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Learning from good practice: a review of current oral health promotion materials for parents of young children

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Abstract

Objectives: To examine the quality of UK-based oral health promotion materials (OHPM) for parents of young children aged 0-5 years old.

Data sources: OHPM were obtained via: email request to Dental Public Health consultants and oral health promotion teams in the UK; structured web-based searches or collected from oral health events.

Data selection: Materials were included if: they were freely available; in English; were parent facing and included oral health advice aimed for children aged 0-5 years old

Data extraction: Quality assessment was based on: Whether the oral health messages were consistent with Public Health England's Delivering Better Oral Health guidance, and What barriers to good oral health were addressed by the OHPM using the Theoretical Domains Framework (TDF).

Data synthesis: A wide range of printed and digital OHPM were identified (n=111). However, only one material covered all 16 guidance points identified in Public Health England's Delivering Better Oral Health (mean 6, SD 4), and one other material addressed all 12 domains of the TDF (mean 6, SD 2).

Conclusions: Although there were examples of high quality further development is required to ensure OHPM are clear, consistent and address a wider range of barriers to good oral health behaviours.

Introduction

Dental caries is the most common chronic disease affecting children. In the most recent Child Dental Health Survey, decay was present in 31% of five year olds and 46% of eight year olds[1]. Moreover, there are significant health inequalities in oral health, with children from more deprived backgrounds having a greater likelihood of experiencing poor oral health than their same age counterparts[1]. Caries causes pain and suffering as well as changing what children eat, their speech, quality of life, self-esteem and social confidence[2-7]. In addition, the need for dental treatment has a significant impact on school readiness, therefore limits their ability to benefit from education and develop emotionally, behaviourally and socially[8]. Furthermore, it is the most common reason for young children to have to attend hospital for a general anaesthetic, which places a substantial burden not only on the child, but their family[9], and the NHS[10].

Both the National Institute for Health and Care Excellence (NICE)[11] and Public Health England (PHE)[8] have emphasised the importance of early intervention in the prevention of dental caries in childhood. As such, numerous organisations have sought to promote good oral health in young children with the aim of reducing the prevalence of dental caries. There is a lack of a standardised format to these resources and it is uncertain whether all materials adhere to current guidance or whether they address barriers to good oral health practices. Currently in England, PHE has developed an evidence-based oral health toolkit called 'Delivering Better Oral Health'[12] which includes detailed guidance for children aged 0-6 years (see Table 1). Furthermore, the delivery of oral health promotion is evolving with the use of modern technology translating print-based materials onto digital platforms. The benefits include digital media costing less to replicate than print-based materials, being easier to update and permitting multiple styles of presentation such as website and phone app. These are significant advantages, especially in the current climate of financial restraint. A key priority therefore is to assess the quality of these materials, especially in terms of whether they are they all providing the correct oral health advice and are they effectively addressing all the barriers to good oral health in young children. The reason for this is twofold. First, to assess if such materials already exist, and therefore can be used nationally in their current form or with modification. Second, to identify where problems with current materials lie and what can be improved. As such, this paper provides advice for developers to ensure future materials are designed to effectively target key barriers to good oral health practices, which is underpinned by appropriate psychological theory.

Psychological theory is increasingly being utilised within dentistry, and indeed, such an approach has numerous benefits. For instance, two recent systematic reviews on the use of psychological theory in oral health promotion have shown psychological interventions are more effective in improving oral hygiene, gingival health, plaque-index and self-efficacy in tooth brushing compared to traditional education/information based interventions[13-14]. The Theoretical Domains Framework (TDF) is a particularly useful psychological framework that has been used to successfully identify important determinants of dental behaviours[54-16]. The TDF[17] is a comprehensive list of the determinants of behaviour derived from 33 behaviour

change theories. It identifies 12 key domains thought to influence behaviour, including knowledge, skills, motivation and goals, beliefs about capabilities, social influences and behaviour regulation (See Table 2 for full list). Furthermore, it provides a valuable framework for assessing the psychological determinants of behaviour at all levels of influence (individual, interpersonal and environmental); thus provides an underlying scientific rigor and allows the mechanism of action within interventions to be studied.

