

## **Deprivation, demography and missed scheduled appointments at an NHS primary dental care and training service**

**Authors:** Ms Amelia West (*former student*)<sup>1</sup>, Ms Tara Stones<sup>1</sup>, Dr Kristina Wanyonyi<sup>1</sup>

1. University of Portsmouth Dental Academy, University of Portsmouth, William Beatty Building, Hampshire Terrace, PO1 2QG Portsmouth

Corresponding author: Dr Kristina Wanyonyi

Address: University of Portsmouth Dental Academy  
Hampshire Terrace, Portsmouth PO1 2QG

Email: kristina.wanyonyi@port.ac.uk

### **In brief:**

- Demonstrates the potential to use electronic dental records to predictively monitor and support individual patient behaviour patterns within general dental practice.
- Contributes to the literature highlighting the complex relationship between continued dental access behaviour, deprivation and cost of care, while proposing the potential benefits of free dental checks for older patients.
- Highlights the safe guarding opportunities and potential cost saving if missed appointments are monitored and informed policies are developed.
- Expands the research on missed scheduled appointments to include data on adults and general dental practice.

## Abstract

**Background:** Patients often do not attend planned routine dental appointments. This leads to unmet dental needs, under-utilisation of dental services, lost revenue for dental practice owners and lost educational opportunities when this occurs in centres of training. The aim of this project was to use Electronic Dental Health Records to investigate the factors associated with failing to attend dental appointments in an NHS primary dental care service provided free at the point of delivery.

**Method:** Electronic patient data over a one-year period were extracted. Data included; patients' age, sex, deprivation status and whether they missed at least one appointment. Deprivation status was derived from patients' postcodes converted to the indices of multiple deprivation quintiles (IMD). Data was analysed descriptively and analytically. Chi square tests were used to identify statistically significant associations ( $p < 0.05$ ) between patient characteristics and a record of a missed dental appointment. Logistic regression was used to model the patient related factors which predict failure to attend scheduled appointments while controlling for confounding.

**Results:** A total of 3,678 patients aged between 2 and 98 years had at least one appointment offered within the twelve-month period studied. Of these, 627 (17%) had at least one instance of 'Did Not Attend' ('DNA') on record. The age group with the highest proportion of patients with a 'DNA' were the 6-12 year olds (23.6%), and the lowest proportion were the >75 years olds (10.4%). A higher proportion patients had a 'DNA' in the two most deprived quintiles (Quintile 1 - 32.4% and Quintile 2 – 33.3%), when compared with the least deprived quintile (Quintile 5 – 6.5%). Logistic regression showed that males were 20% more likely to have a 'DNA' than females, the most deprived were twice more likely to have a 'DNA' than least deprived ( $p < 0.05$ ) and younger patients were more likely to not have a 'DNA' on record.

**Conclusion:** Electronic primary dental care records when analysed at the individual level revealed a predictive pattern of missed appointments, which were independently associated with patients' age, deprivation and sex. Understanding these patterns can positively influence comprehensiveness of care, child safeguarding, patient outcomes and primary dental care practice financing.

## Background

Making health services accessible is a priority for all health systems. Within dentistry, there is a legitimate case for the measurement of a range of domains that define dental access more comprehensively so as to allow the effective evaluation of progress towards policy goals [1]. The ongoing dental contract reform in the UK has been grappling towards the same goal; by seeking to align financial incentives for general dental practitioners (GDPs) with improved access to dental services and population oral health [2]. Access to dental services is a complex process with multiple facets [3], and one cannot help but reflect on the fact that at present, the proportion of the population who have attended a National Health Service (NHS) dentist in the last 24 months is the main performance indicator used to measure dental access [1]. According to Harris 2013, operationalisation of dental access as a construct would benefit from drawing a distinction between the concept and process of access. The latter representing the issues which come into play after a patient has entered the system and impact on effective, equitable, and efficient care [1]. These reflections contribute to the importance of investigating broader indicators of continued dental access such as missed appointments.

The most recent UK ex-Scotland Adult Dental Health survey, found that 1% of those who gained an NHS dental appointment did not attend ('DNA') [4]. This number is likely to be higher if social desirability biases, which are common to surveys, are to be considered. The gross impact of 1% missing at least one scheduled appointment is particularly significant as NHS dentists complete over 39 million courses of care annually, with each course requiring a number of appointments [5]. The result of these missed appointments is unmet dental needs, resources waste, costs to the NHS and financial implications for dental practice owners. These implications are not necessarily related to profit, but practice owners could incur penalties for not meeting contract targets. Although the cost implication of missed appointments in general dental practice is not well-documented, missed general medical practice appointments in the England have been estimated to result in £216 million in losses annually [6].

