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Factors affecting willingness to pay for NHS-based Orthodontic Treatment

Introduction

The challenge of meeting demand for state-funded dental care is particularly evident in orthodontics, where discrepancies exist between perceived and normative need and demand for treatment, culminating in the more targeted use of orthodontic resources in recent years.(1) There is a growing realization that in most cases the contribution orthodontic treatment makes to health and well-being cannot be defined within a simplistic oral disease prevention model but in the more widely accepted concept of health that embraces psychological and social well-being (2-4).

Orthodontic provision within the NHS has been rationed over the past decade with particular focus on funding only cases with greater objective treatment need.(5) Further limitations on the scope of orthodontic services within the NHS have been mooted with, for example, constraints on the provision of orthognathic care imposed locally.(6) It is worth noting that these priorities have also been set by commissioners without formal consideration of the public's view. This contradicts the NHS Constitution which espouses public ownership and involvement.(7) The Constitution also clearly articulates that the public have the right to choose the services commissioned by NHS bodies, encouraging public input in service planning, the development and consideration of proposals for change, and operative service decisions. It is also known there is often a discrepancy between services considered important by healthcare providers and the general population.(8) There is also an increasing emphasis on the importance of patient choice and patient-centred care within the NHS.(7)
A popular quantitative research technique for eliciting individual preferences is discrete choices experiments (DCE) which clarifies the ways that individuals value selected attributes of a system,(9) product or service. This approach has been used in an array of health policy and resource allocation decisions in both high- and low-income settings, being used to canvas opinion on healthcare diagnosis and treatment,(9) access to services (10, 11) and the employment preferences of nurses and other healthcare workers.(12, 13)

DCE may be used to determine the significance of various attributes of a service or intervention and the possible acceptance of alternatives.(14) It requires respondents to state their choice from sets of hypothetical alternatives. Each alternative comprises combinations of facets at particular levels, known as attributes, and individual responses can be used to infer the value placed on levels of each attribute. Compared to other stated preference techniques that require the individual to rank or rate alternatives, DCE more closely resembles a realistic decision.(15) The chosen preference is assumed to be the one producing greatest individual benefit, known as utility.(16) There are numerous examples of the successful use of DCE to prioritise and plan services e.g. lung health programmes(17)

and management of HIV/AIDS.(18) An understanding of the relative importance of the various attributes is useful for those involved in policy decisions and setting resource allocation priorities.(17) DCE has also been used recently to evaluate the relationship between Index of Treatment Need (IOTN) scores and perceived willingness to pay for treatment (19) highlighting a disconnect between the two even with the pronounced impact of an increase in overjet.

In the event of partial or total withdrawal of services from a publicly-funded system, willingness to pay (WTP) may be particularly helpful, being capable of delineating the likely future uptake of paid services and acting as a surrogate measure of the societal value attached to the intervention.(20) An alternative involves the analysis of quality-adjusted-life-years (QALY). However, WTP is regarded as a more complete assessment as QALY is confined to health-related quality of life, while WTP has no restriction on the range of factors to which value can be attached and against which comparisons can be made. It is also regarded as particularly pertinent in the evaluation of benefits, as it is measured in the same unit as costs, which may also help policy makers to improve resource allocation.(21)

Willingness to pay for the incremental changes in specific health care attributes can be assessed by DCE along with estimates of the marginal valuations of attributes.(17) DCE methods can also be used within subgroups facilitating better assessment of the impact of malocclusion and reconfiguration of services according to social group.(22)

The aims of this part of the study were to isolate the factors considered most important to patients in relation to provision of public funding of NHS-based orthodontic services, and to investigate WTP for orthodontic treatment.

Methods

Ethical approval for this study was obtained from the London City & East REC (Reference number: 15/LO/1663). Participants were selected based on age (16 years old and above) and English language proficiency from a London-based dental hospital and a mixed dental practice in Kent. Participants completed a 10-minute online questionnaire in the waiting area using an electronic tablet. Following an initial pilot study involving 30 participants, the main survey including 250 participants was undertaken. An online discrete choice experiment and contingent valuation exercise was conducted over a period of four months up to February 2019.

