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Developing a theory-based toolkit (the 'STAR' tool) to support supervised toothbrushing in the home in Scotland: a mixed-methods feasibility study

Emma Fletcher BDS, MPH

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degree of Doctor of Philosophy

School of Medicine, Dentistry and Nursing
College of Medical, Veterinary and Life Sciences
University of Glasgow

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Abstract

Background

Despite improvements over the last several years, dental caries in children in Scotland is still high and large socioeconomic inequalities persist. These improvements (observed in the first year of school) are thought to be as a result of the universal supervised toothbrushing programme in nursery schools, which is part of Childsmile, Scotland's national child oral health improvement programme. Many children, however, experience tooth decay before reaching nursery age (2-3 years), prior to receiving the benefit of the nursery supervised toothbrushing programme - with the greatest burden of disease being experienced by children from the most socio-economically disadvantaged areas. Childsmile's Dental Health Support Workers (DHSWs) provide tailored support to targeted families in the home setting, including the promotion of supervised toothbrushing in the early years. It is widely recognised that there are numerous social, environmental and family level barriers to positive toothbrushing behaviours but to date there have been no theory-based interventions targeted to more socio-economically disadvantaged families of very young children in the home setting. An existing behaviour change intervention to support parental supervised toothbrushing, called Uitblinkers, is in place in dental practices in The Netherlands delivered by dental therapists to families with children aged 2 to 10 years who attend practice, that has shown some promising results. This thesis describes the process of the development and feasibility testing of a new home-based toothbrushing tool, STAR, based on the Uitblinkers tool, delivered by Childsmile's DHSWs to targeted families in Scotland.

Methods

The research process is underpinned by the use of a pragmatic approach and informed by elements from implementation science. The project is comprised of three studies. For the first study, an initial review of the literature was carried out to identify reported barriers to home toothbrushing for parents/carers with young children to inform the first round of a Delphi study. The aim of the Delphi was to reach consensus amongst experts on the most important barriers to

parent/carer supervised toothbrushing and appropriate behaviour change techniques to address them. Purposive and snowball sampling identified an expert panel who completed a modified Delphi exercise consisting of two rounds. In the first Delphi round, an expert panel prioritised the most important barriers to include in the new tool, while in the second round the panel validated the most appropriate strategies to address these barriers. The second study utilised 12 qualitative in-depth interviews with DHSWs to seek feedback and insight into the potential barriers and facilitators to the use of the new toothbrushing tool. Interviews were analysed using framework analysis and mapped to the modified Consolidated Framework for Implementation Research (CFIR). Development of the content and resources for the new tool was undertaken and co-produced with DHSWs. Prototype cards and illustrations were designed alongside a graphic designer. This then resulted in the production of a prototype complete set of cards being produced to be tested out as part of the next study. As part of the third study, a two-day simulation workshop with four DHSWs and two parents tested the acceptability and feasibility of the tool. The simulated interactions between DHSWs and parents were video recorded and the conversational process was analysed and visually represented using the Functional Resonance Analysis Method (FRAM) - a novel approach in this area. Six exit interviews with six participants were also conducted and again analysed using framework analysis and CFIR.

Results

The literature review identified 18 relevant papers from which parent/carer home supervised toothbrushing barriers were collected. Twenty one experts ranked 11 out of 13 barriers as being important with 'difficult child behaviour' and 'structures and routines' being the most important. Twenty one experts ranked the strategies operant conditioning, stimulus-control, and goal-setting, as being appropriate approaches to tackle the barriers.

DHSWs were positive about the use of the STAR tool, feeling it would be a useful addition to their current practice. The barriers included in the tool were relevant and reflected what they saw during home visits and strategies were thought to be helpful and would fit in with support they currently provide.

Working alongside DHSWs, the STAR toothbrushing tool was then simulated with parents and DHSWs to investigate it feasibility and acceptability. DHSWs and parents responded positively to the use of the STAR tool and reported it was easy to use and adaptable to families with different barriers to toothbrushing. Six weeks follow-up found that parents had been able to use the strategies given to them to make beneficial changes to their toothbrushing routines. FRAM analysis showed that there was variation between DHSWs in how the STAR tool was used in action, in terms of both identifying toothbrushing barriers and delivering appropriate strategies. Each DHSW was able to complete each stage of the STAR process while still being able to incorporate their current Childsmile support. The STAR tool was able to be used flexibly by DHSWs to provide tailored toothbrushing advice to families.