Traditionally, oral health promotion has focussed on knowledge transfer, however, there is little evidence to show improvements in knowledge lead to long-term behaviour change[14]. Furthermore, earlier work undertaken by our inter-disciplinary research group via a systematic review[18], qualitative interviews with parents of young children[19] and patient and public engagement[20] identified that barriers and facilitators to good oral health practices are spread across all the domains outlined in the Theoretical Domains Framework. Thus oral health promotion materials need to address a range of barriers to support the adoption of good oral health practices. Key barriers where practical advice is needed for pre-school aged children are beliefs in capabilities (confidence in how to correctly perform oral health practices), behaviour regulation (managing the behaviour of an uncooperative toddler), nature of the behaviour (setting oral health routines), and social influences (the influence of family, friends and health professionals on oral health behaviours).

The current review aims to examine the quality of UK-based oral health promotion materials for parents of young children (0-5 (inclusive) years old). It identifies examples of good practice and draws attention to gaps in the current provision of oral health materials by assessing:

1. Whether the oral health messages are consistent with Public Health England's (PHE) "Delivering Better Oral Health" guidance[12]

2. What barriers to good oral health are addressed by the materials using the Theoretical Domains Framework (TDF)

Method

Search and inclusion/exclusion criteria

The search for materials was conducted between January and February 2016, with oral health promotion materials being obtained from three key sources based on the recommendations of a University of Leeds information specialist with expertise in review methodology and guidance from Public Health England:

(1) Advertisement requesting examples of materials adhering to the inclusion criteria. These requests were sent to all consultants in Dental Public Health and to all members of the National Oral Health Promotion Group. These individuals were asked to circulate our request to the wider members of the oral health promotion community.

(2) Internet searches were conducted using the Google search engine. To ensure only UK based materials were included site limits were imposed to university (.ac), NHS, (.nhs), government (.gov), organisation (.org), and company (.co) as these can be

followed by .uk. Using the advanced search option on Google our search terms were: leaflet OR book OR poster OR video OR cartoon OR app "child oral health" site:nhs.uk, with the same search times being run with each website type.

(3) Our on-going research interest in children's oral health[19-20] has led to the donation and collection of materials from various organisations; therefore any oral health promotion materials adhering to the inclusion criteria were included in the review.

Inclusion and exclusion criteria

Oral health promotion materials were included if:

- UK-based
- Freely available
- In English
- Provided oral health guidance aimed towards children aged 0 – 5 (inclusive) years old
- Included oral health practices covered in "Delivering Better Oral Health" (see Appendix for full list of recommendations)
- Targeted parents or were parent-related (defined as materials for professionals (e.g., health visitors, teachers etc.), which would give out to parents either verbally or through physical resources (e.g., leaflets); or materials aimed at children, but had dedicated parent features (e.g., apps))
- Oral health materials available as one of these electronic or physical forms: leaflet, book, poster, video, cartoon or app.

Oral health promotion materials were excluded if they:

- Aimed beyond the 0 – 5 (inclusive) year old age range. Although, where clear distinctions between the guidance for those within the age range and outside of the age range were present, the information specific to the 0 – 5 (inclusive) year old age range was included in the review.
- The oral health information is only provided as text-based webpages

Coding

Each oral health promotion material identified for inclusion in the review was coded initially by a researcher with expertise in psychology and behaviour change (KG-B). A random ten percent of the materials were independently coded by a second reviewer (JO) with expertise in oral health. KG-B and JO subsequently met, reviewed their coding and following discussion agreed a standard framework. A customised data extraction proforma was used to extract information from each material regarding: type (e.g., leaflet, video, song), length (i.e., number of pages, duration of song/video in minutes), title, target audience, who provided the material and who it was developed by, topics covered, which 'Delivering Better

Oral Health' guidelines were covered and their accuracy, and the barriers to oral health as defined by the Theoretical Domains Framework addressed.

Results

The search methodology identified 111 oral health promotion materials for inclusion in the current review[1] (see Figure 1).