Affordability and anxiety are some of the most commonly cited barriers to dental attendance, when attendance is measured by an annual visit to the dentist [4 7 8]. Despite free dental access offered at the point of delivery in NHS services for all children and some groups of adults, children and adults from lower socio-economic areas are the least likely to report an annual dental visit [4 9]. Studies have proposed that free vouchers for adults may improve decisions to attend the dentists regularly [10]. While other studies have suggested that mobile

dental units at school premises, Dental Access Centres and Out Of Hours services could increase dental attendance in families from deprived areas [11]. Indeed, Dental Access Centres and Out of Hours services have been established , but these services have ended up as emergency services, rather than providers of routine care as intended [12]. It is evident that for underserved groups, multidimensional factors contribute to dental attendance. There is therefore a need for more individual level research from primary dental care; investigating multiple dimensions of dental access.

The aim of this study is to use Electronic Health Records (EHR) from an NHS training and primary dental care service providing services free at the point of delivery both adults and children [13 14]. This is with a view to establish patient related factors which predict failing to attend scheduled dental appointments after patients have made contact with the primary dental care practice (gained entry). Missed scheduled appointments are proposed here to be an under-researched important measure of ‘continued access’ behaviour, which contributes to effective, equitable, and efficient care.

The study site is the University of Portsmouth Dental Academy (UPDA). UPDA is an NHS primary dental care service and training centre for undergraduate dental care professionals together with outreach dental students from King’s College London. At UPDA, patients who are unable to attend scheduled appointments are required to notify the team at least 24 hours in advance. However, if a patient notifies UPDA less than 24 hours in advance, the records are updated as a ‘Late Cancellation’. If the patient does not notify UPDA at all, this gets recorded as a ‘Did Not Attend’ (‘DNA’) appointment (Figure 1). Multiple processes exist at UPDA to avoid an instance of a ‘DNA’ such as; printed appointment cards, letters, texts reminders and phone calls, however, often a small proportion still miss appointments without cancelling.

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**Figure 1: UPDA’s ‘DNA’ policy and the protocols**

## **Methods**

This study adhered to the RECORD statement for The Reporting of studies Conducted using Observational Routinely-collected health Data (RECORD) [15]. NHS Research Ethics Committee Approval REC 18/SC/0296 and HRA approval 18/SC/0296 was received for this

study. Electronic patient data of all appointments over a year (January 2016 - January 2017), were extracted from UPDA's electronic records data warehouse. The data had been anonymised by the dental school's Data Custodians. The data were cleaned and validated using the methodology set out by Wanyonyi, Radford and Gallagher (2019) [16]. During this process, data inputting errors were identified and then cleaned after a validation process was undertaken to identify inconsistencies and outliers in the data. Data included; patient sex, age, deprivation by quintiles and whether they had at least one instance of a 'DNA' on record. Deprivation data was derived from patients' postcodes and converted into the English Indices of Deprivation (IMD) 2015 Deciles, via Ministry of Housing, Communities & Local Government [17]. The English Indices of Deprivation 2015 are based on 37 separate indicators, organised across seven distinct domains of deprivation which are combined, using appropriate weights, to calculate the Index of Multiple Deprivation 2015 (IMD 2015). This is an overall measure of multiple deprivation experienced by people living in an area and is calculated for every Lower layer Super Output Area (LSOA), or neighbourhood, in England (Lower Super Output Area – cluster of about 1500 people). Every such neighbourhood in England is ranked according to its level of deprivation relative to that of other areas[17]. The IMD deciles were then converted into quintiles of deprivation. IMD is regularly used in research and health care planning in the UK to analyse patterns of deprivation and identify areas that would benefit from targeted schemes for health [18]. Data were then analysed descriptively and analytically, using SPSS 22. Univariate analyses (chi square tests) were undertaken to investigate statistically significant differences ( $p < 0.05$ ) in the proportion of patients who 'Did Not Attend' at least one scheduled appointment by sex, age group (adults vs children) and deprivation of quintile. Logistic regression was used to predict the same while controlling for confounders.

