

Title page

An examination of consistency in the incremental approach to willingness to pay: evidence using societal values for NHS dental services

Running title: Consistency of the incremental willingness to pay

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Abstract:

Introduction: Willingness to pay (WTP) is used to generate information about value.

However, when comparing two or more services using standard WTP techniques the amounts elicited from participants for the services are often similar, even when individuals state a clear preference for one service over another. An incremental approach has been suggested, where individuals are asked to first rank interventions and provide a WTP value for their lowest ranked intervention followed by then asking how much more they are willing to pay for their next preferred choice and so on. To date, evaluation of this approach has disregarded protest responses, which may give information on consistency between stated and implicit rankings.

Methods: A representative sample of the English population (n=790) were asked to value five dental services adopting a societal perspective, using a payment vehicle of additional household taxation per year. The sample were randomised to either the standard or the incremental approach. Performance for both methods is assessed on discrimination between values for interventions and consistency between implicit and stated ranks. The data analysis is the first to retain protest responses when considering consistency between ranks.

Results: The results indicate that neither approach provides values that discriminate between interventions. Retaining protest responses reveals inconsistencies between the stated and implicit ranks are present in both approaches, but much reduced in the incremental approach.

Conclusion: The incremental approach does not improve discrimination between values, yet there is less inconsistency between ranks. The protest responses indicate that objections to giving values to the dental interventions are dependent on a multitude of factors beyond the elicitation process.

Introduction

Estimating monetary values for health services using contingent valuation (CV) can be a useful tool in estimating the benefits a service can provide to the population questioned. It is often a necessity to aid decision-making when market values cannot be observed, as is frequently the case with publicly financed healthcare (Baker *et al.*, 2014). A stated preference technique frequently used in this context, willingness to pay (WTP), elicits the maximum value participants are willing to pay for specific goods or services. However, eliciting WTP-based preferences for multiple health services competing for limited public funds can be contentious.

When WTP is used to elicit values from members of the public for such competing services, the results often contain inconsistencies known as preference reversals, meaning the rank generated from a simple ordering of interventions (stated or explicit rank) and that generated from elicited WTP values (implicit rank) often do not match (Shackley and Donaldson, 2002; Lamiraud *et al.*, 2016). It is difficult to determine the cause of this inconsistency, but it has been linked to confusion regarding the exercise or anchoring on the assumed cost of similar services (Blamey *et al.*, 1999). However, these preference reversals could be an indicator that participants are not giving an accurate representation of value, present a more-fundamental problem for current WTP methodology (Baron and Maxwell, 1996; Carlsson and Martinsson, 2001).

Furthermore, WTP exercises often generate non-discriminatory values (i.e. participants state values with little or no significant difference across services). Depending on the nature of the research and anticipated use of results, this can also be problematic. It is possible that non-discriminatory values represent true indifference. Alternatively, when options are disparate and it is not unreasonable to anticipate a preference and therefore distinction between values, non-discriminatory values may indicate participants have not fully engaged with the

exercise and may be relying on a behavioural heuristic such as yea-saying (Blamey *et al.*, 1999). Results which contain both preference reversals and non-discriminatory values may indicate the WTP exercise has produced results which may not accurately represent (differences in) value.

An adaptation to the elicitation of WTP was proposed in 2002 to resolve these issues. The 'incremental' approach to WTP (originally coined the 'marginal' approach) suggested placing an exogenous framework on respondents based on their explicit rank that would eliminate preference reversals and increase discrimination between values (Shackley and Donaldson, 2002). This approach asks respondents to provide a value for their least preferred option, and then asks how much *more* they would pay to attain their next preferred option. This methodology means each value must be as much as, or more than, the value given before it and therefore eliminates inconsistencies between ranks. Economic theory indicates that by asking how much *more* individuals are willing to pay for each subsequently preferred option, the respondent is encouraged to carefully consider how much additional utility each option provides, forcing individuals to estimate their consumer surplus at each stage thus encouraging differentiation between options and providing an accurate representation of value (Lamiraud *et al.*, 2016). As respondents are free to give a zero value an increase in value is not enforced but, provided it is considered a true zero, would indicate the next preference is worth nothing additional.