Discrete choice experiment (DCE)

The factors pivotal to the likely choice made by participants (attributes) and their corresponding levels were selected from the key themes identified in our qualitative research and through consultation with experts to ensure that they accurately reflected the influences of NHS funding of orthodontic treatment. Seven key attributes were included with 20 different levels attached to these attributes (Table 1).

A conjoint design was used to develop the DCE survey. The hypothetical case was selected using a statistical design to ensure that all attributes varied sufficiently to identify a model explaining how orthodontic treatment choices were influenced by the attributes. To limit burden on participants, the survey was split into two subsets with eight choices in each. Software was used to randomly select various combinations to deal with the statistical issues, and mitigate against bias caused by learning or fatigue.(23)

The task was explained and a description of each attribute provided with corresponding levels as well as, for example, photographs of varying severity of malocclusion based on the aesthetic component of IOTN. For each DCE task, participants were asked to select one option or indicate 'neither' as their answer.(24-26) These measures were piloted in order to ensure that the questions were correctly worded and understood by participants.(27)

Preference analysis

The conjoint exercise used Ngene (choice-metrics.com) to produce a D-efficient design. An efficient design was used as the number of attributes/levels was significant, leading to a larger number of choice sets. As all of the choice sets cannot be shown to each respondent, the designs were therefore divided into blocks, leading to loss of orthogonality and associated efficiency, with a D-efficient design used for this purpose.(28)

Contingent Valuation Exercise

The design of this part of the online questionnaire was informed by experts and with reference to the methodology used in a study on patient preferences for cancer testing in primary care.(29) The survey was piloted on a sample of 30 participants using cognitive testing to check that participants interpreted the question correctly, and understood why the question was asked. To mitigate starting point (anchoring) bias, a two-part exercise was designed. Participants were first presented with a bounded discrete choice with the response to that question establishing the range for the starting point in the bidding process. The specific figure was generated randomly from within this range, and the participants could then bid up or down from this figure. In total, 18 end points were used, four for each of the

lower two bands (£1 to £1,000 and £1,001 to £2,000) and five for the each of the upper two bands (£2,001 to £3,500 and £3,501 to £5,000). Within each band, the difference between each end point and the one immediately higher increased as the value increased so that proportional differences were broadly similar. (30)

Contingent valuations were analysed using descriptive statistics. Socio-demographic information including age, gender, ethnicity, education level, occupation, income and number of children under 18 years old were gathered in the last section of the questionnaire. Age was grouped into four categories as follows: 16-24, 25-34, 35-54, and 55+. Data were analysed using bespoke software including Microsoft Office Excel and Accent Software (http://www.accentsoftware.co.uk).

Results

Characteristics of participants

Two-hundred and fifty respondents completed the survey with the majority being female (n=173, 69%) with 43% (n=108) between 35 and 54 years old. Almost half of the respondents were white Caucasian and held a degree. Approximately one-fifth had professional occupations and one-third had an annual income of £20,000-£39,999 (Table 1). Most participants (n=208, 83.2%) reported having good or very good general health while only six participants felt that their health was either bad or very bad (2.4%). Around 33% (n=82) of participants reported having received orthodontic treatment in the past. Of these 57 (69.5%) had a good or excellent orthodontic experience, whereas only seven (8.5%) reported a poor or fair experience.

Discrete Choice Experiment

Overall, five factors significantly influenced participants' preferences for the NHS to fully fund orthodontic treatment. Participants felt that free NHS-based orthodontic provision should be prioritised for those under 18 years old, regardless of family income, for those with developmental rather than iatrogenic anomalies, particularly where self-esteem and confidence are affected (Table 2).

Effect of socio-demographics on preferences

Gender, age and income appeared to significantly influence decisions concerning prioritisation of orthodontic treatment (Table 3). More participants aged 16-24 more strongly preferred full NHS funding for orthodontic treatment for those under 18 years old (p=0.007, 95% CI -0.57 to -0.09) who dislike smiling in public, especially where self-esteem and

confidence are impaired (p=0.002, 95% CI 0.16-0.71). More females (p=0.057, 95% CI -0.01 to -0.37) and those aged 25-34 years (p=0.04, 95% CI 0.02-0.71) than from any other age group significantly prioritised full NHS funding for orthodontics regardless of income. Furthermore, more females (p=0.000, 95% CI 0.23-0.66) particularly aged 35-54 (p=0.000, 95% CI 0.22 -0.77) had a higher preference for the NHS to provide orthodontic treatment free at the point of delivery.

