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An assessment of the orthodontic treatment needs of the resident population of Derbyshire, Derby, Nottinghamshire and Nottingham compared with the level of current service provision - 2018

Executive Summary

NHS orthodontic care is the treatment of malocclusions and is provided in both primary and secondary care, but the majority is provided in primary care for those cases of index of orthodontic treatment need of 3.6 and above.

Across Derbyshire and Nottinghamshire, a total of 40 contracts were commissioned to provide orthodontics within primary care (2016-17). Practitioners were contracted to provide either mixed GDS and orthodontic care (27 contracts) or purely orthodontic care (13 contracts). All commissioned activity is recurrent.

March 2019 sees the expiry of the majority of PDS Orthodontic contracts across Derbyshire and Nottinghamshire (12 contracts). The remaining general and orthodontic contracts are not available for procurement as they have no end date.

Estimates have been made of the numbers of cases delivered by the hospital services, however it is unknown whether there may be the potential for some cases to be delivered in a primary care specialist setting. The recently implemented referral management system will support delivery of care in the most appropriate environment for the needs of the individual patient.

There are various methods of determining orthodontic treatment need in a population which have been explored for the population of Derbyshire and Nottinghamshire and produce broadly comparable estimates.

The **estimated** number of case starts per year within Derbyshire and Nottinghamshire requiring access to orthodontic treatment when only demand (and not caries) is considered, based on the locally available epidemiological evidence and taking into account predicted population growth between 2008 and 2029 lies within the range **7144 and 8458**.

The current estimate of annual total case starts (primary and secondary care) across Derbyshire and Nottinghamshire is **7664.**

Due to the historical location of practices there is an apparent inequity in access to commissioned specialist primary orthodontic care services across Derbyshire and Nottinghamshire with residents of High Peak (Derbyshire) and North and North East Nottinghamshire having little or no specialist orthodontic provision. However, local interpretation will be required to understand natural patient flows. NHS England will need to consider addressing inequity in service provision.

There are several important modifying factors which impact upon whether the need is met:

- The population in Derbyshire and Nottinghamshire is estimated to grow by 16% by 2029 and this has been taken into account in the estimates made within the needs assessment.

- The willingness of individuals to have orthodontic treatment (demand) will impact on the numbers of individuals seeking orthodontic care
- Patient suitability for orthodontic treatment. Patients must have excellent oral hygiene and no active oral disease to fulfil the clinical requirements for orthodontic treatment.
- The ability of patients to travel to providers of orthodontic services
- Provision of secondary (hospital) orthodontic services
- The provision of private orthodontic care

Factoring an un-quantified private market, cases with dental caries and hospital orthodontic service provision the data from this needs assessment suggests that the overall orthodontic activity contracted in Derbyshire and Nottinghamshire is likely to meet identified need.

Future orthodontic needs assessments will benefit from the information on referrals that the recently implemented referral management system will generate.

This orthodontic need assessment takes into account need in any given year but does not take into account waiting lists. Consideration should be given to validating the lists through the referral management system.

Efficient use of available resources (contracted UOAs) will be key to enabling shorter waiting times and more people receiving orthodontic treatment. This will be essential to securing sufficient treatment for the population. This will be supported by the referral management system and the use of KPIs.

Quality will be further enhanced by consistent application of independent PAR scoring of cases and performer engagement in the Managed Clinical Network.

Efficient use of UOAs is key to securing an adequate volume of courses of treatment for the population. Quality is not simply related to the technical competence of treatment. It refers to whether care is relevant to need and to its effectiveness, efficiency, equity, acceptability and accessibility.

1. Background

Orthodontics is a speciality branch of dentistry concerned with facial growth, development of the dental occlusion and the correction and prevention of occlusal abnormalities. (Mitchell, 2007).Treatment for orthodontics is provided by services in both primary and secondary care settings. This is provided by specialists, including consultant orthodontists and non-specialists.

Comprehensive treatment planning in orthodontics can be complex and involve a multidisciplinary approach. Treatment can involve a wide range of interventions such as dental extractions and a variety of appliance therapies depending on the assessment of occlusion.

Historically, orthodontic services derived funding from the National Health Service (NHS) Primary Care General Dental Services (GDS) budget and as a speciality, orthodontics required an increasing level of funding, rising from 3% to 16% of the NHS GDS spend in 14 years, equating to £152 million. Introduction of the Health and Social Care (Community Health and Standards Act (2003) stabilised orthodontic spending by introducing Primary Care Trusts (PCTs). This enabled local commissioning responsibilities to PCTs based on the needs of their population within a pre-defined ring fenced budget. The introduction of General and Personal Dental Service contracts in 2006 further defined the use of a finite orthodontic resource, in that, other than in exceptional circumstances, only those shown by the current evidence base to benefit from orthodontic treatment (individuals with an Index of Orthodontic Treatment Need Dental Health Component (IOTN DHC) of 4 or 5 and those with an IOTN DHC of 3 plus an Aesthetic Component (AC) of 6 or above) would be treated under NHS Regulations.

Following the introduction of the Health and Social Care Act (2012), Primary Care Trusts (PCTs) ceased to exist. Clinical Commissioning Groups (CCGS) were formed to commission the majority of health care services for their local populations, except dentistry, pharmacy and optometry. Commissioning of dental services is overseen by NHS England, working to a single operating model with local teams undertaking primary and secondary care commissioning of dental services appropriate to local needs. Provision of an integrated commissioning service offers the opportunity for commissioners to assess the specific orthodontic needs of a population and adjust the focus and amount of commissioned orthodontic services as required to meet those needs.

The focus of this report is to investigate the need for orthodontic services for the responsible population of NHS England North Midlands (Derbyshire & Nottinghamshire) which includes, Derby City, Derbyshire County, Nottingham City and Nottinghamshire (excluding Bassetlaw). The aim is to identify whether current orthodontic service provision across this geography is appropriate in addressing this need.

2. Prevalence of Malocclusion and Treatment Need

A number of methodologies have been used to assess need for orthodontic care.

Normative Need

Defining normative need is an important concept in completing a needs assessment. Normative need is defined by a dental professional and is the ability to biologically benefit from orthodontic treatment, in terms of occlusion. This definition does not include demand for treatment, or the potential detrimental effects caused by orthodontic treatment.

The BASCD co-ordinated dental epidemiology survey of 12-year-olds (2008/09) included measurement of orthodontic need in the sample of 12-year-old children examined and can be used to estimate normative need (Figure 1)

Figure 1: Prevalence of Orthodontic Treatment Need by local authority

Location (Former PCT geography)	12-year-old population (Mid-2008)	Examined (n) from the drawn sample	Examined (%) from drawn sample	Number of children examined with NEED	% of children examined with NEED
England	608, 460	89,442	74.1%	28,269	31.6%
Derby City	2794	534	77.2%	112	21%
Derbyshire County	8934	1829	71.0%	453	24.8%
Nottingham City	2849	423	86.3%	143	33.8%
Nottinghamshire County (excluding Bassetlaw)	7839	1183	75.0%	335	28.3%

Source: Survey of the dental health of 12 year olds (2008/09) - http://www.nwph.net/dentalhealth/

Incorporating Demand for Treatment

Although the biological treatment need is important, not all those children who have need, for orthodontic treatment, will demand it. Therefore, demand for orthodontic treatment is an important consideration when estimating likely uptake of treatment.

