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**Parental decisions about children's oral health behaviour:
relative or absolute?**

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Abstract:	<p>Objectives: To test the extent to which parents' judgements about their children's oral health behaviour conform to the principles of a specific theory of cognitive decision making – Range-frequency Theory.</p> <p>Methods: Experimental study with an opportunity sample of 121 parents of young children (3-6 years old) living in areas of relative deprivation in South Wales. Parents were allocated to 4 different experimental groups, and each completed a pen-and-paper exercise, which involved being presented with (and rating) how often other parents brushed their children's teeth. The brushing frequencies presented were varied between groups, in order to directly test the rank and range principle of Range-frequency Theory.</p> <p>Results: Parents' ratings of other toothbrushing frequencies were consistent with the range and rank principle of Range-frequency Theory. A comparison between Group 1 and Group 2 showed that parents' ratings of similar brushing frequencies were affected by their relative rank among other brushing frequencies presented. A comparison between Group 3 and Group 4 showed that parents in a group who were presented with a very high brushing frequency (21 times a week) rated all other brushing frequencies as relatively less healthy than the comparison group.</p> <p>Conclusions: The principles of Range-frequency Theory were shown to be consistent with parents' judgement about children's oral health behaviour – specifically toothbrushing frequency. These findings provide a theoretical framework on which to develop future oral health education and interventions aimed at promoting twice-daily toothbrushing to parents of young children.</p>

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3 **Parental decisions about children's oral health behaviour: relative or absolute?**
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Abstract

Objectives: To test the extent to which parents' judgements about their children's oral health behaviour conform to the principles of a specific theory of cognitive decision making – Range-frequency Theory.

Methods: Experimental study with an opportunity sample of 121 parents of young children (3-6 years old) living in areas of relative deprivation in South Wales. Parents were allocated to 4 different experimental groups, and each completed a pen-and-paper exercise, which involved being presented with (and rating) how often other parents brushed their children's teeth. The brushing frequencies presented were varied between groups, in order to directly test the rank and range principle of Range-frequency Theory.

Results: Parents' ratings of other toothbrushing frequencies were predicted by the range and rank principle of Range-frequency Theory. A comparison between Group 1 and Group 2 showed that parents' ratings of similar brushing frequencies were affected by their relative rank among other brushing frequencies presented. A comparison between Group 3 and Group 4 showed that parents in a group who were presented with a very high brushing frequency (21 times a week) rated all other brushing frequencies as relatively less healthy than the comparison group.

Conclusions: The principles of Range-frequency Theory predicted parents' judgement about children's oral health behaviour – specifically toothbrushing frequency. These findings provide a theoretical framework on which to develop future oral health education and interventions aimed at promoting twice-daily toothbrushing to parents of young children.

Background

The benefits of regular fluoride toothpaste use for preventing dental caries in both children and adolescents are well established¹. Clinical trials have demonstrated improved oral health outcomes for twice-daily brushing compared to brushing just once a day or less², and twice-daily brushing is widely recommended for all age-groups^{3,4}. However, national surveys suggest that a significant proportion of parents of 5-year-old children fail to adhere to these guidelines, with less than twice-daily brushing particularly prevalent among socio-economically deprived groups⁵.

Behaviour-change interventions targeted at parents and caregivers therefore represent an opportunity for reducing the prevalence of tooth decay in young children. Previous efforts to change oral health behaviours have, however, been largely unsuccessful and criticised by researchers for lacking a theoretical underpinning or for relying on “now dated attempts to use social cognition models to predict behaviour”⁶. Despite a growing acknowledgement of the important role that parents and carers play in determining their children’s oral health behaviour, theoretical explanations for the way in which parents make decisions in this area are still lacking³.

Through a combination of interviews and cross-sectional survey work, our group has previously shown that the frequency with which parents brush their young children’s teeth is significantly associated with their perceptions of how often other parents brush their children’s teeth. Our research also suggests that parents evaluate their own child’s routine in relation to what they think others do^{7,8}.