Materials

The types of materials used to deliver oral health messages were wide ranging, including both print and digital media (Table 3). Nevertheless, of the 21 different types of oral health promotion materials identified, the majority (16/21) were print-based, with leaflets being the most popular oral health promotion material. The length of printed materials dedicated to oral health (considering some oral health promotion materials were embedded within wider health promotion materials) ranged between 1 – 109 pages. Digital materials (e.g., songs, videos, radio infomercials) ranged in duration between 51 seconds – 16 minutes 45 seconds. Apps hosted a range of materials, including games and colouring books for children and parent dedicated leaflets/screens. Materials were primarily developed by three sources: the NHS/health institutions, local authorities, and dental/pharmaceutical companies. Thus, all the materials came from credible sources, primarily delivered through experts in oral health, with some instances including interactions with parents and children. With regards to the target audience, 85 materials were targeted at parents/carers, 13 targeted parents and children, seven targeted parents via health professionals and the wider childhood workforce, such as health visitors, teachers etc., and one material did not make clear who it targeted, thus could be used by both parents and children.

Delivering Better Oral Health

There are 15 key points of oral health advice for children aged 0-5 (inclusive) years old covered in the 'Delivering Better Oral Health' guidance and we added visiting the dentist to the criteria, resulting in 16 key points. No single material covered all the evidence-based guidance outlined in 'Delivering Better Oral Health' (Table 3). The most commonly provided advice was regarding toothbrushing frequency, type of toothpaste, sugar consumption and visiting the dentist, whereas the type of toothbrush to use, brushing children's teeth upon eruption and fluoride varnish were less commonly covered. Many of the materials also included guidance beyond that contained within 'Delivering Better Oral Health', with guidance frequently being on subjects such as dummies, replacing toothbrushes, flossing and reducing the spread of germs by not sharing toothbrushes and eating utensils.

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[1] The oral health promotion materials included in this review were provided to the research team for this project with the understanding that we would not distribute them further. However it may be possible to provide the contact details for those who kindly sent us a copy of their materials.

Generally, the materials provided oral health advice in line with guidance. However, there were instances where information was inconsistent or incorrect, namely with regards to toothpaste amount, spitting rather than rinsing and dental visits. For example, three materials recommended a smear of toothpaste for under 2 year olds and a pea-sized amount for over 2 year olds, and one material recommended a pea-sized amount from 6 months – 6 years old. In addition, there was a lack of clarity in the guidance surrounding parental supervised toothbrushing (PSB). In the materials that did not explicitly address PSB, the wording was unclear and could possibly be implied, or it was advised that the child should brush independently. Even between materials that recommended PSB there were inconsistencies in the description of what it actually entails, with this including 'brushing', 'supervising', 'helping' and 'asking a grown up for assistance'. Moreover, these differing descriptions could be seen within the same material or despite recommending a parent's involvement in toothbrushing would also include pictures/video of children brushing their own teeth unaided.

Barriers to good oral health practices based on the Theoretical Domains Framework

Although all 12 barriers were addressed within the 111 materials, only one of the materials addressed all the barriers by themselves (see Table 3). The range of barriers addressed within a single material was between two to twelve. However, it is imperative to acknowledge that although technically the barriers were addressed it was not always to a high quality or correctly. For example, skills could be minimally addressed by simply providing what to use (i.e. what toothbrush and toothpaste) and what to do (i.e., instruction on the 'Delivering Better Oral Health' guidance), but lacked practical skills on how to actually brush a child's teeth (e.g., position, brushing technique), set toothbrushing routines and manage children's behaviour. On the other hand with regards to social role the information was incorrect with in some cases responsibility being placed wholly on the child, which is contradictory to the guidance. The main barriers addressed included beliefs about consequences, skills, and the most commonly addressed barrier was knowledge. Barriers that were less well addressed included motivation and goals, memory, attention and decision process, and social/professional role and identity.

Discussion

This is the first review to examine the quality of UK-based oral health promotion materials for parents of young children (0-5 (inclusive) years old). This is a key piece of research as it not only reviews the quality of current provision, but also describes a robust methodology to support development and evaluation of future oral health promotion materials. The findings have revealed that although there are examples of good practice within existing health promotion materials there are issues with consistency and clarity that need to be addressed to ensure future materials deliver clear evidence-based messages to parents. Each of which will be discussed in turn.