Figure 2 demonstrates a range of need across Derbyshire and Nottinghamshire, which take in to account of those have a biological need with those who also express demand for treatment. It is clear from the data that not all individuals who have a need for treatment will demand it.

In 2008/09 in the expressed demand for orthodontic care (children who think their teeth need straightening and are prepared to wear an appliance) was similar across the geography (Derby City – 34.3%, Derbyshire – 35.3%, Nottingham City – 34.5%, Nottinghamshire – 31%) and when compared with England (35.4%). Figure 2 illustrates that in 2009 lower proportions of 12-year-olds across Derbyshire and Nottinghamshire with an identified but unmet need were prepared to demand care.

Figure 2: Orthodontic Need and Demand

Location (Former PCT geography)	Examined (n)	No. of children examined with NEED	% of children examined with NEED	No. of children examined who DEMAND and NEED	% children examined who DEMAND and NEED
England	89,442	28,269	31.6%	17,238	19.3%
Derby City	534	112	21%	73	13.7%
Derbyshire County	1829	453	24.8%	307	16.8%
Nottingham City	423	143	33.8%	74	17.5%
Nottinghamshire County (excluding Bassetlaw)	1183	335	28.3%	201	17%

Source: Survey of the dental health of 12 year olds (2008/09) - http://www.nwph.net/dentalhealth/

It is important to include the number of 12-year-olds already wearing an appliance when assessing orthodontic need (who were not considered in Figure 2). It can be assumed that the children already in receipt of treatment had the biological need and the demand to engage with this treatment. The variation in those wearing and appliance across Derbyshire and Nottinghamshire ranged from 3.8% to 9.7%, compared with the England prevalence of 7.9%.

Figure 3: Proportion of children examined in the survey of 12-year-olds (2008/09) already wearing an appliance

Location (Former PCT geography)	No of children already wearing an appliance	% of children examined wearing an appliance
England	7,105	7.9%
Derby City	48	9%
Derbyshire Country	178	9.7%
Nottingham City	16	3.8%
Nottinghamshire County (excluding Bassetlaw)	77	6.5%

Source: Survey of the dental health of 12 year olds (2008/09) - http://www.nwph.net/dentalhealth/

The next step is to convert the data based on the sample of 12 year olds resident in the region to illustrate the need and demand for treatment across all 12 year olds across the geography (Figure 4).

Figure 4: Need and demand for treatment across all 12 year olds in the NHS England North Midlands (Derbyshire & Nottinghamshire) geography.

Location (former PCT geography)	12 Year old population (Mid-2008) A†	No. of children with NEED and DEMAND (not wearing an appliance) B†	Estimated 12 year old population already wearing an appliance C†	Total (Need, demand and appliance) D (B+C)	Proportion of 12 year olds with need and demand compared to all 12 year olds (%) E (B+C/A*100)
England	608,460	117, 267	48,334	165,602	27.2%
Derby City	2794	382	251	633	22.7%
Derbyshire County	8934	1500	869	2369	26.5%
Nottingham City	2849	498	108	606	21.3%
Nottinghamshire County (excluding Bassetlaw)	7839	1332	510	1842	23.5%

†Source: Survey of the dental health of 12 year olds (2008/09) - http://www.nwph.net/dentalhealth/

Impact of Dental Caries

The numbers of 12-year-olds with a biological need for orthodontic treatment and a desire to proceed has been calculated (column D, Figure 4) but this may be an overestimate of the orthodontic treatment needed across the region, because those children who are not suitable for treatment (active caries/poor oral hygiene) have not been considered. Regardless of normative need and demand, 12-year-olds with active decay or poor oral hygiene are likely lead to the patient being refused treatment, or at least having their access to treatment delayed, due to the risk of compromising their of overall dental health.

Based on the 2008/09 dental survey data for 12-year-old children, 17.9% of children across the East Midlands had active decay into dentine in one or more teeth (Range - Nottingham City 22.8%, Derbyshire 9.8%). This may delay or make them unsuitable to undertake orthodontic treatment.

Additionally, 9% of children across the East Midlands were assessed as having substantial plaque deposits which may prohibit treatment. This can be compared with the national England average of 10.5%. There may be an overlap between the group with plaque and the group with caries; however, this cannot be quantified from the available data. Even if all children needing orthodontic treatment became dentally fit, had good oral hygiene and attended regularly, there will still be a proportion who do not take up the offer of orthodontic treatment. Thus, demand for treatment will always be less than normative need.

Given the evidence (i.e. children who have a carious lesion are more likely to have poor OH, reports of receptiveness in children when given OHI and support in oral care by hospital teams) it seems reasonable to estimate that approximately 17% of children may be unsuitable for orthodontic care. Therefore, the need identified in Column E in Figure 4 will need to be modified to take account of this (see Figure 7).

Orthodontic Need Following Premature loss of Primary Teeth

Evidence from historic cohort studies has confirmed that space loss in the primary dentition occurs following extraction of the primary molars (Northway et al, 1989, Hoffding and Kisling, 1978). As a result, dental clinicians are encouraged to manage or restore primary teeth where possible in order to maintain space in the permanent dentition and minimise possible orthodontic crowding (Bhujel et al 2014).

Despite this, there has been relatively little evidence to review the long term impact of premature extraction of primary teeth and subsequent need for orthodontic treatment. A study of 107 children who accessed the salaried dental service did find a positive association between the number of primary teeth extracted and orthodontic need in the permanent dentition (Bhujel et al 2014). A more recent systematic review identifying 513 studies concluded that although premature

extraction of primary deciduous molars is associated with various features of malocclusion and space loss in the mixed and permanent dentition, no studies that met the inclusion criteria describe the effects of premature extraction on subsequent need for orthodontic treatment (Bhujel et al, 2016). This highlights the importance of early detection and management of the resultant space problems associated with premature loss of deciduous teeth in order to reduce features of malocclusion (Murshid et al 2016, Al-Shahrani et al 2015, British Orthodontic Society, 2010).

Without quantifiable evidence this will not be further considered in this needs assessment.

Need for interceptive and adult orthodontics

The Standing Dental Advisory Committee report by Stephens (1992) detailed an unpublished report of a predictive method, which could be used to assess future orthodontic treatment need based on the 11-12year olds population. The formula is shown below:

$$\frac{*\text{12 year old popn.}}{3} \times \frac{100 + \text{interceptive factor} + \text{adult factor}}{100}$$

* '12 year old population/3' quantifies the 12 year old population need. When epidemiological data is available to estimate the need of the 12 year old population, the first part of this equation is not needed. However, the second part of the formula can be used to estimate the need for interceptive and adult orthodontic treatment.

Within the paper, Stephen`s (1992) assumed that 33% of children would fall into IOTN categories 4 & 5 (NHS England, 2011). Stephens considered that those in DHC 3 needing treatment is offset by the proportion of cases in categories 4 & 5 who despite a normative need for orthodontic treatment will decline treatment (NHS England, 2011). Stephens suggests that the interceptive factor should be 9% and the adult factor should be 4%, however, there is no explanation to support these percentages (NHS England, 2011). It is assumed therefore that these have been chosen by professional judgement, and as there is no current evidence to inform this decision they will be applied with the understanding that they may not be directly proportionate to the populations covered within this needs assessment.