## Results

The total number of patients who had made an initial contact and scheduled at least one appointment at UPDA in the year was 3,678. Of these, 17% had at least one 'DNA' appointment on record. Table 1 shows that the proportion of children under the age of 18 years who had a 'DNA' was 21.5%, compared with 15.8% adults (18 years and over). More males (18.4%) than female patients (15.7%) had at least one 'DNA' on record. Children aged 6-12 years had the highest 'DNA' rates (23.6%). Followed by 18-24 year olds (22.7%). Zero to two year olds were the best attenders (100%), however, they were a small sample ( $n=4$ ). There was a social gradient within the patients who had at least one 'DNA' on record; with the most deprived quintile having the highest proportion (24.9%) of patients who had a 'DNA' on record.

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**Table 1: The proportion of patients who had at least one 'DNA' appointment at UPDA within a year by sex, adult vs children, NHS age groups, and deprivation**

Figure 2 displays the relationship between proportion of patients who did not attend a scheduled appointment by their age group and deprivation. Notably, the social gradient is clearer in patient's aged below 18 years. With patients from the two most deprived quintiles having the highest proportion of patients with a 'DNA' record when we observe these younger age groups. The older age groups (55 years and over) seem to have a more even distribution between all deprivation categories.

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**Figure 2: The proportion of patients who had at least one 'DNA' appointment at UPDA within a year by deprivation quintile and within age group**

Table 2 displays the findings from a logistic regression model predicting whether a patient had a 'DNA' record. In this fully adjusted model, the results show that within every year of reducing age, patients were 1% more likely to have a 'DNA' on record. Males were 20% more likely to 'DNA' than females, and when the most deprived patient group was compared to the least deprived, the most deprived patient group were 2.16 times more likely to have a 'DNA' on record.

**Table 2: Logistic regression model predicting having an instance of "DNA" by social and demographic factors**

## **Discussion**

This is the first study to use individual patient level data from primary dental care NHS electronic records in England to predictively investigate both adults' and children's missed scheduled appointments. Previous studies on this subject have mainly described cumulative rates of missed appointment, focused on children, and have been set in secondary care, community or specialist dental services [19-21].

This study has revealed that in a service provided free at the point of delivery, individuals' social and demographic predisposing factors persist in predicting the nature of 'continued access' [1]. In this instance continued access is measured by missed dental appointments after an initial contact with the service provider. This supports the call for the inclusion of a broad framework of measures when monitoring and planning policies for improved dental attendance in the population [1].

Overall, a higher proportion of children had a 'DNA' on record (21.3%) compared with adults (15.9%). The logistic regression model confirmed that age was indeed a predictor of a 'DNA' record, with younger patients more likely to have a 'DNA'. Although 'DNA' rate is measured for individuals in this study, the results compare with other studies undertaken in dental specialist services and wider healthcare, where cumulative missed appointment rates for children were analysed and found to be between 15% and 32% [19 20 22 23]. Children aged between 6 and 12 years were the group with the largest proportion of patients who had missed at least one scheduled appointment (23.6%). Younger children aged 0-2 years had no recorded 'DNA' in this study, but were a small sample of 4. This low overall attendance for this age group is equally a concern, and suggests a need for doubling of efforts around the 'dentist by one' campaign by The Chief Dental Officer, Public Health England and The British Society of Paediatric Dentistry [24]. Missed appointments by children has been proposed as an indicator of neglect and is a safeguarding issue [19 25 26]. The findings from this study further support the call within healthcare literature to change terminology from 'Did Not Attend ('DNA')' to 'Was Not Brought (WNB)' [23] when considering children's missed appointments. This reinforces the need to consider interventions that have some success such as reminders [21], but also enacting a 'WNB pathway' which includes sharing information across health and social care to ensure safeguarding [19].

Patients who lived in the most deprived quintile were 2.16 times more likely to have at least one 'DNA' compared with the least deprived in this service; even while controlling for age and sex as predictors. This is also despite the services being provided free at the point of delivery for all patients. This compares with an intervention trial among orthodontic patients, where patients from working class and manual households had 2.7 times higher likelihood of missing an appointment, even while controlling for the use of the intervention, which involved text or letter reminders [21]. This is of particular interest because a social gradient in regular dental attendance is commonly attributed to affordability of treatment. Respondents of the 2009 UK Adult Dental Health Survey [27] cited affordability (63%) and location (23%) [28] as the main

reason they did not attend an annual NHS dental visit. What the present study findings suggest is that financial constraints are not the barriers to dentistry experienced by socially deprived groups. This supports Can et al., (2003) who concluded that the reasons for missed appointments among orthodontic patients from deprived communities is more complex [26].