In contrast, the standard approach usually starts by asking participants to state the order of their preference, followed by asking them to state how much they are willing to pay for each option independently. Previous studies have found the incremental approach to be superior to the standard approach as the former eliminated inconsistencies and increased discrimination between values (Olsen *et al.*, 2004; Lamiraud *et al.*, 2016). Yet, the

methodology used in the aforementioned studies discarded protest responses when considering preference reversals. A zero value is considered a protest response if the justification is not related to the intervention itself, but an objection to the elicitation process. Provided the participant elicits at least one positive value within the exercise, a zero response in this context is unlikely to be a function of the elicitation system, but rather relates to the intervention in question, as an objection to the elicitation system would manifest as protest responses to all interventions. By removing zeros thought to be protests but elicited amongst other positive values, previous studies have, therefore, eliminated the possibility of identifying inconsistencies in the incremental approach as the framework dictates the value must be the same as, or more than, the previous value in the elicitation process. This analysis considers the role of protest responses and investigates whether they contribute to explicit and implicit rank inconsistencies.

The incremental approach remains relatively unused, as the evidence available with respect to its validity and reliability has been limited since the initial proposal. This paper contributes to the body of evidence regarding the incremental approach and presents evidence of its performance relative to the standard approach. The analysis presented evaluates both approaches with respect to preference reversals and discriminatory power in resource allocation for dentistry, a setting which has not yet been explored. The evidence used in this paper is from the Resource Allocation in NHS Dentistry: Recognition of societal Preferences (RAINDROP) study. This study applies priority setting techniques to generate a multi-criteria decision making tool – including preferences from the public – to optimise allocation of resources to oral health services in a publicly funded, resource constrained system. The full protocol for this research can be found elsewhere (Vernazza *et al.*, 2018). The preference elicitation element of the study establishes monetary values from residents living in England and aggregates them into a societal value for dental interventions. The interventions presented are dental services either currently provided or which have the potential to be

provided as part of NHS England dental services or through public health initiatives provided under the umbrella of Public Health England. Previous research using the incremental approach has compared scenarios considered to be close substitutes, with the most recent evidence (Lamiraud *et al.*, 2016) examining public preferences for different service providers of a single type of care (emergency and out-of-hours services). The study described in this paper is set in the context of oral health problems faced by the population in England. Preferences are elicited for a broad range of treatments where there is arguably a more complicated trade-off; with interventions targeting different societal groups.

Methods

In line with the objectives of the RAINDROP study, a questionnaire was designed to collect WTP values for dental interventions. This was administered by an independent survey company, Qa Research. Ethical approval was gained from Newcastle University (Reference Number 7065/2016).

Recruitment

Researchers approached households in 50 small local clusters across England, with a maximum of one individual recruited in each household. A quota target list was used to ensure recruitment of different demographic groups. Potential participants were given information about the study and gave consent to be interviewed, with a £10 incentive offered. Data collection was undertaken in face-to-face interviews at the interviewee's home with the interviewer using a computer-assisted interface. Randomisation was undertaken at an individual level during the interview as part of the computer-assisted interface to either incremental or standard approach using software-based randomisation. The algorithm for randomisation is built into the survey software used by Qa Research.

Questionnaire design

The questionnaire was developed with the aid of a focus group recruited from a Patient and Public Involvement group at Newcastle University to ensure that the questionnaire was understandable and engaging for members of the general public. The questionnaire was then piloted with a small sample of the general public (recruited in the same way as for the main data collection) and small changes to the wording were made.

The questionnaire included three distinct sections: the initial section gathered information regarding the participant's demographics and socio-economic status. The second section

introduced participants to the interventions, collected explicit ranks and WTP values. The third section asked for information on participants' incomes, their experience of dental interventions and frequency of dental visits, all of which are hypothesised to impact their maximum willingness to pay for interventions.

Explicit ranking

The five interventions valued were chosen as part of a workshop with NHS England dental commissioners and clinical dental leaders as areas of interest for potential investment or disinvestment in the NHS. Table 1 offers a brief summary of each intervention.