In comparison to the other age groups, those who were between 25 and 34 years old (p=0.02, 95% CI 0.07-0.65) had a higher preference for patients to make a contribution of £1,250 for the treatment. However, younger patients aged 16-24 felt that the NHS should prioritise patients who dislike smiling in public because of teeth position with normal self-confidence compared to those from the other age groups (p=0.04, 95% 0.02-0.62).

In terms of income, participants with an annual income of less than £20,000 annually felt that the NHS should provide orthodontic treatment free at the point of delivery, and prioritised those who dislike smiling and have impaired self-esteem and confidence (p=0.000, 95% CI 0.54-1.63). However, participants with an annual income of £60,000-99,999 had the highest preference for the NHS to fund orthodontic treatment regardless of family income (p=0.02, 95% CI 0.13-1.47), and placed an onus on addressing developmental rather than iatrogenic anomalies (p=0.004, 95% CI 0.22-1.15).

Willingness to pay

Most participants (n=232, 92.8%) were willing to undergo orthodontic treatment; and of these 159 (63.6%) were willing to pay for it. The minimum amount that participants would be willing to pay for orthodontic treatment was £50 (n=1), while the maximum was £5,000 (n=3) (Tables 4-6). About 88% of participants were willing to pay between £1 and £2,000, whereas only 2.5% (n=4) of the sample were willing to pay £3,501-£5,000 (Table 4). Only three participants felt that the NHS should not contribute towards the cost of orthodontic treatment.

Discussion

The findings from the present study build on Paper 1, which identified a number of key factors valued by end-users in relation to NHS dental services. The previous study also indicated the high priority afforded to provision of emergency care within the NHS. Notwithstanding this, a more complex picture emerged with respondents acknowledging the importance of providing treatments which can enhance quality of life and self-confidence. The latter are often attributed to orthodontics as well as aspects of restorative care. (2)

Key factors affecting preferences for full funding of NHS treatment included age (under 18 years), developmental rather than iatrogenic anomalies, particularly where self-esteem and confidence are affected and regardless of family income. It is interesting to note that most of these are already accounted for within the existing service. Specifically, a threshold age of 18 years already applies, and provision of care is not means-tested. Views concerning means-testing varied based on family income, with those with lowest and highest income united in advocating provision of free-to-access care irrespective of family income. Lower socio-economic groups are more likely to opt for extractions as opposed to complex restorative treatments, whereas those with higher income are generally more willing to pay for dental treatment.(31) Similarly, willingness-to-pay for dental implants may be influenced by income; those with higher income are more likely to pay for treatment.(32) Conversely, in a further analysis in England, willingness-to-pay for cheaper preventative treatments is unaffected by demographics.(33)

In terms of the aetiology of malocclusion and its relationship to the provision of free care, there was consensus that malocclusion of developmental rather than iatrogenic origin should be given priority. The majority of malocclusion is thought to arise from genetic and developmental causes(34) and as such, this is rarely a consideration. Other iatrogenic causes may include digit sucking and the effect of premature loss of primary teeth due to caries. Clearly, these issues may also co-exist with underlying developmental problems and it is therefore difficult to separate these aspects. The preference for provision of treatment to address impaired self-esteem and confidence related to malocclusion is particularly noteworthy. Malocclusion has variously been linked to negative impacts in terms of quality of life with increased overjet and overbite, visible anterior spacing, hypodontia and dentofacial deformity all implicated.(2-4) However, at present treatment is rationed within the NHS based purely on the IOTN score, which has relatively little association with subjective impacts.(14) As such, modifications to this approach, or indeed the development of a more holistic tool, may be required in order to better prioritise treatment need accounting both for objective measures as well as personal impacts.

