeking regular dental care following the DGA. Although the service accepts some referrals for patients living outside the city of Wolverhampton these were excluded from the study which included a total of 213 2 and 3-year-olds of Wolverhampton residents only. The Index of Multiple Deprivation (IMD) 2015[12] was used to determine the relative deprivation of the child's area of residence using small area geographies known as lower super output areas (LSOAs) containing individual post codes. Using the IMD index LSOAs were ranked into deciles according to the level of relative deprivation (i.e. 1 to 10, where 1 =10% most deprived area).

The number of teeth extracted was analysed using a 3-way Analysis of Variance (ANOVA) with the 3 factors being "ethnicity", "year" and "sex". The number of quadrants involving extractions was recorded and monitored by year (2011-2016). The association between the quadrants involved by year was analysed using a chi-square test of independence. Statistical significance was set at the P value of 0.05. The number of children treated by deprivation decile was analysed using a chi-square goodness-of-fit test (the null hypothesis was assumed to take a uniform distribution).

Results

Table 1 demonstrates the demographic characteristics of the 2 and 3 -year-olds treated by sex and year of treatment. Of the 213 treated from 2011- 2016, 111 (53.3%) were boys and 102 (46.7%) were girls. The majority of those treated were White British (57%) with South Asian accounting for 14.5%, Other Whites (White persons not English, Scottish, Welsh or Irish) 13%, Black 5.1% and Mixed Race and Other Ethnic Groups both 4.7%. The ethnicity of 2 children (0.9%) was not stated.

See Table 1

The 3-way ANOVA identified no high-order interactions (between ethnicity, year and sex) and the only significant main effect was due to ethnicity (P=0.026), see the mean numbers of deciduous teeth extracted by ethnicity in Figure 1. Bonferon multiple comparisons identified the greatest difference was predominately between the mean number of deciduous teeth extracted for the White British (Mean = 4.00) compared with Other Whites (Mean = 6.3) (difference = -2.3, P=0.012; with 95% CI -4.3 to -0.28).

See Figure 1

The association between the extracted quadrants-by-year was significant, with the chi-square test of independence χ^2=30.3 with 15 df (P=0.011), see Table 2.

See Table 2

The significant association confirms a trend of children's teeth being extracted from one and two quadrants in the earlier decades (2011 and 2012) but being extracted more frequently from three and four quadrants in more recent years (2015 and 2016).

Concerning socioeconomic trends this can be seen in Table 3 with more children being treated who lived in relatively deprived areas compared to more affluent ones. The Chi-squared goodness-of-fit

test for the “Observed” and “Expected” number of children (assuming a uniform distribution under a Null hypothesis) shows this confirming that more children were treated from areas of greatest deprivation (Deciles 1 & 2) in contrast with those living in more affluent areas (Deciles 3 to 10). The imbalance is clearly illustrated in Table 3 and Figure 2.

See Table 3

The results of the Chi-Square goodness-of-fit Test was χ^2=318.4 with 9 degrees of freedom (df) (P<0.001). This imbalance can be seen in Figure 2 below.

See Figure 2

Discussion

The results of this study show that socioeconomic and ethnic status are risk factors in dental caries for some 2 and 3-year-olds living in Wolverhampton involving the need for a DGA. The association between deprivation and ethnicity was not measured but the data shows a clear relationship between risks of caries experience and relative deprivation (see Table 3, Figure 2) with more episodes of care required by children living in relatively deprived areas in the East and South East of the city. 70% of children receiving a DGA resided in the most deprived LSOAs (Deciles 1 and 2) nationally in Wolverhampton. The results also reveal a disproportionate percentage of children treated from some ethnic groups based on data from the last Census[13] involving 5.3% Other Whites compared with 1.39% White British; 1.29% Other Ethnicities; 0.44% South Asians; 0.42% Black and 0.24% Mixed Race. The association between loss of deciduous teeth and increased numbers of quadrants involving three or four quadrants increased in later years (2015 and 2016) including loss of deciduous second molars. This is concerning as loss of this tooth increased the risk of crowding and impaction of the permanent second premolar due to mesial movement of the permanent first molar.