Figure 5: Orthodontic need in Derbyshire and Nottinghamshire based on the Stephen's formula

	Population			33% of population			Stephen's Formula		
	2008	**2019**	**2029**	**2008**	**2019**	**2029**	**2008**	**2019**	**2029**
Derby City	2794	3300	3360	931	1100	1120	933	1101	1121
Derbyshire County	8934	8840	8960	2978	2947	2987	2982	2950	2991
Nottingham City	2849	3620	3840	950	1207	1280	951	1208	1282
Nottinghamshire County	7839	9400	9860	2613	3133	3287	2616	3137	3291
Total case starts per year				**7472**	**8387**	**8673**	**7482**	**8398**	**8685**

Stephen's formula however ignores the impact of demand and those who may be considered unsuitable for orthodontic care due to poor oral hygiene or untreated decay.

Subjective Need

Subjective need is the need experienced by the patient themselves. The majority of orthodontic treatment is carried out due to aesthetic or psychosocial reasons, most frequently amongst females (Grzywacz, 2003, BOS, 2012 and Chestnut et al 2016). In order to benefit from orthodontic treatment, both objective and subjective need must be present together. However, the relationship between objective and subjective need is complex and difficult to predict (White and Patel, 2017).

It has been well documented in the literature that patients, parents and clinicians differ in their perception of orthodontic treatment need based on facial appearances (Hamden, 2004 and Juggings et al 2005). The IOTN is useful in clearly defining objective need, but fails to take into account the perception of need or the social impact of malocclusion from the perspective of the patient and parents. According to the Child Dental Health survey (2013), 44% of 12-year-olds and 28% of 15-year-olds would like to have their teeth straightened. It has also been shown that parents can overestimate their child`s subjective need (Birkeland et al 1996, Espeland et al 1992, Gosney 1986, Pietila and Pietila 1994, Hamdan, 2004). The perceptions of children and their parents however did not show high levels of agreement with the assessment of treatment need from the clinical examination (Figure 6). Therefore, both clinical and subjective standpoints need to be considered when assessing orthodontic treatment need (Child Dental Health Survey, ONS, 2013).

In addition, children have also been shown to both over or under estimate their subjective need in comparison to clinically assessed objective need (using the IOTN aesthetic component) (Mohlin et al, 2002, Birkeland et al 1996). This difference

between clinically defined need and the perceived need of patients and parents has led to some research suggesting value in combining IOTN with Quality of Life indicators to enhance orthodontic treatment need assessments (De Oliveira et al 2008).

Perceptions of orthodontic treatment need are complex and multifactorial. It is important to be aware that malocclusion is affected by psychological, social and cultural variables and subjective need is thus individually determined (Shaw, 1981).

Figure 6: Parent reported need for orthodontic treatment, by child self-assessment

England, Wales and Northern Ireland, 2013		Percentages	
Children aged 12, 15 with a parent assessment		12 years	15 years
Self assessment	**Parent assessment**		
My teeth are all right	Their teeth are all right	86	88
	Would prefer them straightened	7	5
	Child in treatment	7	7
Would prefer my teeth straightened	Their teeth are all right	35	50
	Would prefer them straightened	46	42
	Child in treatment	18	8
Unweighted bases			
Their teeth are all right		*355*	*397*
Would prefer their teeth straightened		*346*	*204*

Table 1.10 does not report on children who said they were in treatment, or those who couldn't make an assessment, due to low base sizes

Figure 7 illustrates the estimated local orthodontic treatment need for 12 years olds based on the 2008 population and epidemiological data, which has been adjusted to take account of:

- Patient demand
- Caries rates
- Children already wearing an appliance
- Need for interceptive orthodontic care in younger in children
- Need for orthodontic treatment in adults (>18-years)

The estimated number of case starts per year within the Derbyshire and Nottinghamshire requiring access to orthodontic treatment based on the 2008 population ranges between 5408 and 7292 when demand and caries are taken into account.

The caries data in 12-year-olds on which these calculations are based were collected during 2008/09. During the intervening time period oral health of 5-year-olds has continued to improve (Local authority area variation in the oral health of 5-year-olds, PHE, 2018).

Distribution of caries in 12-year-olds is known to reflect the distribution in 5-year-olds, so it is reasonable to assume that there may be an improving trend in 12-year-olds. As this cannot be quantified with available data, the lower limit has been calculated without adjustment for caries (Column O). Although the upper limit is presented without adjustment for caries (Column P) it is inappropriate to use this figure as the 12-year-old population are not without characteristics that would prevent some individuals from taking up care (active decay and /or inability to achieve and maintain good oral hygiene).

Therefore, the estimated number of case starts per year within the Derbyshire and Nottinghamshire requiring access to orthodontic treatment based on the 2008 population ranges between 6159 and 7292 when only demand is taken into account.

Figure 7: Orthodontic treatment need for the resident population of Derby, Derbyshire, Nottingham and Nottinghamshire (2008)

	Estimated normative need & demand of 12-yr-olds but no appliance	Estimated normative need & demand of 12-yr-olds but no appliance adjusted for caries i.e. **reduced by 17%**	Estimated normative need of 12 year olds (no appliance)	Estimated normative need of 12-yr-olds adjusted for caries (no appliance) i.e. **reduced by 17%**	Estimated normative need and demand in 12-yr-olds - appliance fitted	Estimated need of remaining population (younger children and >18 yrs.) i.e. increase **by 13%**	Estimated need of remaining population adjusted for caries (younger children and >18 yrs) i.e. reduced **by 17%**	Estimated adjusted need (taking into account need demand and caries) **Lower estimate of need**	Estimated adjusted need (taking into account need and caries) **Upper estimate of need**	Estimated adjusted need (taking into account need and demand ***but not caries***) **Lower estimate of need**	Estimated adjusted need (taking into account need ***but not caries***) **Upper estimate of need**
	F	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**
Data Source	Figure 4 col B	Column F x 0.83	Figure 1 - population 12-yr-olds (2008) x % need	Column H x 0.83	Figure 4 column C	Figure 4 Column D x 0.13	K x 0.83	G+J+L	I+J+L	F+J+K	H+J+K
Derby City	382	317	586	486	251	82	68	636	806	715	919
Derbyshire County	1500	1245	2213	1837	869	308	256	2370	2962	2677	3390
Nottingham City	498	414	963	799	108	79	65	587	973	685	1150
Nottinghamshire County	1332	1105	2220	1842	510	239	199	1814	2551	2082	2970
Total number of case starts required per year (2008)								**5408**	**7292**	**6159**	**8429**

The wearing of an orthodontic appliance has become increasingly acceptable within the past 20 years together with the change towards use of fixed appliances compared with removable appliances (Figure 8). If this trend continues, the difference between the lower and upper estimate may further reduce.

Figure 8: Types of orthodontic appliance worn by children wearing an orthodontic appliance at the survey examination (CDH Surveys, ONS, 1993, 2003)

Types of Appliance	12 years	
	1999	2003
Fixed	49%	72%
Removable	50%	28%
Other	2%	3%

https://www.nature.com/articles/4813640.pdf?origin=ppub

Anticipating future trends in population growth

In June 2016, the UK mid-year population estimate was 65,648,100 and the number of people resident in the UK rose by 0.8% (538,000 people) (ONS, 2017). The estimated total population for Derby City, Derbyshire County, Nottingham City and Nottinghamshire mid-2016 is 4,724,437.