Methodology

The current paper is the first of its kind to apply a robust review methodology to materials of this nature, and it is hoped that this approach will be useful to researchers who wish to conduct such research in the future. However, it has not been without its challenges. Unlike a traditional systematic review where various electronic databases are employed to search for literature, no such database system collates health promotion materials. Therefore, a pragmatic and informed approach had to be adopted to gather materials. Furthermore, as the review includes digital materials it has to be recognised that there are ongoing updates of such materials, and thus these changes could alter results. A realistic approach was taken to web-based materials with videos, games and leaflets that are accessible on the web included. Simple text-based webpages were excluded, as the vast volume of such pages that exist would the review unmanageable to undertake. A key strength of the current review was the use of two independent experts to code the materials for quality (i.e., DBOH guidance and TDF barriers addressed), therefore ensuring the coding was reliable and valid. In addition, this allowed us to identify where and how barriers to oral health care had been addressed at a superficial level and a deeper level, which can be seen in Table 4. This guidance on the assessment of different TDF domains will permit other research groups to use this methodology in the future for the evaluation and development of health promotion materials.

Materials

The findings revealed that the majority of oral health promotion materials were print-based, with leaflets commonly being used. The problem, however, with the reliance on print-based materials is that although there are indeed an effective means of transferring knowledge to the public, there is no evidence to support their effectiveness in changing behaviour[13]. Moreover, print-based materials may restrict the number of barriers to oral health behaviour that can be sufficiently addressed, due to constraints on space and budget. On the other hand, although longer materials may address more barriers, they also may lose their appeal and appear burdensome to the target audience. Digitalisation of oral health promotion materials may help to remove these constraints and therefore allow a greater number of barriers to be addressed. In addition, making digital materials available via the internet provides the opportunity to share materials to a wider audience as they are easily accessible and freely available. A small number of materials were used by multiple organisations in different formats utilising both print and digital formats of the same material. However, irrespective of how many formats or organisations used the same material, the material was only counted once in the results as it was the same information that was presented. Indeed, it must be acknowledged that due to the unique nature of the review investigating both printed and digital media we have had to adopt a customized search strategy, especially as no databases exist that collate such materials. Nevertheless, despite consulting with an expert with regards to the search strategy, it does have its limitations in terms of being dependent on responses from outside organisations and the searching algorithms use by internet search engines. Another limitation is that it is possible that ongoing development of some digital media (e.g., apps) may mean the materials have changed since data extraction.

Another important issue regards the source of the materials. In the present review materials were primarily developed by three sources: the NHS/health institutions, local authorities, and dental/pharmaceutical companies. Thus, all the materials came from credible sources, primarily delivered through experts in oral health, with some instances including interactions with parents and children. The nature of the source providing oral health advice is important, as it can be a barrier or facilitator to the effectiveness of oral health promotion[14]. The target audience must trust those who are giving the advice, and feel as though they empathise with them, thus depending on the audience credible sources could include dental professionals, community workers and peers, with this being of key importance considering verbally presented oral health advice can be particularly effective in improving oral health[14].

Delivering Better Oral Health

Firstly, it has to be acknowledged that the ‘Delivering Better Oral Health’ toolkit provides guidance for children aged 0-6, however we chose to focus on the age range of 0-5 (inclusive) years old. The reasons for which are threefold. First, a number of materials grouped their own materials from 0-5 years old and from 6 years onwards, thus going beyond the age based guidance provided by the ‘Delivering Better Oral Health’ toolkit. Second, for most children the permanent dentition erupts around the age of six with differing preventive advice provided, the focus for our review was the primary dentition. Third, in the UK it is mandatory for all children to begin school at the age of five, and this research aimed to focus on the oral health of preschool children.