Table 1 here

Respondents were presented with a long-form explanation of each intervention and were asked if they understood each description. For those who did not, a flash card with a succinct version of the key information was presented. These were accessible for each participant throughout the exercise. The order in which the interventions were presented to respondents was randomised to control for ordering and anchoring effects (Smith, 2006; Shackley and Dixon, 2014). After respondents had read descriptions for all interventions, they were asked to rank interventions from their most preferred to their least preferred. This will be referred to as their explicit rank and represents an ordinal ranking of alternatives. For this part of the exercise equal ranking of options was not possible, thereby replicating difficult resource allocation decisions where options are mutually exclusive and the budget is finite (Lamiraud *et al.*, 2016).

Value elicitation

Before eliciting monetary values, interviewers read a 'cheap talk script' to respondents based on Mahieu *et al.*, (2012). This reinforces the hypothetical nature of the exercise and attempts to reduce hypothetical bias by informing the respondents of behaviour which is common in contingent valuation settings but not necessarily replicated in real life situations. The

statement was also included to encourage participants to express the value they hold for the intervention, instead of focusing on cost, and to minimise gaming from respondents.

The payment vehicle of extra taxation for the household was chosen for a multitude of reasons. Firstly, the majority of residents in England who see a dentist receive their dental care from the NHS (Hill *et al.*, 2013). The NHS is funded through taxation but in dentistry there is also a co-payment for most users. Secondly, the interventions discussed are provided at a national level and therefore may not have a direct impact on the household. Taxation encourages an individual value for a service provided at a societal level. Thirdly, the service would be continual, provided year on year for the foreseeable future. Finally, additional taxation fits the wider scope of the project as the RAINDROP study addresses how to best allocate resources within NHS dentistry whilst taking into account societal preferences. Those who do not pay tax were asked to give an estimation of the maximum amount they would be prepared to voluntarily contribute each year (Olsen and Donaldson, 1998).

Participants were randomised into two groups for the value elicitation portion of the exercise, each using a different approach to WTP: standard or incremental. As described previously the standard approach asks for an absolute, stand-alone maximum value from respondents for each intervention. To ensure the greatest degree of comparability between the two approaches, values for the standard approach were collected from the respondent's least to most preferred option. The incremental approach is a sequential valuation exercise whereby values are elicited by asking participants the maximum they are willing to pay for their least preferred option, then how much more they are willing to pay for their next preferred option. The value of the intervention is therefore partially dependent on the value elicited directly before it; generating an exogenous framework determined by the explicit rank where each

subsequent value is equal to or more than the value which came before. For both approaches a ranking is inferred from the monetary values given for the interventions, with the highest valued intervention corresponding to the most preferred option and the lowest valued option corresponding to the least preferred option. This rank is referred to as the implicit rank.

To elicit the values respondents were presented with a series of randomised payment cards on their computer interface to avoid anchoring (Smith, 2006). The values range from £1 to £200 in various increments and were informed by discussions with the focus group.

Respondents had to sort the payment cards into three categories: 'yes – willing to pay' 'no – not willing to pay' or 'not sure'. Values which were sorted in the 'not sure' category were presented again once all other values for that intervention had been sorted, to check if the respondent wished to move any 'not sure' cards into 'yes' or 'no' categories. As the list of payment cards was not exhaustive, respondents were asked after the sorting exercise if they were able to give an exact estimate of the maximum they would be willing to pay using an open-ended question. This gave participants an opportunity to reassess or confirm their valuation. If an exact estimate was not given but there was a response to the payment card portion a mid-point between the last 'yes – willing to pay' and first 'no – not willing to pay' was used (Bock *et al.*, 2017). Respondents were able to give a zero response at any point during the exercise.

Zero Values

When a zero value was given the respondent was prompted to justify their answer. This justification is used to determine if the response was a true zero or protest response, where a true zero is thought to be an accurate representation of value. The zero justification section used in the questionnaire is largely based on sections developed by Dixon & Shackley (2003) and Ryan *et al.*, (2004) which used set-text responses and included an open-ended

option. Free speech responses to the zero value classification question were transcribed by the interviewer issuing the questionnaire. These were reviewed independently by two members of the research team for classification into protest or true zero, with disagreements resolved by discussion.