The current study aimed to further develop this work by testing the extent to which parents’ judgements about oral health behaviour are consistent with a specific theory of relative decision making: Range-frequency Theory (RfT). RfT argues that most value judgements are made by ‘relative’ rather than ‘absolute’ processes⁹. There are two underlying principles of Range-Frequency Theory: the range principle and the rank principle. Briefly, the range principle posits that objects are perceived to be more valuable if they are proximal to the object with the largest value in the ‘contextual set’, while the rank principle argues that the relative rank of an object influences its perceived value. Researchers have shown that the rank and range principles of RfT can be applied to understanding people’s judgements in broader economic, social and health-related fields. The theory has been shown to accurately model people’s judgements of their own personal happiness¹⁰, their satisfaction with their job

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3 salary¹¹, their perceptions of body image¹², and their perceptions of the health benefits of
4 different levels of exercise. For example, Maltby and colleagues asked participants how many
5 minutes they typically exercised per week, then showed them information about how often
6 other people did so, before finally asking participants how healthy they considered their own
7 exercise levels. They found that participants' were heavily influenced by the information they
8 were given about others – a participant who did an hour of exercise a week might consider
9 themselves healthy if shown information suggesting that it compared favourably with their
10 peers, but unhealthy if shown information suggesting it compared relatively unfavourably
11 with their peers¹³. Despite this growing body of work, Range-frequency Theory has to our
12 knowledge never been tested in the context of oral health behaviours.

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20 The aims of the current study were therefore to: (1) manipulate information shown to parents
21 about how often other parents brush their child's teeth each week, in order to test whether
22 their judgements about what constitutes a healthy or unhealthy brushing routine conform to
23 the rank principle of RfT; (2) manipulate information shown to parents about how often other
24 parents brush their child's teeth each week, in order to test whether their judgements about
25 what constitutes a healthy or unhealthy brushing routine conform to the range principle of
26 RfT; (3) manipulate information shown to parents about how often other parents brush their
27 child's teeth each week, in order to test whether this has any subsequent effect on their
28 perceived norm for weekly brushing among other parents; (4) manipulate information shown
29 to parents about how often other parents brush their child's teeth each week, in order to test
30 whether this has any subsequent effect on how satisfied they are with their own child's
31 brushing routine.

32 33 34 35 36 37 38 39 40 41 42 43 **Methods**

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45 Ethical approval for the study was granted by Cardiff University Dental School Research
46 Ethics Committee (DSREC Ref: 13/11).

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49 Participants were an opportunity sample of 121 parents or caregivers of children aged
50 between 3-6 years old. The children were attending one of twelve nursery and infant schools
51 that were participating in the national Designed to Smile toothbrushing scheme in the Cardiff
52 and Vale University Health Board area, South-East Wales.

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3 The twelve nursery schools and infant schools were randomly selected from the full list of
4 163 schools taking part in the Designed to Smile scheme in the Cardiff and Vale University
5 Health Board. Designed to Smile is the Welsh national oral health improvement programme
6 targeted primarily at areas of high social and economic deprivation¹⁴. At each school,
7 eligible parents of children attending nursery (up to 3 years old), reception (4-5 years old) and
8 Year 1 (5-6 years old) classes were invited to take part in the study. Recruitment was aided
9 by staff from the Community Dental Service who distributed invitation letters, information
10 sheets and consent forms to class teachers to circulate to parents.
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17 Parents indicating a willingness to take part in the study were contacted by telephone, where
18 they had the chance to ask questions about the study, and were then asked to confirm that
19 they still wished to take part in the study. Where no contact could be made, parents were
20 called a maximum of three times (at least once in the evening or at a weekend) with
21 answerphone messages left where possible. For parents who could be contacted and who
22 consented to take part, a convenient time and place was agreed upon for them to complete the
23 exercise while the researcher was present – usually at their own home.
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29 Participants were paid £10 in shopping vouchers for taking part in the study.
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31 *Study design and procedure*