During the 10 years between mid-2016 and mid-2026, the projections for the UK suggest that 7.7 million people will be born, and 6.1 million people will die (ONS, 2017). The estimates stated in Figure 7 for orthodontic treatment need are based on the 12-year-old population across Derby City, Derbyshire County, Nottingham City and Nottinghamshire County at the time of the epidemiological survey. Figure 9 illustrates that estimated changes in the population of 12-year-olds. The projected 12-year-old population in Derby City and Derbyshire County is expected to stay relatively stable; however, increases similar to the changes at regional and national level are expected in Nottingham City and Nottinghamshire County. Therefore, such changes in population need to be considered when planning orthodontic services for the Derbyshire and Nottinghamshire population. It must also be noted that these figures may be an overestimation, as this does not take into account infant mortality rates, which may not be proportionate.

The influences of migration and emigration and the impact of new housing developments derived from local authority plans have also be considered and are described in Appendix 1.

Figure 9: Anticipating future trends in population growth

	Population of 12-year-olds			
	2008	**2019***	**2029***	**% change 2008 to 2029**
England	608,460	665,700	702,700	15%
Derby	2794	3300	3360	20%
Derbyshire	8934	8840	8960	0%
Nottingham	2849	3620	3840	35%
Nottinghamshire	7839	9400	9860	26%
Derbyshire & Nottinghamshire	22,416	25,160	26,020	**16%**

* ONS 2014-based Subnational population projections

https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/livebirths/datasets/birthsbyareaofusualresidenceofmotheruk

In order to future proof the commissioning plans it is appropriate to plan services based on the predicted population sizes anticipated throughout the duration of the contract. Using the predicted 16% increase in the population of 12-year-olds between 2008 and 2029, Figure 10 applies a 16% uplift to the estimates based on the 2008 data.

Figure 10: Orthodontic treatment need for the resident population of Derby, Derbyshire, Nottingham and Nottinghamshire (2008 to 2019)

	Estimated adjusted need (considering need demand and caries) **Lower estimate of need**	Estimated adjusted need (considering need and demand ***but not caries***) **Lower estimate of need**	Estimated adjusted need (considering need and caries) **Upper estimate of need**
	M	O	N
2008	5408	6159	7292
2029	6273	**7144**	**8458**

Therefore, the estimated number of case starts per year within the Derbyshire and Nottinghamshire requiring access to orthodontic treatment based on the estimated 2029 population ranges between 7144 and 8458 when only demand is taken into account.

3. Orthodontic service provision for the responsible population of Derby City, Derbyshire, Nottingham City and Nottinghamshire

Who provides services and what quantity of treatment is commissioned and provided?

Primary Care Orthodontic Services

Orthodontic care is commissioned in terms of volume of orthodontic activity which includes assessments, interceptive orthodontic treatment and full courses of treatment. It is measured by Units of Orthodontic Activity (UOAs). UOAs may be commissioned according to two systems. Recurrent commissioning accounts for the volume of UOAs that are commissioned year on year and are agreed before the start of the financial year between local NHSE commissioners and the provider with the provider being contractually bound to supply the volume of 'work', in terms of UOAs, that have been commissioned throughout the year. This component represents the steady state of activity which can be expected each year. If the needs of the resident population of the commissioning geography are expected to stay stable then the number of recurrent UOAs commissioned should both remain constant and match the identified need.

Non-recurrent commissioning accounts for extra funding that may be available in the short term only. It may be useful to help manage a historical waiting list for example (as recurrent funding may meet current need and demand but be insufficient to deal with cases of historical need). When examining data on provision of orthodontic care it is important to be clear regarding what proportion of cases have been funded recurrently and what proportion have been funded non-recurrently.

There was a total of 40 contracts commissioned to provide orthodontics within primary care across Derbyshire and Nottinghamshire in the financial year 2016-17. Practitioners were contracted to provide either mixed GDS and orthodontic care (27 contracts) or purely orthodontic care (13 contracts). All commissioned activity is recurrent (Figure 11).

Appendix 2 provides a description of the location of the currently commissioned primary care orthodontic provision together with how this relates to the distribution of the 12-year-old population across Derbyshire and Nottinghamshire and local travel distances and times.

Figure 11: Orthodontic contracts held and number of case starts recurrently provided.in Derbyshire and Nottinghamshire by CCG (2016/17).

CCG	**No. of contracts (April 2016-March 2017**	**Mixed**	**Orthodontic only**	**No. of recurrent UOAs commissioned in 2016/17**	**Case Starts provided (Estimated 22.5 UOAs)**	**Case starts (Actual)** Assess and Accept FP17Os*
NHS Erewash	2	2	0	2608	116	352
NHS Hardwick	1	1	0	3233	144	435
NHS Mansfield and Ashfield	3	2	1	21183	941	730
NHS Newark and Sherwood	2	2	0	1892	84	332
NHS North Derbyshire	11	9	2	24938	1110	789
NHS Nottingham City	5	1	4	33313	1481	869
NHS Nottingham North and East	2	2	0	1685	75	464
NHS Nottingham West	0	0	0	0		377
NHS Rushcliffe	2	1	1	15818	703	375
NHS Southern Derbyshire	6	2	4	17622	783	1878
NHS Southern Derbyshire – Derby City	6	5	1	18493	822	
Total	**40**	**27**	**13**	**140815**	**6258****	**6601**

*Based on CCG of residence of patient

**Numbers rounded up to whole integers

In an efficient system whereby, a case should be started for every 22.5 UOAs commissioned in accordance with the Department of Health recommendations the total number of recurrent UOAs commissioned in Derbyshire and Nottinghamshire (140815) equates to 6528 case starts. This doesn't take account of the number of interceptive cases which would only attract 4 UOAs and so slightly underestimates the no. of case starts we would expect for that number of commissioned UOAs.

During 2016/17 there were **c6601** case starts compared with an anticipated **6528**. This suggests that across all contracts that there is efficient utilisation of UOAs compared with the reference number of 22.5 UOAs per case. There is some variation across contracts.

It may **appear** from the previous table that there is uneven provision of care across the Derbyshire and Nottinghamshire. However, without an assessment of patient flow, both within and beyond the Derbyshire and Nottinghamshire geography and in terms of non-residents that receive treatment in Derbyshire and Nottinghamshire and residents of this area that receive treatment elsewhere, we are unable to assess if the current provision of orthodontic treatment matches the needs of the resident population.

Outflow

This is concerned with where patients who reside in the Derbyshire and Nottinghamshire geography were treated, if they received treatment 'out of area'. The patient is assigned as a resident of the Derbyshire and Nottinghamshire commissioning geography based on the home postcode recorded in the personal details section of each FP17O submitted to the NHSBSA and therefore is dependent on this information being included and accurate in the records. During 2016/17, 292 case starts were provided, mainly within the commissioning geographies of Cheshire, Warrington and the Wirral, South Yorkshire and Bassetlaw and Leicester and Lincolnshire (Figure 12). What is not known from this data is the reason why patients received care out of area and may not reflect lack of access to care but rather patient's choice or convenience

In summary, in 2016/17 for the residents of Derbyshire and Nottinghamshire there were 6601 orthodontic case starts provided in primary care within the Derbyshire and Nottinghamshire commissioning geography and 292 case starts out with the Derbyshire and Nottinghamshire geography.

Figure 12: Derbyshire and Nottinghamshire residents treated in primary care out with their resident commissioning geography.