Conclusions

This theory-based toolkit (The STAR tool) was developed to assist Childsmile DHSWs deliver tailored toothbrushing support to (targeted) parents/carers of young children in the home setting. The toolkit was feasible and acceptable to end users (both those delivering and those in receipt) and offered a flexible means of delivery dependent on the parents/carers level of need. A number of potential barriers to full scale roll out were identified during the process which may require additional considerations including DHSWs who only visit a family once, DHSWs who only carry out home visits when the child is very young and before toothbrushing has started, children with additional support needs and families in which English is not their first language. The STAR is currently being rolled out for use by DHSWs in the home setting and outcome and process evaluation is underway.

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Author's Declaration

I declare that, except where explicit reference is made to the contribution of others, this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.

Name: Emma Fletcher

Signature:

Parts of this research, included in this thesis have been submitted for publication or presented in the following national or international conferences.

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National Conferences

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Oral presentation title: Developing a community-based intervention to optimise family toothbrushing behaviours in the home setting in the early years

International Conferences

International Association for Dental Research, 22nd June 2022, Online
Oral presentation title: Developing a home-based toothbrushing intervention for families with young children

International Association of Paediatric Dentistry Congress, 15th June 2023, Maastricht, Netherlands
Oral presentation title: Optimising family toothbrushing behaviours in the early years in Scotland: developing the STAR tool - a community based toothbrushing intervention

European Association of Dental Public Health Congress, 15ᵗʰ September 2023, Riga, Latvia

Oral presentation title: Simulation workshop to test STAR: a home-based toothbrushing intervention within Childsmile

Abbreviations

A&A	Ayrshire and Arran
ACTA	Academic Centre for Dentistry Amsterdam
aOR	Adjusted odds ratio
BCT	Behaviour Change Technique
CI	Confidence interval
CFIR	Consolidation Framework for Implementation Research
COM-B	Capability, Opportunity, Motivation – Behaviour model
DHSW	Dental Health Support Worker
dmfs	Decayed, missing or filled surfaces (primary teeth)
DMFT	Decayed, missing, or filled permanent teeth
dmft	Decayed, missing, or filled primary teeth
d_3mft	Dental decay extending to dentine (obvious decay), missing, and filled teeth (primary teeth)
ECC	Early childhood caries
EDDN	Extended duties dental nurse
FRAM	Functional Resonance Analysis Method
GG&C	Greater Glasgow and Clyde
KTA	Knowledge to Action framework
MI	Motivational Interviewing
NDIP	National Dental Inspection Programme
NHS	National Health Service
OR	Odds ratio
PARIHS	Promoting Action on Research Implementation in Health Services
ppmf	Parts per million fluoride
PRISMA	Preferred Reporting Items for Systematic reviews and Meta analyses

PSB	Parental supervised toothbrushing
RE-AIM	Reach Effectiveness Adoption Implementation and Maintenance
SD	Standard deviation
SDCEP	Scottish Dental Clinical Effectiveness Programme
SIGN	Scottish Intercollegiate Guidelines Network
SIMD	Scottish Index of Multiple Deprivation
STAR	Support, Talk through barriers, Apply, Recap
TDF	Theoretical Domains Framework
WHO	World Health Organization

Impact of Covid-19 on PhD project

It is important to acknowledge from the start that the Covid-19 pandemic had a major impact on this PhD project, having an effect both on my personal circumstances and the research itself. The PhD began in December 2019 and full lockdown was put in place in March 2020 meaning home/remote working was necessary for extended periods of time during the course of the PhD. The pandemic also impacted the Childsmile programme and its staff which also had an impact on several aspects of this project. Further information on the impact of Covid-19 on the PhD is detailed in Section 7.2.1.

Chapter 1

1.1 Dental caries

Oral health is a vital part of general health as well as being essential for well-being (Petersen, 2003). Oral health has been defined by the World Dental Federation as being "multi-faceted and includes the ability to speak, smile, smell, taste, touch, chew, swallow and convey a range of emotions through facial expressions with confidence and without pain, discomfort and disease of the craniofacial complex" (p.792) (Glick et al., 2016, Glick et al., 2017). The most common disease affecting oral health is dental caries, also known as tooth decay, which has also been reported as being the most prevalent chronic disease worldwide (GBD 2019 Disease and Injury Incidence and Prevalence Collaborators, 2020).