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34 The experimental research design was adapted from a series of experimental studies carried
35 out by Wood and colleagues^{13,15-16}, in which they tested whether people's judgements about
36 alcohol consumption, exercise duration and gratitude adhered to the rank and range principles
37 of RfT.
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41 Parents were allocated to one of four experimental groups. Group allocation was quasi-
42 randomised with parents assigned to groups sequentially, whereby the first participant to
43 carry out the exercise was assigned to be in Group 1, the second participant in Group 2 and so
44 on.
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49 Participants completed a pen and paper exercise in their home or in a quiet location such as a
50 cafe or their place of work. The researcher introduced the study as being related to their
51 child's toothbrushing routine, and encouraged them to be as honest as possible with their
52 answers, assuring them that all results would be anonymised and stored confidentially.
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3 The researcher read each participant a set of standardised instructions, and then presented
4 them with the exercise sheet. Parents were told to follow the instructions on each page and to
5 take as much time as they needed. The researcher was present at all times during the exercise,
6 and parents were encouraged to ask questions if there was anything they were unsure of.
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8 Otherwise, participants were left to complete the form on their own. The exercise typically
9 took around 15-20 minutes to complete.
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13 In all groups, parents were first asked for their child's age and gender, and then to indicate
14 how often they brushed their child's teeth at home each week. Parents were subsequently
15 presented with a table showing how many times nine other parents brushed their child's teeth
16 in a normal week, and told that the data was taken from a previous survey of toothbrushing
17 habits. On the following page, they were then asked to rate each of the nine brushing routines
18 on an 11-point scale, ranging from 1 (very unhealthy) to 11 (very healthy). On the final page,
19 parents were asked to use the same 1-11 scale to indicate how healthy they believed their own
20 child's brushing routine was. They were then asked to estimate how often they thought an
21 'average' child in their son or daughter's school class might have their teeth brushed at home
22 each week.
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31 <Figure 1>
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33 The participants were allocated to one of 4 experimental groups (Figure 1). All groups
34 answered the same pre and post exercise questions. The main experimental manipulation was
35 the set of nine brushing frequencies that each participant saw. Participants were shown one of
36 four different sets of numbers, depending on their group allocation. In Groups 1 and 2, the
37 distribution of brushing frequencies was manipulated to test the 'rank principle' of RfT,
38 whereas in Groups 3 and 4, the distributions were manipulated to test the 'range principle'.
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44 *Rank principle*
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46 Table 1 shows the distribution of the brushing frequencies presented to participants in Group
47 1 and Group 2. Participants were told that the numbers represented the frequency with which
48 various parents had reported brushing their child's teeth in a normal week, and were shown
49 the brushing frequencies in a randomised order. The frequencies common to each group are
50 highlighted in bold for the purpose of illustration. All frequencies were presented to the
51 participants in plain black text.
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56 <Table 1>
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3 The range (=12) and sum of brushing frequencies (=72) was equal for both groups: that is, the
4 difference between the maximum value (=14) and minimum value (=2) were the same, and
5 the nine brushing frequencies added to the same value for both groups. The highlighted
6 values (5, 8 and 11 times per week) were common to both groups and were used as reference
7 points. The three reference points were of equal proximity to the minimum, maximum and
8 mean values in each group.
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13 The only way in which the reference points differed between groups was in their rank
14 position among the other brushing frequencies. In Group 1, “5 times per week” was the
15 second lowest value in the group (rank = 8th out of 9), whereas in Group 2, it was the fourth
16 lowest value (rank = 6). “11 times per week” was the second highest value in Group 1 (rank =
17 2), whereas it was the fourth highest in Group 2 (rank = 4). In both groups, “8 times per
18 week” was ranked in the middle of the group (rank = 5).
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24 This allowed for a direct test of the rank principle: because their proximity to the range and
25 distance from the mean was the same, any difference in the way that the two groups rated the
26 “5 times per week” and “11 times per week” frequencies could only be accounted for by the
27 fact that these values differed in their rank position.
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31 *Range principle*

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33 Table 2 shows the distribution of the brushing frequencies presented to participants in Group
34 3 and Group 4. Again, participants were told that these numbers represented the frequency
35 with which various parents had reported brushing their child’s teeth each week, and the order
36 of brushing frequencies was randomly generated for each participant.
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41 <Table 2>

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43 Despite the different distributions, the range (=16) and sum of brushing frequencies was
44 equal for both groups (=95).
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47 The only difference between the groups was that in Group 3, the majority of the values were
48 close to the top of the range (i.e., the distribution was negatively skewed), whereas in Group
49 4, the majority of the values were closer to the bottom of the range (the distribution was
50 positively skewed).
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54 This allowed for a direct test of the range principle. In theory, the average rating given to the
55 nine brushing frequencies should be equal between the two groups, because the average
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brushing frequency was the same for both groups. Any significant difference in the sum of subjective health ratings between the two groups could therefore only be accounted for by the proximity of the frequencies to the minimum and maximum values in each group.