Overall, all the materials included in the review presented advice in line with the “Delivering Better Oral Health” guidance, but there were key areas where a lack of consistency and clarity were evident. Inconsistencies were particularly found with regards to the appropriate amount of toothpaste to use at different ages, spitting out toothpaste rather than rinsing and dental appointments (initiation and regularity). However, it is possible that some of these materials may have been produced before 2009 when the ‘Delivering Better Oral Health’ guidance first emerged. Nevertheless, there is a need to remove/update such materials as it is vital to present a clear oral health message that is consistent nationally to ensure parents are receiving the correct information and avoid confusion, especially as evidence shows adherence to such behaviours has a beneficial impact on caries development. For example, a recent systematic review showed that toothbrushing twice a day with fluoride toothpaste reduces the incidence of carious lesions[21]. Similarly, clarity was lacking with regards to the appropriate type of toothbrush to use and the nature of parental supervised toothbrushing, with vague terms being used to describe both of these guidelines. Once more, the problem with using unclear descriptions that are open to interpretation is that it perpetuates parental confusion over correct oral health care for their children. This is of particular concern as parental supervised toothbrushing is an important means of preventing caries[22-23]; yet evidence shows current practice is low[1]. The best examples addressing parental supervised toothbrushing made clear statements that the parents should brush the child’s teeth both verbally and pictorially or explained how the level of involvement may change as the child increased in age with greater independence being given as children

approached preschool age, but still aided by a parent nevertheless. Furthermore, good examples included information on positioning while brushing a child's teeth and how to brush a child's teeth that could be further demonstrated pictorially. In a similar vein, the best examples providing advice on diet included how to identify sugar on food labels, examples of high-sugar snacks and healthy snacks, or included the Eatwell Guide[24].

Barriers to good oral health practices based on the Theoretical Domains Framework

It is unsurprising that knowledge was the key barrier addressed, as this is the basis of most health promotion materials. However, there is little evidence to show improved knowledge leads to improved oral health behaviour[14]. Therefore, there is a need for future oral health promotion materials to attempt to address as many barriers to oral health as possible within the constraints of the medium of delivery; and the increasing use of digital media may help to address a wider number of barriers to good oral health practices. For example, digital media (e.g., videos, animations) may be particularly useful to actively demonstrate practical skills. Indeed, previous research[18-19] has shown that the main barriers experienced by parents relate not to knowledge, but to skills, beliefs about capabilities, social influences, behaviour regulation and routine setting (nature of the behaviour). Within the current review the best examples addressed these barriers through demonstration, providing practical advice/resources and empathising with the parent (see Table 4).

Conclusions

Broadly, the majority of materials available to parents of 0-5 year olds adhere to the guidance provided by 'Delivering Better Oral Health' and there is evidence of good practice in those materials addressing the barriers of social influences and behaviour regulation, which can be particularly problematic for parents. However, there is a need to ensure that the guidance provided is clear and correct, as there were a number of instances where clarity and consistency was lacking in currently available materials, predominantly regarding parental supervised toothbrushing. Moreover, with our underpinning work which shows barriers to good oral health are spread across all of the TDF domains we have developed a robust methodology with which to quality assure oral health promotion material. This will help not only with the development of future oral health promotion materials by highlighting what barriers to address and providing examples of good practice on how to address them, but also evaluation of oral health promotion materials in the future, both in this area and other pertinent areas of oral health

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References

1. Health and Social Care Information Centre. Children's Dental Health Survey 2013. Report 2: Dental Disease and Damage in Children. England, Wales and Northern Ireland: 2015. http://content.digital.nhs.uk/catalogue/PUB17137 (accesssed 31 January 2017).

http://www.nature.com/bdj/journal/v221/n6/full/sj.bdj.2016.682.html

2. Sheiham A. Oral health, general health and quality of life. *Bull World Health Organ*. 2005; 83: 644.

3. Shepherd MA, Nadanovsky P, Sheiham A. The prevalence and impact of dental pain in 8-year-old school children in Harrow, England. *Br Dent J*. 1999; 187: 38-41.

4. Krisdapong S, Sheiham A, Tsakos G. Oral health-related quality of life of 12- and 15-year-old Thai children: findings from a national survey. *Community Dent Oral Epidemiol*. 2009; 37: 509-17.

5. Gilchrist F, Marshman Z, Deery C, Rodd HD. The impact of dental caries on children and young people: what they have to say? *Int J Paediatr Dent*. 2015; 25:327-338.

6. Murray CJ, Richards MA, Newton JN, Fenton KA, Anderson HR, Atkinson C, et al. UK health performance: findings of the Global Burden of Disease Study 2010. *Lancet*. 2013; 381: 997-1020.