Data Analysis

Descriptive statistics are provided for the whole sample. As this paper is mainly concerned with the elimination of preference reversal in the incremental approach, the main body of analysis examines this, but the other major purported advantage of the incremental approach, increased discrimination between competing options, is also considered.

Preference reversals

To generate evidence regarding preference reversals responses are sorted into three categories: consistent, partially consistent and inconsistent. These are defined as follows:

- Fully consistent – where the implicit and explicit rank correspond exactly;
- Partially consistent – where the deviations between the implicit and explicit rank are due to equal values. For example, if the fifth and fourth preference both receive the lowest value, but the values increase for the third, second and first preference this is a partially consistent response;
- Inconsistent (preference reversal) – where the implicit and explicit rank are directly contradictory and the deviation is not due to equal values. For example, if the third preference is valued lower than the fourth preference.

Although partially consistent responses are possible in the incremental approach, the framework placed on respondent valuations for the incremental approach in conjunction with the elimination of protest responses means that preference reversals are impossible.

However, for the purposes of this paper, it is assumed that, after giving some positive

values, a respondent in the incremental approach group then registers a protest response, this is evidence of an inconsistency between implicit and explicit ranks and thus a preference reversal. This paper therefore presents new evidence regarding preference reversals in the incremental approach by retaining all protest responses for the analysis of respondent consistency.

Discrimination between values

To examine the discrimination between values for both approaches we give the mean, standard deviation of the mean and median associated with each intervention and rank. For the analysis regarding discrimination, responses considered to be protest responses are discarded, as they are not considered to be a representation of value and may therefore deflate the societal value unjustly (Olsen and Donaldson, 1998; Dixon and Shackley, 2003; Wisner, 2007). The median values are the main focus of discussion as means are more susceptible to bias from outliers (often driven by high-income respondents who may place high bids on their preferred interventions).

Results

A total of 790 participants were recruited, 6 participants with incomplete data collection were dropped. The remaining participants were randomised to either the incremental approach (n=335) or the standard approach (n=449). Descriptive statistics for both samples are presented in Table 2.

Table 2 here

As seen in Table 2, the median household income for the sample is lower than the national average for the United Kingdom (£27,300) (Office for National Statistics, 2018). All other demographics reported were broadly representative of the United Kingdom for the year 2016, when the data was collected.

Explicit rank

The explicit rank is shown in Table 3. For both the incremental and standard approach the least preferred intervention is providing dentures in care homes. Supervised tooth brushing is most frequently picked as first and second preference across approaches. Out of 120 possible combinations of intervention ordering with respect to explicit preferences, 115 are present with the most frequently observed combination only occurring 3% of the time.

Table 3 here

Values Elicited

Values for specific interventions and with respect to rank can be found in Table 4. For the incremental approach median values range from £25 for fluoride varnish to £30 for orthodontics, supervised tooth brushing and dentures in care homes. The mean values range from £60.77 for orthodontics to £77.95 for supervised tooth brushing.

Table 4 here

In the standard approach values are lower than in the incremental approach, with the means, maxima and medians all occurring at lower values. The median values range from £10 for supervised tooth brushing to £20 for root canal, orthodontics and dentures in care homes. The standard deviations associated with the incremental approach are higher for all interventions. The mean values range from £42.76 for root canal to £49.70 for orthodontics.

Protest responses

There was a total of 423 protest responses given by 135 participants, the details of which are displayed below in Table 5. Only 21 (2.68%) participants across the approaches gave protest responses to each intervention in the valuation process. Generally, the number of protest responses given falls as the exercise progresses. The most frequently objected to intervention for the incremental approach is supervised tooth brushing, whilst for the standard approach it is fluoride varnish.

Table 5 here

Preference Reversals

A novel approach in this analysis is identifying how protest responses impact consistency of the implicit and explicit ranks. Comparing the approaches, we find that for the incremental approach 72% (n=228) of respondents were fully consistent, compared with only 2% (n=10) of respondents in the standard approach. The proportions of inconsistent respondents are 11% and 72% respectively, almost a mirror image of results. The remaining respondents are partially consistent. Examining the sources of inconsistency revealed two patterns of protest behaviour across approaches:

- a) Participants give protest responses at the start of the exercise with the participant joining with positive values later. For example, they may give protest zeros for their fifth and fourth preference, but positive values for their third, second and first.