Data analysis

Data were entered and analysed using SPSS v20¹⁷.

To test the rank principle between Group 1 and Group 2, a two-factor mixed factorial ANOVA was used. Group (Group 1, Group 2) was a between subjects factor and brushing frequency (5 times per week, 8 times per week, 11 times per week) was a within subject factor. Analysis tested for main effects of brushing frequency and group, and for an interaction between the two factors. As is recommended with a mixed factorial ANOVA, effect sizes for significant findings are reported using the eta squared statistic (η^2)¹⁸.

One-way ANOVAs were used to test mean differences between the two groups in terms of parents' ratings of their own child's brushing frequency and their estimated 'norm' for weekly brushing frequency. For one-way ANOVAs, effect sizes for significant findings are reported using the Cohen's *d* statistic¹⁹.

To test the range principle, a one-way ANOVA was used to test mean differences in the average scores allocated to all nine brushing frequencies, with group (Group 3, Group 4) as the between subjects factor. To further test the range principle, a one-way ANOVA was employed to look at the mean healthiness score that each group assigned to the '14 times per week' frequency, which was common to both groups and ranked the same (3rd out of 9) in both. As above, one-way ANOVAs were used to test mean differences between the two groups in terms of parents' ratings of their own child's brushing frequency and their estimated 'norm' for weekly brushing frequency.

For each participant, a measure of socio-economic status was derived from their home post-code (provided on the consent form). Participants were allocated to one of five deprivation quintiles, assigned using the 2011 version of the Welsh Index of Multiple Deprivation²⁰ ranging from WIMD = 1 (least deprived) to WIMD = 5 (most deprived).

Results

<Table 3>

A one-way ANOVA showed that there were no significant differences between the groups in terms of the mean frequency with which parents reported brushing their child's teeth ($F(3, 117)=0.03$, $p=0.99$) or the child's age ($F(3,113)=0.23$, $p=0.88$). Chi-square analysis showed that there was no significant difference in the distribution of WIMD quintiles between the groups ($\chi^2 =9.09$, $p=0.70$), or any significant imbalance in children's gender ($\chi^2 = 6.26$, $p=0.10$) between groups.

Rank principle

There was a main effect of brushing frequency on the mean healthiness rating across the two groups ($F(1,59)=188.68$, $p<0.001$), whereby '11 times per week' was rated as generally more healthy than '8 times per week', which was in turn rated as generally more healthy than '5 times per week'.

When averaging the ratings assigned to 5, 8 and 11 times per week, there was no overall difference in healthiness ratings between the two groups ($F(1,59)=0.33$, $p=0.57$). However, there was a significant interaction effect between group membership and brushing frequency ($F(1,59)=6.98$, $p=0.01$; $\eta^2=0.08$) (Figure 2).

<Figure 2>

As predicted by the rank principle of Range-Frequency Theory, participants in Group 1 rated '5 times per week' as less healthy than participants in Group 2. The only way that the '5 times per week' frequency differed between groups was the fact that it was ranked lower among the other brushing frequencies presented to parents in Group 1 (rank = 8th out of 9) compared to its rank in Group 2 (rank = 6th out of 9). Conversely, parents in Group 1 rated the '11 times per week' brushing frequency as more healthy than those in Group 2. Again, the only way that this item differed between the groups was in its rank position among all brushing frequencies shown to parents. It was ranked higher in Group 1 (rank = 2nd out of 9) compared to Group 2 (rank = 4th out of 9). No difference in health ratings was observed for the '8 times per week' frequency, which had the same rank in both groups (rank = 5th out of 9). This significant interaction effect therefore suggests that parents' judgements about toothbrushing frequencies comply with the rank principle of RfT. If parents made absolute judgements about the healthiness of different brushing frequencies, there should have been no