It is worth noting that the influence of no cost may have been an attenuating factor in the relationship between 'DNA' and deprivation for older patients (65+). This is evidenced by the overall low rate of 'DNA'; only 11% had a 'DNA' on record. It was also interesting to find that when the proportion of patients who had at least one 'DNA' record were distributed by age group and deprivation quintile (Fig 2), the proportions appear to be spread evenly across all deprivation categories amongst age groups over the age of 65. A number of studies suggest that older people of poorer socio-economic status (SES) experience cost as a main barrier to regular dental access [29 30]. The BDA 2020 Vision for oral healthcare for older people recommends that patients over the age of 60 years receive free check-ups. This is yet to be enacted in England, but is in effect in the devolved nations [31]. This study's findings indicate that this age group could respond positively to free check-ups. The impetus to increase the limited access to dental services for older people living in the community does exist. It is supported by the evidence of an expected increase in demand for complex care due to longer tooth retention and an increasing ageing population [28].

The findings related to differences in missed appointment rates between the sexes is also worth considering. Male patients were 20% more likely than female patients to have at least one 'DNA' in the defined period. This could be associated with health seeking behaviour; where women are found to be more likely to seek health care and have treatments [32]. Another study in the same setting found that women were more likely to have curative treatments than males [33]. The significance of these findings are that perhaps a more targeted approach is required for male patients. As there is a need for more qualitative work with all patients related to their dental access patterns, there is also certainly a need for further qualitative research to uncover barriers to dental attendance, which are unique to male patients.

A strength of this study is that it demonstrated that patient dental access patterns through courses of care can be monitored through EHRs in dentistry. It highlights that failure to sustain maintain attendance to the dentist is not only an initial challenge, but also follows through courses of care. There is a limitation in this study's ability to explain individual behaviours or predict future 'DNA's as more insights into circumstances need to be investigated qualitatively



with different groups with high 'DNA' rates. At present the extraction of electronic dental records has not advanced to efficiently include presenting complaints. This is because there is a lack of diagnostic codes in dentistry [16]. In addition, free text language queries are yet to be developed to reliably extract data. Another limitation is that this was a cross-sectional study over a year and perhaps a longer study will have different predictive patterns. The generalisability of the study to other primary dental care practices is limited as this is within an educational institution and students may work slower than fully qualified professionals, which could have impacted patient behaviour. Additionally, services are free at the point of delivery for all patients, which differs from traditional general dental practices. There is a need for more research with traditional general dental practices to uncover the hidden financial and organisation costs of missed appointments. The uniqueness of the site is, however, equally a strength, as it provides a natural experiment to inform whether more free dental care may improve access behaviour; it seems this is may be the case for older patients. Further research is required to identify the underlying reasons for certain socio-demographic groups not attending appointments in order to provide a full picture for health promotion and policy planners.

## **Conclusion**

Missed appointments interfere with the comprehensiveness of care, and impact on health system function and patient outcomes. It can lead to significant losses for general dental practices and NHS budgets. In a teaching facility, there is a significant impact on loss of clinical hours, training, competencies and education. Consequently, other patients may suffer the effects of longer waiting lists and progression of disease. Therefore, such research is important. It helps to characterise dental access more robustly and helps identify patients who need support to continue accessing care or children who may be experiencing forms of neglect. The findings will inform ways to encourage equitable dental access and assist policy makers to understand the multidimensional aspects that relate to dental access.

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Tables and figures

**Table 1: The proportion of patients who had at least one DNA appointment at UPDA within a year by sex, age group, and deprivation**

Patient characteristics	DNA n (%)	P value
<b>Overall</b>	627 (17%)	
<b>Sex</b>		0.025 *
Male	338 (18.4%)	
Female	289 (15.7%)	
<b>Adults vs Children</b>		0.000 **
Children (18 years and below)	171 (21.5%)	
Adults (19 years and above)	456 (15.8 %)	
<b>Age Group</b>		
0-2	0 (0.0%)	
03-May	20 (17.9%)	
06-Dec	99 (23.6%)	
13-17	44 (19.0%)	
18-24	67 (22.7%)	
25-35	96 (19.8%)	
35-44	90 (20.1%)	
45-54	74 (13.4%)	
55-64	80 (13.9%)	
65-74	39 (10.3%)	
75+	18 (10.4%)	
<b>IMD Deprivation Quintiles (n=3,614)</b>		0.000 **
IMD Quintile 1 (Most deprived)	192 (24.9%)	
IMD Quintile 2 (2nd most deprived)	193 (16.7%)	
IMD Quintile 3 (Middle)	132 (14.4%)	
IMD Quintile 4 (2nd least deprived)	45 (11.2%)	
IMD Quintile 5 (Least deprived)	44 (11.9%)	