Dental caries is defined as "the localised destruction of susceptible dental hard tissues by acidic by-products from bacterial fermentation of dietary carbohydrates" (p.51) (Selwitz et al., 2007) and its development is multifactorial. The definition, pathogenesis and aetiology of dental caries has been extensively reviewed (Selwitz et al., 2007, Colak et al., 2013). These narrative reviews covering the historic literature are broadly in agreement. Briefly, caries develops as a result of the interaction between sugars in food and drink and bacteria in dental plaque. The main cariogenic bacteria found in the oral cavity are *Streptococcus mutans* and *Streptococcus sobrinus* (Zhu et al., 2023). It was identified that when compared with children without dental caries, children with active caries more often had specific microorganisms and at higher levels (Fragkou et al., 2016). The isolation rates of these specific microbes were 66% *Streptococcus mutans*, 11% *Streptococcus sobrinus* and 18% *Candida albicans*.

The sugars found in food in drink are metabolised by the oral bacteria leading to an increased production of acids. The resultant fall in pH level causes calcium and phosphate to be lost from the enamel, a process known as demineralisation (Colak et al., 2013). Demineralisation can lead to tooth surface loss and the formation of carious lesions. Saliva has a protective capacity in that it can dilute

and buffer plaque acids and act as a reservoir for minerals which can enter the enamel, allowing remineralisation to take place (Pedersen and Belstrom, 2019). Figure 1-1 visualises the balance between protective and pathological factors involved in the caries process, outlining the mineralisation versus remineralisation dynamic. The authors of the 'caries balance' model outline that a carious lesion will progress if the pathological factors such as presence of bacteria or sugars in the mouth are present, while the protective factors such as fluoride or sufficient salivary follow can halt the progression of caries (Featherstone, 2004). This approach, however, indicates only the biological factors involved in the caries development process, which is often the basis of biomedical models of oral health. The biomedical model of health considers only the biological causes of a disease without taking into account any social, psychological or behavioural elements of a disease (Farre and Rapley, 2017).

While the 'caries balance' explains the biological process of how dental caries develops, the Lancet Commission published a series on oral health (Peres et al., 2019) which highlighted the importance of shifting from a biomedical model to a model which fully encompasses the social and commercial determinants of oral health including dental caries.
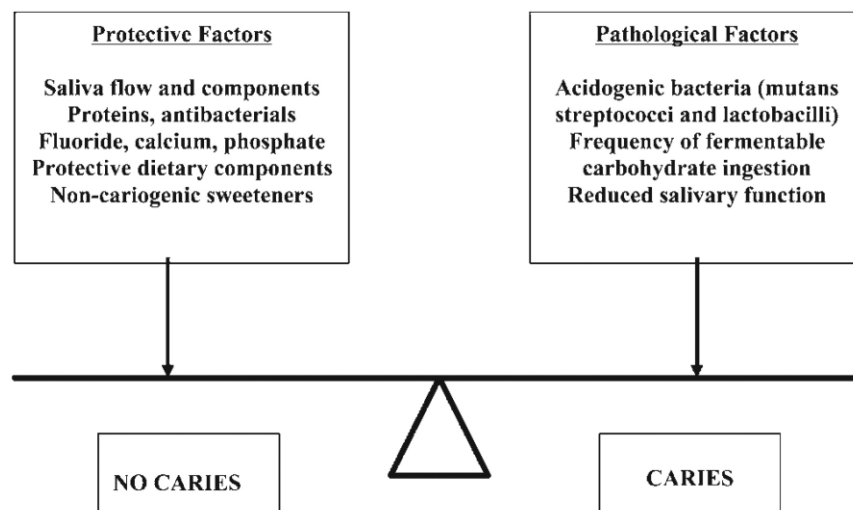
Figure 1-1: The 'caries balance' (Featherstone, 2004)

1.2 Global burden/trends of dental caries

While the prevalence of caries has fallen across all age groups in many countries, particularly high and middle income countries over the past few decades (Lagerweij and van Loveren, 2015), it remains one of the most common diseases globally, in particular in socioeconomically deprived groups (Do, 2012). Caries has been described as a "disease of deprivation" (p.72) (Masood et al., 2019), with those in lower socioeconomic groups having a significantly greater risk of suffering from caries (Schwendicke et al., 2015).