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3 difference in the ratings assigned to the '5 times per week' and '11 times per week'
4 frequencies between the two groups.
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7 *Range principle*

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9 There was a significant main effect of group on the average healthiness rating of all items
10 (F(1,58)=28.70, $p<0.001$; $d=0.33$), whereby participants in Group 3 rated the nine brushing
11 frequencies as significantly more healthy on average than those in Group 4 (10.5 v 9.3)
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14 The nine brushing frequencies shown to the two groups had the same mean and sum value. If
15 parents were making absolute judgements about the healthiness of brushing frequencies, there
16 should have been no difference in the average ratings assigned to the nine items. This
17 significant difference between the two groups is therefore consistent with the range principle
18 of Range-Frequency Theory: the only difference between the two groups was that parents in
19 Group 4 saw frequencies which were generally further away from the top of the range (the
20 distribution was positively skewed, with a maximum value of 21 times per week) whereas
21 those in Group 3 saw frequencies which were generally quite close to the top of the range
22 (the distribution was negatively skewed, with a maximum value of 16 times per week).
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30 Participants in Group 4 rated their own child's brushing routine as significantly less healthy
31 than participants in Group 3 (8.0 v 9.6) (F(1,57)=5.20, $p=0.03$; $d=0.15$), despite no difference
32 in the frequency which parents in the two groups reported brushing their child's teeth.
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35 Participants in Group 4 also estimated that the 'norm' for weekly brushing frequency was
36 higher than those in Group 3 (11.1 v 10.3), but this difference was not statistically significant
37 (F(1,57)=0.87, $p=0.36$).
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43 **Discussion**

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45 The findings of the study showed that parents' judgements about the healthiness of various
46 weekly toothbrushing frequencies adhered to the rank and range principles of RfT. Parents
47 tended to rate toothbrushing frequencies as more healthy when they were ranked relatively
48 high among the other frequencies shown to them, and they ranked brushing frequencies as
49 more healthy when they were closer to the maximum brushing frequency presented. The
50 findings also demonstrated that showing parents different types of information about what
51 others do, affected how healthy they rated their own child's brushing routine. Parents in
52 Group 4, who were shown an example of a parent who brushed their child's teeth 21 times a
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3 week (or 3 times a day), subsequently rated their own child's brushing frequency as
4 significantly less healthy than those in Group 3. This difference existed despite parents from
5 the two groups reporting similar frequencies for brushing their child's teeth at the beginning
6 of the experiment.
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10 Although a number of steps were taken during the design and administration of the study to
11 ensure data quality and rigor, some limitations of the study must be acknowledged. One
12 common criticism of experimental studies is that they may lack 'ecological validity' – that is,
13 they may not be a realistic approximation of the way in which participants would make
14 decisions in a similar 'real world' situation. In the current study, for instance, it is possible
15 that parents were simply treating the brushing frequencies as numbers and comparing them
16 with the other numbers presented. However, the instructions given to participants specifically
17 mentioned that they should give an overall rating to the brushing frequencies, rather than
18 comparing them to each other. Furthermore, when parents were verbally debriefed, they all
19 indicated that they had understood the instructions and had assigned the ratings as instructed.
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23 The researcher was present when parents completed the exercise, in order to help with any