Contract Health Body	Assess and Accept FP17Os (case starts)
Cheshire, Warrington and Wirral	102
South Yorkshire and Bassetlaw	93
Leicestershire and Lincolnshire	69
Shropshire and Staffordshire	15
Greater Manchester	8
Arden, Herefordshire and Worcestershire	5*
North Yorkshire and Humber	
Total	**292**

Source: NHSBSA
*Numbers less than 5 suppressed.

Inflow

NHSBSA Dental Services data for 2016/17 reports that 6% of patients commencing treatment within the Derbyshire and Nottinghamshire commissioning boundaries live outside the boundaries, the majority living within the areas of South Yorkshire and Bassetlaw, Leicester and Lincolnshire and Shropshire and Staffordshire (Figure 13). This accounts for **c452** case starts. Whilst this is not relevant to the calculation of need in the resident population, it is relevant to the level of commissioning required to meet the needs of those attending local dental practices within Derbyshire and Nottinghamshire. This number of case starts should be factored into the required level of local commissioning for primary care orthodontics.

Figure 13: Inflow of primary care patients to Derbyshire and Nottinghamshire

Area of residence	Assess and Accept FP17Os (case starts)
Unknown	138
South Yorkshire and Bassetlaw	138
Leicestershire and Lincolnshire	133
Shropshire and Staffordshire	37
Birmingham and The Black Country	6*
Cheshire, Warrington and Wirral	
Greater Manchester	
West Yorkshire	
Total	**452**

*Numbers less than 5 suppressed.

Secondary care orthodontic services

There are four locations across NHS England North Midlands (Derbyshire and Nottinghamshire) that provide a secondary care orthodontic service. These four hospital orthodontic departments are managed by three Acute NHS Trusts (Figure 14):

Figure 14

Hospital	Provider Trust
Royal Derby Hospital, Derby	University Hospitals of Derby and Burton NHS Foundation Trust
Chesterfield Royal Hospital, Chesterfield	Chesterfield Royal Hospital NHS Foundation Trust
Queen's Medical Centre, Nottingham	Nottingham University Hospitals NHS Trust
Kingsmill Hospital, Mansfield	Sherwood Forest Hospitals NHS Foundation Trust Orthodontic service provided by : Nottingham University Hospitals NHS Trust

Descriptions of the services provided at each site are shown in Appendix 3.

The case mix in secondary care is different from primary care, with hospital orthodontic departments acting as a referral centres for cases that are too complex to be treated by the skill level available in primary care or which need input from a variety of specialties available in a secondary care setting. Secondary care practitioners also provide advice on treatment planning for colleagues in primary care, with patients referred back to their primary care dentists after a treatment plan has been provided by the consultant.

Activity data recorded relates to the number of first appointments and follow up appointments carried out in each unit. These follow-up visits may include: active orthodontic treatment, treatment with a hygienist/orthodontic nurse (e.g. to improve oral hygiene prior to commencing or during treatment), review visits etc.

In total, residents of the Derbyshire and Nottinghamshire attended 2942 first visits at secondary care orthodontic units within the D&N geography and 24,575 follow up visits within the financial year 2016-17 (Figure 15).

Figure 15: First and follow up appointments by CCG of residence and Trust (2016/17).

CCG of residence	Royal Derby Hospital		Chesterfield Royal Hospital		QMC, University of Nottingham Hospitals		Kingsmill, University of Nottingham Hospitals				
	1st	FUp	1st	FUp	1st	FUp	1st	FUp	Total 1st appoint-ments	Total appoint-ments	Case starts* (2.55 conversion)
NHS Erewash	61	960	1	1	25	202	0	0	**87**	1250	**34**
NHS Hardwick	13	65	63	469	9	32	0	33	**85**	684	**33**
NHS Mansfield and Ashfield	3	36	13	297	67	376	0	98	**83**	890	**33**
NHS Newark and Sherwood	0	7	3	60	37	228	0	38	**40**	373	**16**
NHS North Derbyshire	6	57	179	1693	3	10	0	0	**188**	1948	**74**
NHS Nottingham City	2	89	0	4	160	1187	0	0	**162**	1442	**64**
NHS Nottingham North and East	1	44	2	3	60	690	0	0	**63**	800	**25**
NHS Nottingham West	9	105	4	10	53	390	0	0	**66**	571	**26**
NHS Rushcliffe	1	40	0	1	51	504	0	0	**52**	597	**20**
NHS Southern Derbyshire	714	10071	38	139	12	88	0	9	**764**	11071	**300**
Total	**810**	**11474**	**303**	**2677**	**477**	**3707**	**0**	**178**	**1590**	**19626**	**624**

*Numbers rounded up to whole integers

Hospital Trusts are not routinely required to collect information regarding the number of cases started in hospital. They report only the number of first appointments and follow-up appointments. However, the number of cases started is essential information for a needs assessment.

It is possible to estimate how many cases are started if all initial case starts are PAR scored and abandoned cases accounted for. In NHS North Midlands (Shropshire and Staffordshire) all case starts are PAR scored and abandoned cases accounted for at University Hospital North Staffordshire (UHNS). During a reference period 252 cases were started. It is therefore possible to estimate the number of cases starts in other units if one assumes that other consultant-led units have a similar case mix.

A conversion rate based on initial appointments and actual case starts was calculated for UHNS and is used in the NHS North Midlands (Shropshire and Staffordshire) orthodontic needs assessment. The number of initial appointments at UHNS (644) was divided by the number of case starts (252) to obtain a value of 2.55. The number of case starts undertaken by other units could then be estimated based on the number of initial visits undertaken (Figure 16). For the residents of Derbyshire and Nottinghamshire **c624** case starts were made in secondary care during 2016/17.

Figure 16: Estimated number of case starts in secondary care units in Derbyshire and Nottinghamshire (2016/17)

	No. of initial visits	**Estimated no. of case starts (2.55 conversion factor)**
Royal Derby Hospital	810	318
Chesterfield Royal Hospital	303	119
Queens Medical Centre	477	187
Kingsmill Hospital	0	0
Total	**1590**	**624**

Out Flow

In the same way that residents of Derbyshire and Nottinghamshire cross 'health borders' to receive orthodontic treatment in primary care, this situation occurs in secondary care.

The total number of initial visits for residents of Derbyshire and Nottinghamshire provided by out of area secondary care orthodontic units is 375 (Figure 17). This equates to **c147** case starts.