Willingness-to-pay for orthodontics was not universal with 63.6% (n= 159) being happy to do so. The vast majority of these (88%) were unwilling to pay more than £2,000. Most (91.8%) also recommended an NHS contribution to the provider of less than £2,000. These figures mirror those offered to providers within the U.K. at present, with a full course of treatment costing the NHS approximately £1,200. However, this figure is dwarfed by typical costs associated with orthodontic treatments undertaken within private settings. Recent NHS commissioning exercises have imbedded the role of auxiliaries, chiefly orthodontic

therapists, in the supervised delivery of orthodontic care within specialist practice settings.(35) The associated efficiency savings may partially offset this difference in fees, with projected savings channelled into improving access to care nationally. It is important to note that we did not survey the opinion of respondents concerning the effect of skill mix or care setting on the associated willingness-to-pay for treatment.

In terms of the approach to DCE an efficient design was used, preserving the efficiency even when subdivided into blocks of choice sets/tasks requiring fewer data points to obtain robust models. Participants were asked to make eight choices each in the exercise, balancing the length and complexity of the survey against the statistical advantage of greater numbers of observations. WTP provided a cost-benefit framework, focusing on an individualistic foundation and relying on the elicitation of the individual's WTP for health gain. Since WTP is closely associated with the ability to pay, a health-state valuation based on WTP alone will disadvantage those with lower incomes by directly linking health effects to individual economic means. (36) However, a range of socio-economic groups were included in this study with overlapping findings despite this diversity.

The generalisability of the findings is questionable as participants were recruited from a local setting within one secondary care setting. Notwithstanding this, a range of socio-demographic characteristics were included. It could be argued, however, that patients and their relatives may overemphasise the potential benefit of orthodontics, based on the desire to undergo treatment from which they expect to derive benefit. (37) However, participants were recruited from a range of departments, to mitigate against this potential source of bias. (38) While NHS-based orthodontic treatment is largely offered to adolescents, the DCE questionnaire was completed by an adult cohort. This was essential in order to allow for sufficient depth of knowledge and understanding to permit completion of a complex, multi-faceted questionnaire. We feel that this approach also improved the objectivity of the responses reducing the risk of respondent bias among those hoping to be offered free-to-access care.

Conclusion

Based on this pilot study undertaken in the South-East of England, broad-based support for the continued inclusion of Orthodontics within the NHS was noted. Participants felt that free NHS-based orthodontic provision should be prioritised for those under 18, regardless of family income, and for those with developmental anomalies. There was also an emphasis on

providing freely-available treatment to those whose self-esteem and confidence are adversely affected by malocclusion. Further research is required in order to better inform the optimal configuration of orthodontic services in terms of care settings and skill mix. Furthermore, the priorities underpinning the provision of dental care and orthodontic treatment within the NHS require further elucidation.

Conflict of interest

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Table 1: Characteristics of participants

Socio-demographic data	Number of participants	Percentage (%)
Gender		
Male	77	30.8
Female	173	69.2
Age		
16-24	62	24.8
25-34	57	22.8
35-54	108	43.2
55 and above	23	9.2
Ethnic group		
English/Welsh/Scottish/Northern Irish/British	125	50
Any other White	17	6.8
Mixed Ethnicity	13	5.2
Asian Caucasian	46	18.4
Chinese	8	3.2
Any other Asian background	3	1.2
African	18	7.2
Caribbean	4	1.6
Arab	2	0.8
Other	2	0.8
Do not want to disclose	12	4.8
Highest degree or level of school		
No qualifications	12	4.8
Other Secondary School/NVQ/Essential Qualifications	101	40.4
Apprenticeship	7	2.8
Degree	122	48.8
Foreign Qualifications	8	3.2
Occupation		

Manager, director, senior official in a company/ civil service	22	8.8
Professional occupations e.g. Doctor, Nurse, Teacher, Lawyer	54	21.6
Associate professional, technical occupations e.g. scientist, paralegal	25	10
Administrative, clerical, secretarial	31	12.4
Other	44	17.6
Unemployed	20	8
Retired	12	4.8
Student	42	16.8

Household income		
Less than £20,00	46	18.4
£20,000 -£39,999	81	32.4
£40,000 - £59,999	38	15.2
£60,000 - £99,999	28	11.2
£100,000 and over	16	6.4
Do not wish to disclose	41	16.4

Number of children		
None	104	41.6
One	60	24
Two	57	22.8
Three	21	8.4
Four or more	8	3.2

Table 2: Overall preferences for orthodontic treatment to be funded within the NHS