- b) Participants protest mid-way through the exercise with positive values occurring after the protest response. It may be that the participant gives a positive value for their fifth preference, a protest zero for their fourth, then continues to give positive values for the remaining three interventions.

These are explored further in the discussion.

Discussion

This study is the first to find preference reversals in the incremental approach. However, the proportion of participants eliciting an inconsistent response in the incremental approach is 11%, compared to 72% in the standard approach. The presence of preference reversals is only problematic insofar as it is believed that there should be complete correspondence between the explicit and implicit rank. This rests on the assumption that the individual responding to the questionnaire is valuing the same attributes in both ranking exercises, yet it is not uncommon to observe individuals providing different values for the same service dependent on perspective in the context of health (Dolan and Green, 1998). It is therefore possible that, when asked to explicitly rank, individuals place the interventions in order of what they would personally prefer to be funded – i.e. what would have the largest impact on themselves – whilst the valuation exercise, in asking for additional taxation payments, may encourage a wider perspective. This fluid perspective can be seen in the wider willingness to pay literature. Evidence from the EuroWill study noted that the explicit ranking task and the valuation exercise are fundamentally different (Olsen *et al.*, 2005). The explicit rank is an ordinal rank resting on a direct comparison of competing programmes, whilst the valuation exercise which generates the implicit rank changes the frame of reference and asks people what amount they would be willing to sacrifice from their personal income in order to have the programme offered in the public domain. It is therefore important to consider the nature of the two exercises, and the changing frame of reference, when discussing inconsistencies in willingness to pay exercises, particularly regarding the implications of inconsistencies on validity.

It is also possible that respondents are revising their initial rank, or only arrive at their final rank, as the exercise progresses. The standard approach gives an easy avenue to revisit and revise rank, as values can be assigned freely. The respondents in the incremental approach are somewhat anchored to their initial response as the framework dictates the

value must be as much as, or more than, the preceding value, which could be problematic if ranking preferences across disparate bundles is difficult. However, a previous willingness to pay exercise has explored the discrepancy between explicit and implicit rank with the respondents, with the majority (75%) of respondents identifying that their explicit ranks should be used to inform priorities in a health service (Olsen *et al.*, 2005). If this holds for other priority setting in health exercises, the incremental approach may in fact enable respondents to perform more rationally; the framework may displace heuristics like anchoring on price and allow respondents to more accurately reflect their underlying preferences.

The inconsistent behaviour of those who give one or more protest responses suggest the unobserved underlying objection may be a result of an amalgamation of factors not strictly associated with the elicitation process, arguably indicating that participants are only willing to support some interventions funded by the specified payment vehicle. These patterns of protest responses indicate participants opt in and out of the exercise dependent on the intervention and surrounding context, as opposed to the exercise itself. The current methodology in determining whether a zero is true or protest is therefore limited, and using traditional methods to determine the true intent behind a zero value is insufficient to decipher a response which is a protest to the elicitation system versus other, more-specific objections regarding the interventions and payment vehicle. This is shown by the inconsistent protest behaviour in our sample. Using the traditional approaches limits insight into the nature of the protest and potentially limits the representativeness of the sample (Jorgensen *et al.*, 1999; Frey and Pirscher, 2019).

The values associated with the interventions offer little discrimination at whole sample level for either approach and both suffer from significant clustering at the median which could

suggest a true lack of differentiation in strength of preference or a lack of sensitivity in both approaches. When considering a true lack of differentiation, this may be due to the disparate nature of alternatives and the resulting spread of preference among options. In previous studies regarding the incremental approach there has been a clear consensus rank between options which potentially has contributed towards discrimination between interventions (Lamiraud *et al.*, 2016). As there is no common rank, and the incremental approach depends on rank to provide a valuation framework, it is unsurprising the values associated with the interventions elicited using incremental approach do not offer increased discrimination.