7. American Academy on Pediatric Dentistry. Policy on early childhood caries (ECC): classifications, consequences, and preventive strategies. *Pediatr Dent*. 2008; 30: 40-3.

8. Public Health England. Local authorities improving oral health: commissioning better oral health for children and young people: An evidence-informed toolkit for local authorities. 2014. Online information available at https://www.gov.uk/government/publications/improving-oral-health-an-evidence-informed-toolkit-for-local-authorities (accessed 31 January 2017).

9. Goodwin M, Sanders C, Davies G, Walsh, T, Pretty, I. Issues arising following a referral and subsequent wait for extraction under general anaesthetic: impact on children. *BMC Oral Health*. 2015; 15: 3

10. Department of Health. National schedule of reference costs 2011-12. 2012. Online information available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/213060/2011-12-reference-costs-publication.pdf (accessed 31 January 2017).

11. National Institute for Health and Care Excellence. Oral health: approaches for local authorities and their partners to improve the oral health of their communities. NICE Public health guidance 55; 2014. Online information available at https://www.nice.org.uk/guidance/ph55 (accessed 31 January 2017)

12. Public Health England. Delivering better oral health: an evidence-based toolkit for prevention. 2014. Online information available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/367563/DBOHv32014OCTMainDocument_3.pdf (accessed 31 January 2017).

13. Werner H, Hakeberg M, Dahlstrom L, Eriksson M, Sjogren P, Strandell A, et al. Psychological Interventions for Poor Oral Health: A Systematic Review. *J Dent Res*. 2016; 95: 506-14.

14. Kay E, Vascott D, Hocking A, Nield H, Dorr C, Barrett H. A review of approaches for dental practice teams for promoting oral health. *Community Dent Oral Epidemiol*. 2016; 44: 313-330.

15. Gnich W, Bonetti D, Sherriff A, Sharma S, Conway DI, Macpherson LM. Use of the theoretical domains framework to further understanding of what influences application of fluoride varnish to children's teeth: a national survey of general dental practitioners in Scotland. *Community Dent Oral Epidemiol*. 2015; 43: 272-81.

16. Bonetti D, Clarkson JE. The challenges of designing and evaluating complex interventions. *Community Dent Health*. 2010; 27: 130-132.

17. Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation science*. 2012; 7:37.

18. Aliakbari E, Gray-Burrows K, Vinall-Collier K, Marshman Z, McEachan R, Day P. Systematic review of home-based toothbrushing practices by parents of young children to reduce dental caries. *BMC Oral Health*. In submission.

19. Marshman Z, Ahern SM, McEachan RRC, Rogers HJ, Gray-Burrows KA, Day PF. Parents' Experiences of Toothbrushing with Children: A Qualitative Study. *JDR Clinical & Translational Research*. 2016; 1:122-130.

20. Gray-Burrows KA, Day PF, Marshman Z, Aliakbari E, Prady SL, McEachan RRC. Using intervention mapping to develop a home-based parental-supervised toothbrushing intervention for young children. *Implementation Science*. 2016; 11: 1-14.

21. Scheerman JFM, van Loveren C, van Meijel B, Dusseldorp E, Wartewig E, Verrips GHW, et al. Psychosocial correlates of oral hygiene behaviour in people aged 9 to 19 – a systematic review with meta-analysis. *Community Dent Oral Epidemiol*. 2016; 44: 331-41.

22. Pine CM, Adair PM, Nicoll AD, Burnside G, Petersen PE, Beighton D, et al. International comparisons of health inequalities in childhood dental caries. *Community Dent Health*. 2004; 21: 121-30.

23. Broadbent JM, Thomson M, Boyens JV, Poulton R. Dental plaque and oral health during the first 32 years of life. *J Am Dent Assoc*. 2011; 142: 415-26.

24. Public Health England. The Eatwell Guide: Helping you eat a healthy, balanced diet. 2016. Online information available at https://www.gov.uk/government/publications/the-eatwell-guide (accessed 31 January 2017).