Attribute	Level	Rank	Coefficient	Z (t-stat)	p-value	95% CI
Cost to patient	Free	1st	0.38	4.06	0.000	0.2 -0.57
Responsibility/ Cause	Due to the way teeth developed	2nd	0.3	4.18	0.000	0.16 -0.44
Self-esteem/ confidence	Does not like smiling in public and self-confidence is low because of teeth	3rd	0.25	3.58	0.000	0.11 - 0.38
Family income	Family with any income	4th	0.19	2.48	0.013	0.04 -0.34
Age	Adults	5th	-0.19	-2.8	0.005	0.32 -0.06

Table 3: Association between preferences and socio-demographic data

Attribute	Level	Gender	Coefficient	Z (t-stat)	p-value	95% CI
Family income	Family with any income	Female	0.1834914	1.9	0.057	-0.01 to -0.37
Cost to patient	Free	Female	0.4403873	4	0.000	0.22 to .66
Responsibility/Cause	Due to the way teeth developed	Female	0.3952934	4.57	0.000	0.23 - 0.56
Age	Adults	Female	-0.2064449	-2.53	0.011	-.37 -.05
Self-esteem/confidence	Does not like smiling in public and self-confidence is low because of teeth	Female	0.3266672	3.85	0.000	0.16 - 0.49

Table 4: Willingness to pay for orthodontic treatment by price range

Price range	Number of participants	Percentage (%)
£3,501-£5,000	4	2.5
£2,001 to £3,500	15	9.4
£1,001 to £2,000	58	36.5
£1 to £1,000	82	51.6
Total	159	100

Table 5: Association between preferences and income groups

Attribute	Level	Income group	Coefficient	Z (t-stat)	p-value	95% CI
Family income	Family with any income	Less than £20,000	0.3914989	2.13	0.03	0.03 - 0.75
	Family with any income	£60,00-99,999	0.7994924	2.32	0.02	0.12 - 1.47
Cost to patient	Free	Less than £20,000	1.085047	3.9	0.000	0.54 - 1.63
Responsibility/cause	Due to the way teeth developed	£40,000-59,999	0.3711288	1.91	0.057	-0.01 - 0.75
	Due to the way teeth developed	£60,00-99,999	0.6872433	2.9	0.004	0.22 - 1.15
Prevention of future problems	Orthodontics will help to prevent decay and gum problems	£20,000-39,999	0.2852318	2.12	0.034	0.02 - 0.55
Age	Adults	£20,000-39,999	-0.4400266	-3.82	0.000	-0.67 to -0.21
Self-esteem/confidence	Does not like smiling in public and self-confidence is low because of teeth	Less than £20,000	0.491378	2.57	0.01	0.12 -0.87
	Does not like smiling in public and self-confidence is low because of teeth	£20,000-39,999	0.3256202	2.42	0.016	0.06 - 0.59
	Does not like smiling in public because of teeth but self-confidence is normal	£20,000-39,999	0.2701522	1.96	0.050	0.00 -0.54

Table 6: Association between preferences and age groups

Attribute	Level	Age group	Coefficient	Z (t-stat)	p-value	95% CI
Age	Adults	16-24	-0.33	-2.71	0.007	-0.57 to -0.09
Self-esteem/confidence	Does not like smiling in public and self-confidence is low because of teeth	16-24	0.43	3.07	0.002	0.16-0.71
Self-esteem/confidence	Does not like smiling in public because of teeth but self-confidence is normal	16-24	0.32	2.1	0.04	0.02 – 0.62
Family income	Family with any income	25-34	0.37	2.05	0.04	0.02-0.71
Cost to patient	£1,250	25-34	0.36	2.44	0.02	0.07-0.65
Cause/Responsibility	Due to the way teeth developed	25-34	0.41	2.74	0.006	0.12 – 0.70
Self-esteem/confidence	Does not like smiling in public and self-confidence is low because of teeth	25-34	0.35	2.36	0.02	0.06 – 0.63
Cost to patient	Free	35-54	0.50	3.52	0.000	0.22 – 0.77
Cause/Responsibility	Due to the way teeth developed	35-54	0.45	3.95	0.000	0.23 – 0.67
Cause/Responsibility	Due to the way teeth developed	55 and above	0.50	2.17	0.03	0.05 – 0.96