Figure 17: Out flow first and follow up appointments by CCG of residence and Trust

CCG of residence	Walsall Health Care NHS Trust		Sheffield Teaching Hospitals NHS FT		Univ Hospitals of North Midlands NHS Trust		Burton Hospitals NHS FT		East Cheshire NHS Trust		The Royal Wolver-hampton NHS Trust		Birm-ingham Women's and Childrens NHS FT		Heart of England NHS FT		United Lincoln-shire Hospitals NHS Trust		Stockport NHS FT		Shrews-bury and Telford Hospitals NHS Trust		Total (1st +FU)
	1st	FU	1st	FU	1st	FU	1st	FU	1st	FU	1st	FU	1st	FU	1st	FU	1st	FU	1st	FU	1st	FU	
Erewash	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0+2
Hardwick	0	0	17	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17+88
Mansfield and Ashfield	0	0	9	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9+40
Newark and Sherwood	0	0	7	48	0	0	0	6	0	0	0	0	0	0	0	0	32	383	0	0	0	0	39+431
North Derbyshire	0	0	164	963	0	2	0	0	5	83	0	0	0	0	0	0	0	0	51	533	0	3	220+ 1581
Nottingham City	0	9	4	16	0	11	0	7	0	0	1	5	0	0	0	26	1	25	0	10	0	2	6+109
Nottingham North and East	0	0	5	7	0	8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5+16
Nottingham West	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0+1
Rushcliffe	0	0	2	14	0	0	0	0	0	0	0	0	0	0	0	0	2	28	0	0	0	0	4+42
Southern Derbyshire	0	9	6	46	2	16	67	666	0	0	0	2	0	1	0	20	0	3	0	1	0	0	75+764
Total	**0**	**9**	**215**	**1222**	**2**	**37**	**67**	**680**	**5**	**83**	**1**	**7**	**0**	**1**	**0**	**46**	**35**	**441**	**51**	**544**	**0**	**5**	**375+ 3074**

Private orthodontic services

It is not possible to determine the level of private provision of orthodontic care to residents of Derbyshire and Nottinghamshire and the degree to which this may contribute to meeting the needs of the population.

In summary, an estimated 7664 NHS commissioned orthodontic case starts were provided for residents of Derbyshire and Nottinghamshire during 2016/17 (Figure 18).

Figure 18: Summary of estimated orthodontic case starts for residents of Derbyshire and Nottinghamshire (2016/17)

<table>
<tr><th>Patient area of residence</th><th>Primary care case starts within D&N</th><th>Primary care case starts outwith D&N</th><th>Secondary care case starts within D&N</th><th>Secondary care case starts outwith D&N</th><th>Total case starts provided for D&N residents</th></tr>
<tr><td>Derby</td><td rowspan="2">3454</td><td rowspan="4">292</td><td>318</td><td rowspan="4">147</td><td rowspan="4"></td></tr>
<tr><td>Derbyshire</td><td>119</td></tr>
<tr><td>Nottingham</td><td>869</td><td rowspan="2">187</td></tr>
<tr><td>Nottinghamshire (excluding Bassetlaw)</td><td>2278</td></tr>
<tr><td>Total</td><td>6601</td><td>292</td><td>624</td><td>147</td><td>7664</td></tr>
</table>

Needs assessments should be refreshed at regular intervals and as further data becomes available. This needs assessment has not considered existing waiting times. The recent introduction of the referral management system will contribute valuable data to future revision of this needs assessment. As NHS England moves closer to commissioning the ‘appropriate amount’ of orthodontic care then waiting times will be more relevant and will be a test of whether sufficient volume of services are being commissioned (assuming efficient use of UOAs).

Quality of Orthodontic Services

As part of an orthodontic need assessment, the quality of services provided should be reviewed in addition to quantifying the gap between the needs of the population of Derby City, Derbyshire, Nottingham City and Nottinghamshire and current orthodontic service provision. This should include review of the effectiveness, efficiency, acceptability and accessibility. In doing so, this will further aid commissioners' understanding of local orthodontic service provision. It is noted that NHS England are commissioning external calibrated PAR scoring and it is recommended that future primary care orthodontic contracts include as a minimum requirement that performers participate in an orthodontic managed clinical network (MCN) and undertake PAR scoring.

The accessibility of currently commissioned orthodontic services is described in Appendix 2.

Conclusion

This needs assessment has been used to identify the population need and the current level of service provision in both primary and secondary care. The inequity between need and provision of service across the geography Derbyshire and Nottinghamshire has also been identified and highlighted.

Various methods of determining orthodontic treatment need in a population have been explored for the population of Derbyshire and Nottinghamshire and produce broadly comparable estimates.

The **estimated** number of case starts per year within Derbyshire and Nottinghamshire requiring access to orthodontic treatment when only demand (and not caries) is taken into account., based on the locally available epidemiological evidence and taking into account predicted population growth between 2008 and 2029 lies within the range **7144 and 8458**.

The current estimate of annual total case starts (primary and secondary care) across Derbyshire and Nottinghamshire **7664.**

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13th December 2018

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Appendix 1 – Population growth

Migration and Immigration

During the 10 years between mid-2016 and mid-2026 the ONS (2017) estimated that 5.2 million people will immigrate, and 3.2 million people will emigrate long-term from the UK. This has implications for the planning of orthodontic services in the East Midlands, affecting net population measures, with a resultant 3.6 million increase in total population (ONS, 2017). 1.6 million (46%) is projected to result from the higher number of births than deaths and 1.9 million (54%) is projected to result directly from net international migration (ONS, 2017).

Housing Projections

Drafted housing developments in Nottinghamshire County are likely to be completed in the next 3 -5 years, and therefore, it can be assumed that this will be potential source of population expansion. A further 25,575 units are estimated to be deliverable by 2022/23 across the county, and it is assumed that the population would increase be an average of 2.3 people per dwelling (Nottinghamshire County Council, 2017).

Similarly, in Nottingham City, the Core Strategy predicts 5,640 dwellings will be built between 2017 and 2022, and a further 5,870 dwellings between 2022 and 2027 with an assumed average of average of 2.5 persons for dwellings (Nottingham City Council, 2017).

The Derby City Plan outlines a target to establish 11,000 new homes to 2028, where the annual delivery of new homes is expected to rise to over 1000 per year in the following years (Derby City Public Health Department, 2017).

Increases in future housing have also been planned across the county of Derbyshire (Derbyshire Public Health Department, 2017).

Thus, it is reasonable to assume that estimated increases in the population will result from planned housing, which needs to be considered in terms of future orthodontic provision. However, these figures are likely to be an overestimate, as many of these units may be inhabited by people already living in the district, particularly where there is local pressure on housing (Nottinghamshire County Council, 2017). This does not take into account emigration, or the expansion of the population in Nottingham City being dominated by increases in the student population, who tend to be single occupancy (Nottingham City Council, 2017).

Appendix 2 – Primary care orthodontic provision

Orthodontic service provision, including volume of provision, has been mapped to the distribution of the 12-year-old population across the commissioning geography in Derbyshire and Nottinghamshire (Figure 19).

Figure 19: Primary care orthodontic provision in Derbyshire and Nottinghamshire and the distribution of the 12-year-old population