Tables

Table 1: Guidance from Public Health England on key oral health behaviours which maximises the likelihood that children will grow up free of dental disease

"Delivering Better Oral Health" guidance for 0 – 6 year olds
Commence tooth brushing upon tooth eruption
Brush teeth twice a day - last thing at night and on one other occasion
Use a small-headed toothbrush with medium-texture bristles
Between 0 – 3 years use a smear of toothpaste, 3 – 6 years use a pea-sized amount of toothpaste
Use fluoride (at least 1000ppm) toothpaste
Do not allow the consumption of toothpaste
Children need to be helped or supervised by an adult when brushing until at least seven years of age (parental supervised toothbrushing)
Brush teeth for 2 minutes (while this is not specifically mentioned in Delivery Better Oral Health summary table – the supporting text states 'thorough cleaning may take two minutes')
Spit out toothpaste rather than rinsing
Promotion of breastfeeding
Introduce a free-flowing cup for children to drink from at 6 months old and discourage bottle use by 1 year old
Reduce sugar consumption (do not add to weaning food or drinks/frequency and amount of sugary food and drinks should be reduced/sugar-free medicines/avoid consumption at bedtime)
General dietary guidelines (eating the right amount relative to activity to be a healthy weight/eat a range of foods (as outlined by the eatwell plate)/base meals on starchy foods/eat 5 fruits/vegetables a day/eat 2 portions of fish (including oily) a week)/cut down saturated fat/eat less salt (6g a day)/drink water (6-8 glasses/1.2lts) a day)
Fluoride varnish
Use of additional fluoride (tablets/drops/rinses)
Although not specifically addressed in the 'Delivering Better Oral Health' guidance visiting the dentist regularly was also included in the current review. The guidance states, "Oral hygiene practices, tobacco and alcohol use, certain dietary practices, the use of fluorides and dental attendance are all important oral health related behaviours". Moreover dental attendance provides an opportunity for delivery of oral health messages.

Table 2: Barriers identified from our qualitative interviews, mapped onto the Theoretical Domains Framework[2]

Theoretical Domains from TDF	Example quotes from qualitative interviews with parents
Knowledge	"I don't think they've ever told us that under the age of 7 you should brush your kids teeth"
Skills	"I have to say to her give me a turn and then it's your turn to brush her teeth and she has her turn…"
Social/professional role and identity	"It is my responsibility because they're my kids, I brought them into this world so it's my job to give them the best upbringing"
Beliefs about capabilities	"…all the time I am worrying…like if I'm doing it right…"
Beliefs about consequences	"you can actually smell their breath like when their talking to you and if they've not brushed their teeth it really really smells"
Motivation and goals	"I'd have think its lacking motivation more than anything – obviously I do want them clean but I think with me what it is its just sort of finding the hours in the day to get round and do everything and a lot of the time were just so busy doing everything it's sort of quickly in and quickly out
Memory, attention and decision processes	"I just think I forget cause I've only so many hours in the day to do things"
Environmental context and resources	"…but at night because she's sort of in and out doing things she does tend to forget she's got to come in and do them, and when I go up to bed cause I go up to bed with her, I will say to her bathroom first and teeth done and that's when you start with your problems! She just doesn't want to do them at night"
Social influences	"You see her Dads a problem as well – he doesn't do his as regular, now her Granddad does, he's always in the bathroom and he's always reminding her, he's brilliant doing his"
Emotion	"I'm really happy about it; I prefer brushing their teeth than asking them to do it, because when I do it I know it's done properly"
Behaviour regulation	"…if I try to brush it for him he'll throw a tantrum, he throws the toothbrush at me, toothpaste at me and just lay on the floor and start kicking his legs…"
Nature of behaviours	"but if parents encourage the kids every day or tell them or like me become a habit then it's much more easier for them just getting used to it like a daily routine so they have to do it, they have to do it that's it"

[2] Table adapted from work of Marshman et al[18]