The values associated with rank are strongly discriminatory for the incremental approach. This indicates face validity as it corresponds to the underlying economic theory and provides evidence of the ability of the incremental approach to extrapolate a value, which theoretically accurately represents the participant's consumer surplus. The standard approach provides increasing values from the fourth preference onward, but the intervals are smaller. Assuming participants are not over-stating their maximum WTP, this indicates the incremental approach is superior in capturing the additional value of the next preferred option.

The top ranked intervention in the standard approach, supervised tooth brushing, receives the lowest median value in the standard approach. The incremental approach remains consistent with theory and produces a result which corresponds with the explicit rank. Previous studies and the WTP literature identify the most likely explanation for the discrepancy in the standard approach is that participants will anchor on perceptions of cost (Baron and Maxwell, 1996). Participants are likely aware of the costs associated with brushing their own teeth, with the only other additional cost described by the scenario being a nurse to train teachers. This may be thought of as a 'cheap' intervention and, as such, may receive a lower value. Fluoride varnish, other intervention which may be perceived of as low

cost as it requires few additional resources, receives a similarly low value. These results identify a potential limitation of the cheap talk script as it may have been ineffectual when attempting to eliminate bias from results. However, it is also important to consider these interventions in the wider context of the questionnaire. These services are the only two which would be provided through public health initiatives, which may impact the valuation. These services are also the only ones to specifically target deprived communities and there may be an element of altruistic signalling (Olsen *et al.*, 2004). A participant can be seen as supporting the notion of helping those who are disadvantaged by giving the service a high rank, but may be reluctant to support it financially – either generally through paying additional tax or more specifically through the services suggested, as indicated by the protest responses.

Conclusion

The evidence in this paper identifies that the incremental approach to WTP is superior to the standard approach, yet cannot conclude that the incremental approach is fully consistent with theory. Further research should be conducted into the issue of protest responses within the incremental approach and how they should be considered in the context of preference reversals. In the interim those seeking to elicit values for multiple interventions should consider using the incremental approach, particularly in a policy context. The behaviour displayed by respondents using protest responses has wider implications for the definition, use and analysis of zero responses in WTP questionnaires.

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Tables

Table 1: brief summary of interventions

Intervention	Problem	Treatment	Population targeted	Outcome	Volume to benefit
Fluoride varnish	Dental decay can cause need for fillings, crowns or extraction.	Preventative. Clear varnish applied to teeth at nursery by a dental nurse.	Children aged 3-5; mostly from deprived areas.	Reduces the number of teeth affected by decay (by 37% in 3 years).	216,000
Molar root canal	Back teeth dying off due to deep decay causing an abscess.	Drilling and filling of tooth, placement of crown over three appointments.	Adults, prevalence linked to deprivation.	80% success rate, pain alleviated, the tooth saved. Tooth removed if unsuccessful.	600,000
Extended orthodontics	Misalignment of the teeth.	Aesthetic. Braces placed on teeth then adjusted every 6-8 weeks for 18 months.	Treatment usually at 12 years old, all groups equally likely to need and receive treatment.	Teeth are no longer misaligned.	16 million
Supervised tooth brushing	Dental decay can cause need for fillings, crowns or extraction.	Preventative. Primary school staff trained by dental staff to supervise brushing.	Programme aimed at the deprived primary schools in the UK. Targets children aged 3-11.	Reduces the number of teeth affected by decay between 10-40%.	800,000
Care home visits	Residents require dentures but cannot attend a dentist.	Dental exams, moulds of teeth and denture fittings taking place in care homes.	Care homes are predominantly female, tooth loss is associated with deprivation.	Affected residents find it easier to eat and talk unassisted, feel more confident showing teeth.	3,350-83,750

The figure associated with care home visits is a range. This is because dentures have a finite life span, with a replacement rate of approximately once every five years, meaning a maximum of 83,750 and a minimum of 3,350 are estimated to need replacing in a care home setting per year.