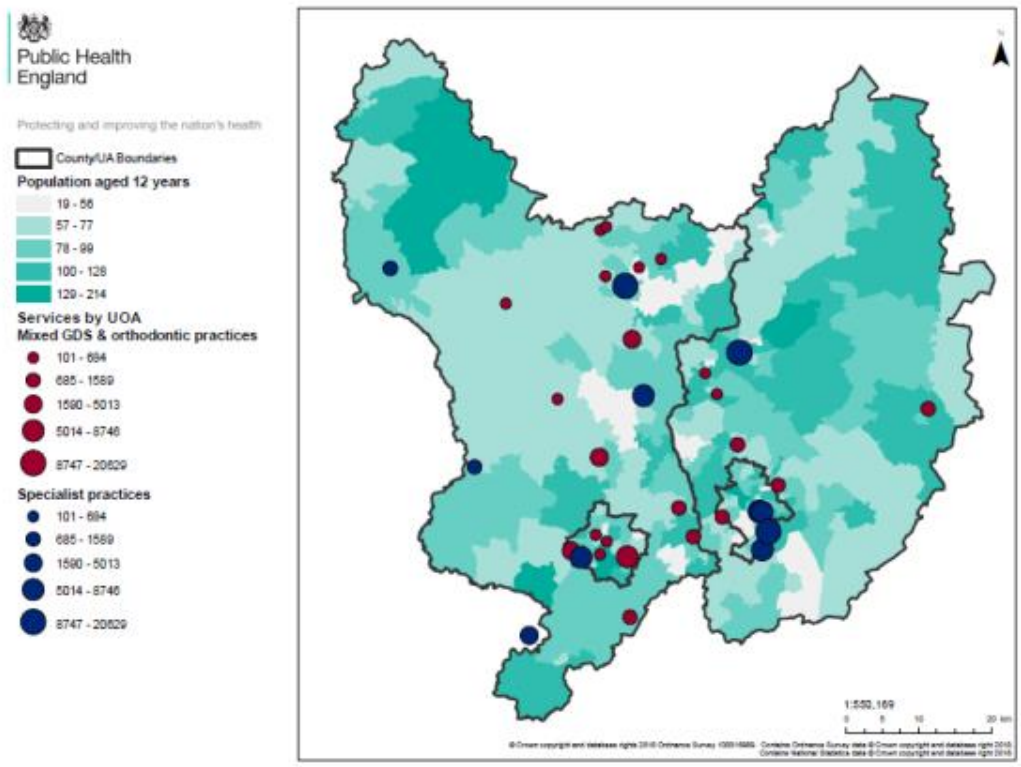
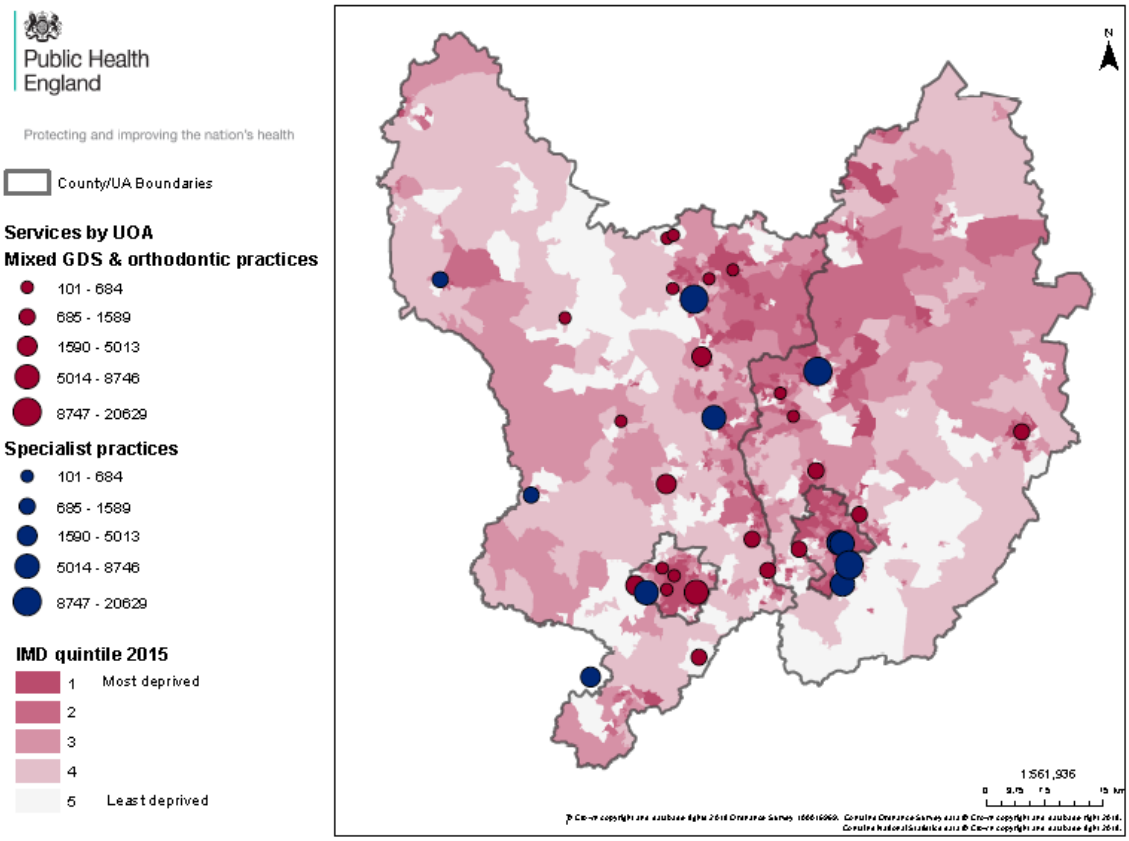


Figure 20 also maps the distribution of currently commissioned primary care orthodontic services to deprivation. Higher levels of deprivation are known to be associated with poorer oral health (caries and oral hygiene) and reduced access to services both in terms of the funds and the means to travel to appointments at some distance, particularly for those living in more rural areas.

Figure 20: Primary care orthodontic provision in Derbyshire and Nottinghamshire and deprivation in the general population



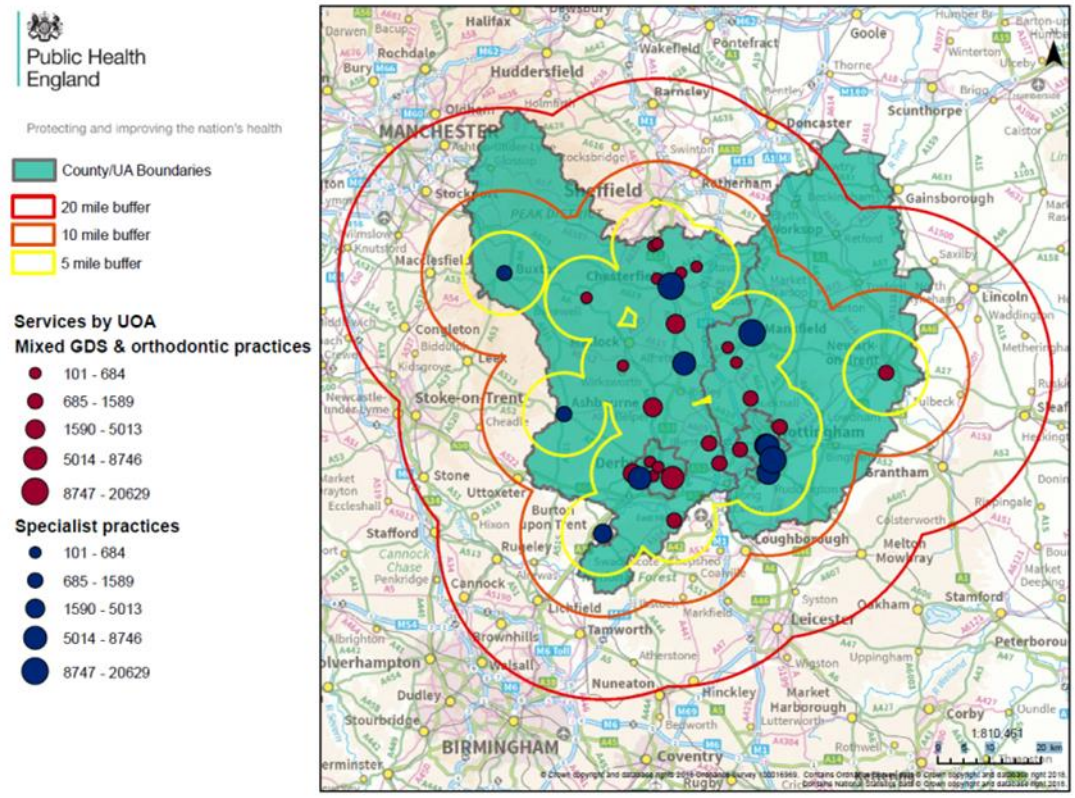
The distribution of practices has also been mapped to explore physical access (Figure 21). In in the High Peak district of Derbyshire, there is only one specialist orthodontic practice and no provision in the North and North-East of Nottinghamshire. As a consequence, patients need to travel longer distances, in the case of High Peak to access services in Chesterfield or across the border towards Manchester, or for North/NE Nottinghamshire patients may travel north towards Doncaster or east towards Lincoln as the nearest alternative specialist orthodontic service.