24 queries about the form. This helped to avoid measurement error by reducing instances of
25 parents misunderstanding questions or ticking too many or too few boxes, for instance. It also
26 allowed for greater standardisation of the process, ensuring that all parents were given the
27 same instructions and that they completed the questionnaire one page at a time, as intended.
28
29 However, despite reminding parents that there were 'no right or wrong answers', this may
30 have led to some element of 'social desirability bias' where participants gave socially
31 acceptable answers. Future work might look to see if there would be any difference in
32 findings if parents completed a similar, self-complete questionnaire.
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36 As the study population was deemed to be fairly homogenous in terms of socio-
37 demographics, it was deemed unnecessary to deliberately balance the groups by matching
38 participants on certain traits. Indeed, the groups were well matched in terms of children's age,
39 the frequency with which parents reported brushing their child's teeth and socio-economic
40 status, suggesting minimal selection bias.
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44 Due to the deliberate focus on parents from areas of relatively high socio-economic
45 deprivation, the findings reported here may have limitations in their generalisability to wider
46 populations. To improve the external validity of the findings, future research may seek to
47 explore whether parents from different socio-economic backgrounds, or older children and
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3 adolescents exhibit the same tendency towards making relative judgements about
4 toothbrushing frequency.
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7 Finally, as this was the first study to test the principles of RfT in relation to oral health, it was
8 not possible to accurately estimate means on which to base an *a priori* sample size calculation.
9 The sample size for each group was instead based on previous studies utilising the same
10 experimental design. As a result, it is important to acknowledge the possibility of type II
11 errors: that is, the chance that some of the non-significant findings may have been the result
12 of a lack of statistical power.
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16 Despite these limitations, this study is the first to apply the principles of RfT to trying to
17 understand parents' decisions about what constitutes a healthy number of times to brush a
18 child's teeth each week. These findings add to a growing research base showing that the two
19 principles of RfT can accurately predict people's relative judgements in areas such as alcohol
20 risk perception, body image, happiness and satisfaction with salary^{10-13, 15}.
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24 The effect of showing people different information about what others do has been shown to
25 influence people's subsequent judgements in other areas as well. Maltby and colleagues, of
26 instance, demonstrated that participants were less likely to feel that their own exercise levels
27 were healthy when previously shown examples of people who tended to exercise more than
28 they did¹³. To our knowledge, this is the first study to demonstrate that presenting different
29 types of information about what other people do can influence people's satisfaction with their
30 own (or in this case, their child's) toothbrushing frequency. Participants shown information
31 suggesting that other parents brush their child's teeth three times a day expressed less
32 satisfaction with their own child's brushing routine. Such findings are consistent with the
33 broader concepts of Social Comparison Theory²⁰, which argues that people have a natural
34 tendency to compare themselves with others when making judgements – including those
35 relating to health.
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39 Assuming that parents who are less satisfied with how often they brush their child's teeth will
40 be more motivated to improve their behaviour, this opens up a range of possibilities for
41 designing oral health education messages or interventions which might bring about behaviour
42 change through giving people different types of information about what their peers do.
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Conclusions