Table 3: Summary table of overall results

Type of material	Number of each material type (n=111)	Delivering Better Oral Health Guidance	Number of materials including Delivering Better Oral Health Guidance (n=111)	Theoretical Domains Framework Domain	Number of materials addressing Theoretical Domains Framework domain
Leaflet	26	Tooth brushing frequency	84	Knowledge	111
Video/Animation	18	Type of toothpaste (fluoride presence and strength)	77	Skills	106
Song	15	Sugar consumption	72	Beliefs about consequences	89
Booklet	11	Visiting the dentist	62	Nature of behaviour	87
Poster	9	Parental supervised tooth brushing	62	Social influences	76
Flyer	5	Amount of toothpaste	60	Behaviour regulation	65
Fact sheet	4	Spitting not rinsing	56	Emotion	21
Tooth brushing chart	5	General dietary guidelines	52	Beliefs about capabilities	21
Book	3	Drinking utensils (bottles/cups)	36	Memory, attention and decision processes	21
App	2	Tooth brushing duration	34	Motivation and goals	20
Bus advert	2	Type of toothbrush	28	Social/Professional role and identity	17
Leaflet/tooth brushing chart	2	Brushing upon tooth eruption	27	Environmental context and resources	14
Passport	2	Fluoride varnish	26	Total number of materials = 111	
Radio infomercial	2	Toothpaste consumption	17		
Book chapter	1	Use of additional fluoride	15		
Checklist	1	Breastfeeding	12		
Game (paper-based)	1	Other guidance	34		
Interactive guide	1	Other guidance includes: sleep, dummies, thumb sucking, replacing toothbrushes, toothbrush/toothpaste storage, sharing toothbrushes/utensils, flossing, first aid for dental injuries, ailments, feeding issues, and using straws.			
Pledge	1				
Slideshow	1				
Training and resource pack	1				

Table 4: Characteristics of good practice addressing the barriers to good oral health practices based on the Theoretical Domains Framework

Barrier to good oral health (based on Theoretical Domains Framework)	**Characteristics of good practice**
Skills	Went beyond what to do and use by providing for example: • Clear instructions on how to brush, and how to read food and toothpaste labels • Practical tips on how to manage a child's behaviour while brushing or when eating and how to manage wider social influences
Beliefs about capabilities	Highlighted the parents' capabilities: • Recognised that parents may have concerns about brushing correctly and that it can be difficult to know how best to care for their child's teeth and master a good tooth brushing technique.
Social/professional role and identity & social influences	• Providing clear examples of how parents could be a role model in terms of encouraging tooth brushing by brushing their own teeth in front of their child, or to encourage healthy eating by eating fruit and vegetables themselves • Providing advice on how to manage wider social influences by for example, asking family and friends not to give children sweet foods as treats, but use other rewards, such as stickers, crayons etc.
Motivation and goals & Memory, attention and decision processes	• Discussed setting targets • Materials were motivating and provided goals within themselves, for example, weekly meal planners, tooth brushing charts, passports that were stamped upon every dental visit, pledges where a commitment to good oral health practices is made and timers/songs lasting for two minutes. • If displayed effectively within the home, these can also serve as memory and attention aids to encourage adherence to oral health guidance. • Recommended resources(e.g., apps) that provide reminders
Environmental context and resources	• Signposted where free resources (e.g., toothbrushes, toothpaste, free-flowing cups, story books, sugar swap guide/cards, stickers,

	vouchers) could be obtained within the local community • Recognised the pressure on parents and how oral health may not be the priority when faced with tiredness and pressures on time
Emotion	• Provided guidance on how to help alleviate fear and anxiety by for example, not demonstrating fear in front of children, taking children to parent dental appointments to accustom them to the experience or having fun family traditions after check-ups, such as going to the park
Behaviour regulation	• Recognised that children may dislike having their teeth brushed and therefore not cooperate, but the message was to persist and try to make tooth brushing a fun activity • Provided examples of how to manage children's behaviour including: brushing during playtime or bath time, pretending to be animals, encouragement, novelty toothbrushes, tooth brushing apps, tooth brushing charts, games, timers, DVD's, songs, pledges, quizzes, cartoons, books/stories • Provided practical advice in relation to dental visits, diet and weaning off bottles and dummies, including passports with fun facts that are stamped when visiting the dentist, letting children help prepare their snacks, and providing distractions (e.g., playtime).
Nature of behaviour	• Highlighted the importance of establishing routines and consistently reinforced this message, with some even providing advice on how to build these routines, for example, adding tooth brushing to the bath time routine, or outlining a whole bedtime routine