The association between caries and socioeconomic status is well established.[14] Evidence for this has also been shown in Oral Health Surveys of 3 and 5- year-olds.[2,7] A study in Glasgow showed caries in the most deprived areas to be 32% compared with 16% in the least deprived areas.[15] Admissions to hospital primarily for dental caries is also more likely to involve children from deprived areas compared with more affluent areas. Data from HES (Hospital Episodes Statistics) 1997-2006 showed that this was the case and that 80% of all admissions involved extractions.[16] Studies have also revealed that ethnic disparities in caries experience is more likely to depend on the population studied and so comparisons are limited. Studies in the UK have shown significantly higher caries experience among pre-school children from South Asian backgrounds.[17] There is little published information concerning caries experience in White Eastern Europeans although a study concerning oral health of White Eastern European pre-school children in East London showed White Eastern European, Bangladeshi and Pakistani children had significantly poorer oral health than their White British counterparts.[18] The 2017 Oral Health Survey of 5- year-olds[7] found that Eastern European and Chinese children had significantly higher decay rates than in other groups.

Our study suggests further evidence of oral health inequalities experienced by pre-school children in more deprived groups and amongst some ethnic communities in particular Other White communities. It also underlines the value of routine-collected data in informing local strategies. Caries is a preventable disease and it is very concerning that children as young as 2 and 3 years are being admitted to New Cross Hospital for elective extractions often involving posterior deciduous molars. There is evidence that dental caries once established continues to rise throughout childhood into adulthood which reinforces the case for oral health prevention or in establishing early intervention to stop the disease as soon as possible. This could be achieved through cultural sensitive oral health programmes in addition to following general evidence-based preventive approaches as recommended in the Department of Health's "Delivering better oral health : an evidence-based toolkit for prevention".[19] It provides guidance for primary care teams on oral health assessments, age-appropriate preventive advice and the importance of supervised toothbrushing with fluoride toothpaste and would be appropriate for use with pre-school children from deprived areas and some ethnic communities including Other White communities. Other health

improvement programmes such as Public Health England's Sugar Smart initiative and the government's sugar levy primarily aimed at reducing obesity and overweight through reductions in sugar consumption would also help reduce levels of dental decay. At local and national level dental commissioners are being encouraged to support the UK wide Dental Check by One (DCby1) campaign launched by the British Society for Paediatric Dentistry with the Office of the Chief Dental Officer which aims to increase awareness of the importance of early dental attendance for children aged 0-2 years.[20]

We have limited information about numbers of this highly selective group of patients that were born and lived in Wolverhampton or of those that might have lived elsewhere before moving to Wolverhampton prior to their DGA. Population estimates for the years 2013-2016 show that the numbers of 2 and 3-year-olds living in Wolverhampton was fairly stable at around 7000 per annum with a slight increase in numbers from 2014.[21] We also have limited information about the dental care the children received prior to their DGA which would be valuable information for future planning of services in Wolverhampton, but it is very unlikely that many will have visited a dentist before they were seen as an emergency by a GDP in Wolverhampton prior to referral for a DGA. It is reported that less than 12% of children attend a dentist before their second birthday.[3] It is surprising that such high levels of caries was seen in these patients in view of the fact that Wolverhampton has a fluoridated water supply beneficial for dental health and such high rates are contrary to that seen in the general 3-year-old population in Wolverhampton where prevalence of decay is 15% (England= 12%) and the $d_3$mft is 2.06 (England= 3.07).[2] There is likely to be several reasons for this including the fact that many children may not have received tap water routinely or had moved to Wolverhampton from non-fluoridated areas prior to referral. Another reason could be due to cultural practices including prolonged use of feeding bottles containing cariogenic fruit juices or milk sweetened with sugar or honey as has been reported in a study in Greater Manchester.[22] Unfortunately in our study no data was collected with regards to weaning and drinking habits to assess whether parents were aware of safe baby drinks and food. This emphasises the importance of applying cultural sensitive programmes recommended in the toolkit on "Delivering Better Oral Health" including advice on use of free-flow cups from one year of age and weaning foods should be

sugar free.[19] A further limitation concerns the small numbers of children treated in some of the 17 ethnic groups used at New Cross. These were collapsed down to 7 broader ethnic groups to improve statistical powers, but in doing so, any disparities existing among the different sub-groups could be missed which might have an effect on caries experience due to cultural, religious or educational status.

Conclusion

Significant numbers of 2 and 3-year-olds required general anaesthetic for dental extractions due to caries in Wolverhampton. High caries levels were associated with relative social deprivation and ethnicity. Reducing oral health inequalities may be considered with cultural-sensitive oral health programmes educating mothers of very young children in relation to dental caries and the need to undergo regular dental assessment.

Conflict of Interest

We have no conflict of interest

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