Table 2: descriptive statistics

	Whole sample (n with % split of categories within approach)	
	Incremental (335)*	Standard (449)*
Gender (%)		
Male	47.46	51.45
Age (%)		
16-24	13.73	18.93
25-34	18.51	18.49
35-44	21.79	15.14
45-54	15.52	16.93
55-64	14.63	12.92
65+	15.82	17.59
Median Income (£)		
	23,400	18,200
Index of multiple deprivation (%)		
30% most deprived	41.49	39.87
30% least deprived	13.13	11.8
NSSEC (%)		
1	27.46	29.18
2	12.84	8.19
3	12.84	10.02
4	7.46	8.46
5	22.69	23.16
Other	16.72	20.27
Experience (%)		
Fluoride varnish	7.16	7.80
Root canal	36.12	35.41
Orthodontics	26.87	29.18
Supervised tooth brushing	8.36	6.46
Care home visits	1.19	1.11
Opinion on government welfare provision (%)		
Too much welfare	27.46	28.51
Right level of welfare	72.54	71.49
Frequency of dental visits (%)		
Less than once every two years	24.18	25.17
At least once every two years	75.82	74.83
Teeth (%)		
Less than 10	6.27	9.13
10-19	8.36	10.47
20+	85.37	80.40
Experience of dental pain (%)		
None	29.81	35.49
Some	67.95	62.83
Current pain	2.24	1.68
Treatment provider (%)		
NHS	57.61	57.02
Private	24.78	19.38
Other/don't know	17.61	23.61

*The random allocation process produced uneven sample sizes. The survey company used, Qa Research, cannot disclose their algorithm but have assured the research team the process was random and could not be influenced by the administrators.

Table 3: explicit preference ranks

Intervention	Rank				
	5 (least like to get funded)	4	3	2	1 (most like to get funded)
Fluoride Varnish	145 (18.49%)	157 (20.03%)	126 (16.07%)	176 (22.45%)	180 (22.96%)
Root Canal	136 (17.35%)	233 (29.72%)	168 (21.43%)	119 (15.18%)	128 (16.33%)
Extended Orthodontics	165 (21.05%)	171 (21.81%)	210 (26.79%)	152 (19.39%)	86 (10.97%)
Supervised Brushing	144 (18.37%)	110 (14.03%)	113 (14.41%)	180 (22.96%)	237 (30.23%)
Dentures in Care Homes	194 (24.74%)	113 (14.41%)	167 (21.30%)	157 (20.03%)	153 (19.52%)

Table 4: values with respect to intervention and rank in 2016 GDP (£)

Intervention	Incremental approach**					Standard Approach**				
	Mean	Median	Max	S.D.	n	Mean	Median	Max	S.D.	n
Fluoride Varnish	69.09	25.00	750	115.66	296	30.59	12.00	300	45.54	391
Root Canal	63.98	27.50	1000	114.79	303	33.14	20.00	250	42.76	406
Orthodontics	60.77	30.00	1000	101.07	299	35.53	20.00	400	49.70	400
Supervised Brushing	77.95	30.00	800	116.90	288	30.36	10.00	300	46.53	403
Dentures in Care Homes	69.59	30.00	950	119.65	301	32.80	20.00	220	43.58	402
Rank	Mean	Median	Max	S.D.	n	Mean	Median	Max	S.D.	n
5	20.79	10.00	200	33.68	285	28.72	10.00	200	42.14	381
4	40.84	20.00	400	63.21	296	27.31	10.00	400	41.58	393
3	65.87	30.50	600	96.46	296	30.21	15.00	200	39.79	403
2	89.30	44.50	800	128.53	301	35.20	19.75	250	47.60	412
1	119.79	65.00	1000	163.31	309	40.41	20.00	300	54.12	413

**As the sample sizes were uneven a decomposition test in the style of Oxaca-Blinder was used to assess if the sample composition was responsible for the difference in value at the mean for the fifth preference. The test indicated if the groups were randomised to the other approach they would produce similar results, these are available on request.

Table 5: protest responses

Intervention	Rank					Total
	5	4	3	2	1	
Fluoride Varnish	27	25	17	18	10	97
Root Canal	16	20	21	10	7	74
Extended Orthodontics	24	13	17	24	6	84
Supervised Brushing	27	18	15	10	20	90
Dentures in Care Homes	23	15	14	9	17	78
Total	117	91	84	71	60	