The current study suggests that decisions about toothbrushing are influenced by the same cognitive processes (the rank and range principles) that predict people's judgements in other aspects of life. The Medical Research Council stress that an important stage in the development of complex interventions is the identification and development of appropriate theory²¹. The findings reported here suggest that Range-frequency Theory may offer one framework for designing oral health education messages or behaviour-change interventions aimed at parents of young children. Further research is required to explore how best to apply this theory to promoting adherence to toothbrushing guidelines among high-risk groups.

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Tables and figures

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Figure 1: Experimental procedure (attached PPT file)

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Figure 2: Average health ratings assigned to selected brushing frequencies by participants in Group 1 and Group 2 – a test of the rank principle (attached PPT file)

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Table 1: Brushing frequencies shown to participants in Group 1 and 2

Group 1	Group 2
<i>Weekly brushing frequency</i>	<i>Weekly brushing frequency</i>
2	2
5	3
6	4
7	5
8	8
9	11
10	12
11	13
14	14

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Table 2: Brushing frequencies shown to participants in Group 3 and 4

Group 3	Group 4
<i>Weekly brushing frequency</i>	<i>Weekly brushing frequency</i>
0	5
6	6
7	7
11	8
12	9
13	10
14	14
15	15
16	21

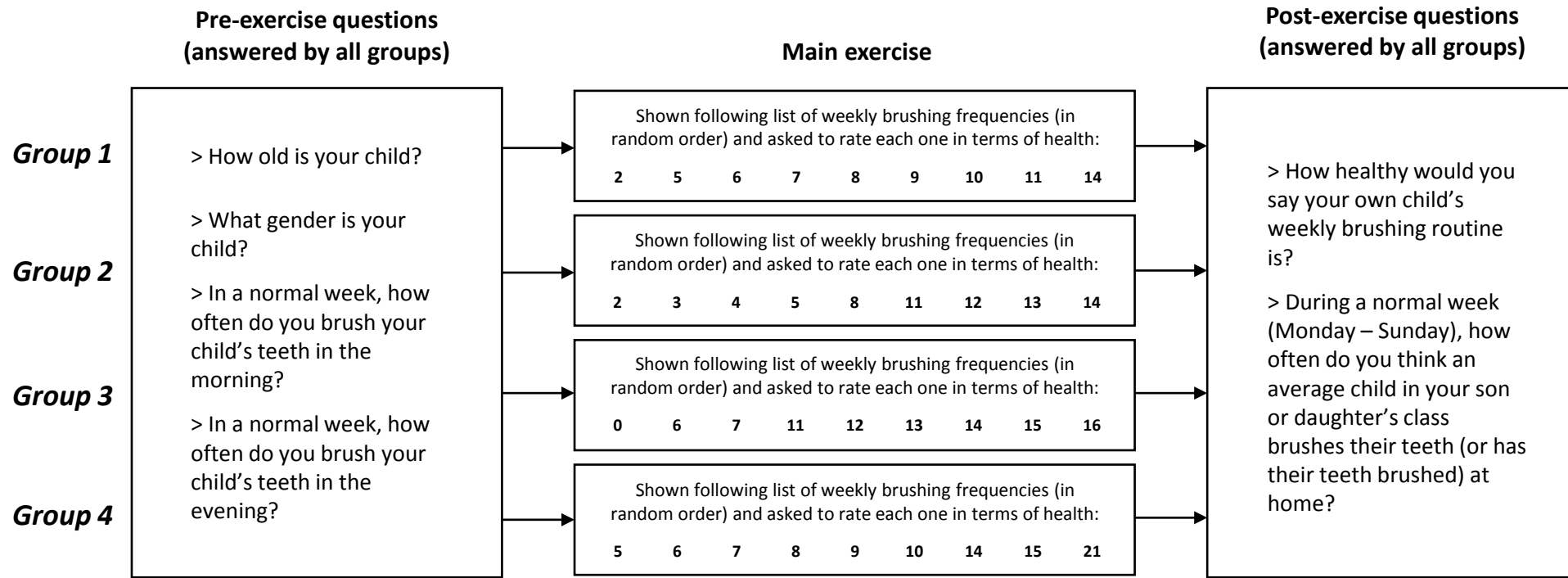
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Table 3: Demographic details of study participants

Variable	Group	N	Mean	Standard deviation	Min value	Max value
Frequency with which parents report brushing child's teeth (weekly)	G1	30	13.0	2.5	7	21
	G2	31	13.0	2.4	8	21
	G3	30	13.1	2.8	5	21
	G4	30	12.9	2.6	7	21
	Overall	121	13.0	2.5	5	21
Child's age (in months)	G1	28	60.4	11.0	40	81
	G2	30	61.8	12.4	34	81
	G3	29	59.8	13.3	38	75
	G4	30	59.3	13.6	25	74
	Overall	117	60.3	12.5	25	81
Child's gender	Group	Male n (%)	Female n (%)			
	G1	15 (50.0)	15 (50.0)			
	G2	12 (41.3)	17 (58.7)			
	G3	20 (66.7)	10 (33.3)			
	G4	11 (36.7)	19 (63.3)			
	Overall	58 (48.7)	61 (52.3)			
Parental socio-economic status	Group	WIMD=1^a n (%)	WIMD=2 n (%)	WIMD=3 n (%)	WIMD=4 n (%)	WIMD=5 n (%)
	G1	2 (7.1)	2 (7.1)	6 (21.4)	9 (32.1)	9 (32.1)
	G2	1 (3.4)	0 (0.0)	10 (34.5)	6 (20.7)	12 (41.4)
	G3	0 (0.0)	2 (6.9)	6 (20.7)	10 (34.5)	11 (37.9)
	G4	1 (3.3)	4 (13.3)	7 (23.3)	7 (23.3)	11 (36.7)
	Overall	4 (3.4)	8 (6.9)	29 (25.0)	32 (27.6)	43 (37.0)

a=Welsh Index of Multiple Deprivation (Welsh Government, 2011*), where 1=least deprived and 5=most deprived

Figure 1: Experimental procedure flow diagram



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Figure 2: Average health ratings assigned to selected brushing frequencies by participants in Group 1 and Group 2 – a test of the rank principle