Note:

1. UPDA – University of Portsmouth Dental Academy
2. n=3,678; IMD (Indices of Multiple Deprivation) Quintile of Deprivation; n= 3,614 as 64 patients post codes could not be converted to IMD
3. \*\*p<0.05; \*\*\*p< 0.001

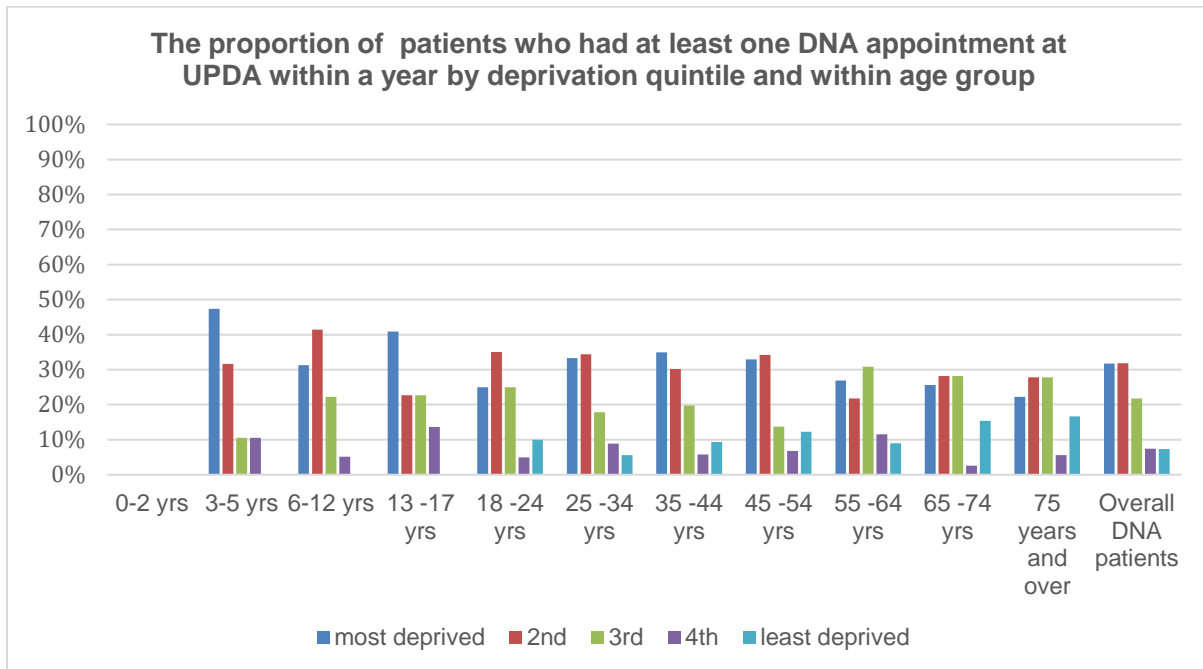
**Table 2: Logistic regression model predicting having an instance of “DNA” by social and demographic factors**

Factors	Odds Ratios (95% CI)
	Fully adjusted
Age in years	0.99*** (0.98, 0.99)
Sex (reference: female)	1.2** (1.01, 1.44)
Deprivation index (reference IMD Quintile 5 (Least deprived))	
IMD Quintile 1 (Most deprived)	2.16*** (1.51, 3.10)
IMD Quintile 2 (2nd most deprived)	1.34 (0.93, 1.89)
IMD Quintile 3 (Middle)	1.13 (0.78, 1.64)
IMD Quintile 4 (2nd least deprived)	0.89 (0.57, 1.39)

\*\*p<0.05; \*\*\*p< 0.001

Figure 1: UPDA's DNA policy and protocols





**Figure 2: The proportion of patients who had at least one DNA appointment at UPDA within a year by deprivation quintile and within age group**