In the autumn term of 2016, the percentage of absences in state funded secondary schools due to medical or dental appointments was 6.6% (Department of Education, 2017). This is now monitored by Ofsted. There have been a reported 233 school dental absences in a 3-month term at Chapel High School, of which 93 were orthodontic appointments (Edwards, 2018). This figure represents a high number of

children in a single term who have had to miss lessons in order to access orthodontic treatment in Chesterfield or Macclesfield. The distribution of the 12-year-old population (Figure 19), the proximity of other orthodontic services and rurality need to be considered in planning accessible orthodontic service provision for all who need and want to access it. In addition, it is essential that the travel links currently available are considered for those unable or unwilling to travel to a practice at some distance from their home.

Whilst it may not be practicable or cost-effective to establish a practice in some rural parts of Derbyshire and Nottinghamshire, consideration could be given to exploring out-reach to existing practice premises as a means of increasing the accessibility of orthodontic care.

Figure 21: Orthodontic Activity and Distance



Appendix 3 – Secondary care providers

Royal Derby Hospital - (University Hospitals of Derby and Burton NHS Foundation Trust)

Royal Derby Hospital has a 'state of the art' orthodontic department with 2 separate teaching surgeries shared with the Maxillofacial team and an open-plan polyclinic with 5 fully equipped units for training and the treatment of the full range of complex malocclusions. Staff comprises:

Consultants
Orthodontists - 2.7 wte
Miss Alison Murray BDS; MSc; FDSRCPS(Glasg); MOrthRCS(Eng),
Mrs Anne-Marie Smith BDS; MSc; FDSRCS (Eng.), MOrth RCS (Eng.) FDS (Orth) RCS Intercollegiate
Mrs Anjli Patel BDS; MSc; MJDF RCS (Eng.), MOrth RCS (Edin.) FDS (Orth) RCS Intercollegiate
Mr Mohit Mittal BDS; MSc; MJDF RCS (Eng.), MOrth RCS (Edin.) FDS (Orth) RCS

Intercollegiate
Mr Joseph Vere (Restorative Dentistry, Leicester) - 1 day / month
Mr Jonathan Syme-Grant (Plastic Surgeon, NGH) - 1/2 day /month

Training posts:
One post-CCST (rotating with CCDH) Amarpreet Atwall- 3 days a week
One academic Post CCST (PhD programme) Hanieh Javidi - 2 days a week
One academic Post CCST (PhD programme) Sarah Longstaff - 1 day a week (finishing Sept 2018)
Two Specialist Registrars in Orthodontics (rotating with CCDH) - 2 days a week

Clinical Assistant - 1 afternoon / fortnight Sean Masterson

Orthodontic therapists
Two orthodontic therapists - 1.4 wte
One training orthodontic therapist - 1.0 wte

Chesterfield Royal Hospital

Chesterfield Royal Hospital has a 'state of the art' orthodontic department with an open-plan polyclinic with 4 fully equipped units for the treatment of the full range of malocclusions. Staff comprises:

Consultants
Professor P J Sandler BDS(Hons); MSc; PhD, FDSRCPS; FDSRCS; MOrthRCS, (Consultant Orthodontist)
Consultants (visiting)
Mr Ian Harris (Restorative Dentistry, CCDH)
Mr Jonathan Syme-Grant (Plastic Surgeon, NGH)
Miss A M Murray BDS; MSc; FDSRCPS(Glasg); MOrthRCS(Eng), (Honorary Consultant Orthodontist)

Hospital Orthodontists Specialist Practitioners
Mr Ajay Patel BDS FDSRCS MMedSci., MOrth(Eng) (Part Time) 2 sessions per week
Mr D Tinsley BDS, MMedSci., MMedSci(Sheff); FDS, MOrthRCS(Eng) (Part time) 1 session per week
Mr J O'Dwyer BDS; MMedSci(Sheff); FDS, MOrthRCS(Eng) (Part time) I session per week

Training posts:
One post-CCST (rotating with CCDH) Catherine Brierley - 3 days a week
One Specialist Registrars in Orthodontics (rotating with CCDH) - 2 days a week
Locum Hospital Orthodontist Dr Mustafa El-Hussein - 3 days per week

Dental Technicians
Mr Dan Shaw, Senior Chief Technician, Full time
Viv Skelland & Lucy Pearson, Dental Technicians Part time

Kingsmill Hospital

The current service is delivered as a satellite of the Queens Medical Centre led service.

The Sherwood Forest Hospitals NHS Trust service ceased in 2015 when the consultant left. Arrangements were put in place at the time for the remaining patients in active treatment to have their treatment completed. The majority received this care in local specialist practices, but arrangements were also put in place for a visiting specialist to complete care for a defined number of patients in the hospital setting. A small number of these patients remain under care. It is recommended

that an audit should be undertaken to establish how much longer this arrangement will be needed.

Queens Medical Centre, Nottingham (and Kingsmill Hospital, Mansfield)

Queen's Medical Centre, Nottingham has a 'state of the art' orthodontic department with an open-plan polyclinic with 4 fully equipped units for training and the treatment of the full range of complex malocclusions.

NUH now also operate a 'satellite service' out of Kingsmill Hospital, Mansfield, 1 day a week, with 2 dental chairs. Staff comprises:

Consultants
Orthodontists (1.5 wte)
Mr Steven Clark;
FDS(Orth) RCS Edin 2002
MOrth RCS Eng 2000
MOrth RCS Edin 2000
MSc Ncle 1999
FDS RCS Edin 1996
BDS Ncle 1992

Mr Andrew Flett;
FDS (Orth) RCS Eng 2015
Ortho RCS Eng 2013
MClinDent (Ortho) 2012
MJDF RCS (Eng) 2008
BDS (Liverpool) 2006

Restorative
Mr Neil Poyser (Restorative Dentistry) - 2 days per week

Cleft
Mr Jonathan Syme-Grant (Plastic Surgeon) - 1 day /month
Jason Neil Dwyer (Plastic Surgeon) - 1 day /month

Training posts: One post-CCST (rotating with CCDH) *Unfilled* – 2.5 days a week

Orthodontic therapists 1.4 wte
Amanda Sweet - 2 sessions (1 day per week)
Diane Argyle – 10 sessions (5 days a week)
Mehreen Akhtar – 8 sessions (4 days a week)

Dental laboratory - led by Jason Watson.

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