It has been estimated by the World Health Organisation that around 3.5 billion people globally suffer from some form of oral disease, including dental caries. This accounts for almost 50% of the global population. The Global Burden of Disease (GBD) 2019 reported that untreated caries in permanent teeth is the most common non-communicable disease (GBD 2019 Disease and Injury Incidence and Prevalence Collaborators, 2020). GBD 2019 also estimated that there were 3.09 billion new cases of untreated caries in permanent teeth, with an additional 2.03 billion existing prevalent cases. In addition, caries is one of the most common conditions affecting children globally. It has been reported that there were 1.15 billion new cases of decay in primary teeth and 0.52 billion existing cases (GBD 2019 Disease and Injury Incidence and Prevalence Collaborators, 2020). There have been large increases in these estimates of caries figures since 1990 (Qin et al., 2022). There was a variation in the trends of caries incidence and prevalence between the 204 countries and regions included in Qin and colleagues' (2022) report. The authors suggested that this may be due to variations in economic development and lifestyles between countries, in particular with regards to eating habits.

Dental caries and other dental diseases also have a large economic impact. This economic burden can be related to both direct costs such as expenses related to dental treatment, and indirect costs such as losses to productivity as a result of missing time from work or school (Peres et al., 2019). According to the World Health Organisation's Global Oral Health Status Report 2022, the reported global annual economic burden of caries in permanent teeth amounts to US$ 22 billion and in deciduous teeth the cost amounts to US$ 1.55 billion (Jain et al., 2023).

1.2.1 Caries in children in Scotland

1.2.1.1 Caries experience

In the primary dentition, caries experience is usually measured using the dmft index. This is a recording of the number of teeth counted during a visual inspection to be decayed (d), missing (m) or filled (f). The process through which a tooth is recorded as being carious during an inspection, involves the reporting of the 'obvious decay experience'. The obvious decay experience ($d_3$mft) is the total number of teeth which appear clinically to have decay into dentine. This includes teeth which have previously been filled and require further treatment, filled teeth and teeth which are missing as a result of decay. No obvious decay experience refers to the absence of any obvious missing, filled or decayed teeth.

1.2.1.2 National Dental Inspection Programme (NDIP)

The National Dental Inspection Programme (NDIP) was set up in 2002 to collect information on the oral health status of children in Scotland. NDIP is comprised of two levels: a Basic Inspection which all children in Primary 1 (age 4-5 years) and Primary 7 (age 10-11 years) receive and a Detailed Inspection which is completed in either Primary 1 or Primary 7 children in alternate years (Scottish Dental, 2023b). NDIP uses a relative measure of deprivation across a number of small areas (known as data zones) across Scotland called The Scottish Index of Multiple Deprivation (SIMD). In 2003, NDIP reported that the decay experience of Scottish children was poor, particularly compared to other Western European countries, with just 45% of children having no obvious decay experience (Scottish Dental Epidemiological Co-ordinating Committee, 2003). In addition, very little improvement in levels of children with no decayed, missing and filled teeth had been seen since the late 1980s. This report also pointed out the existence of a social gradient in the oral health of 4-5 year old children in Scotland.

The 2020 NDIP report described that there have been improvements in caries levels over the past several years with 73.5% of primary 1 children (4-5 years old) having no obvious decay experience (Public Health Scotland, 2020). While there have been decreases in the percentages of children experiencing tooth

decay, socioeconomic inequalities persist. In 2020, only 58.1% of 4-5 year old children from the most deprived areas had no obvious decay experience in comparison to 86.9% in the least deprived area. Figure 1.2 demonstrates that while each socioeconomic group has experienced improvements in caries experience, the gap in caries experience has remained, with an absolute difference of around 30% between children living in SIMD 1 and SIMD 5 areas being maintained between 2012 and 2020. There was, however, a 1.3% improvement in the absolute inequality between 2018 and 2020 as the difference in children with no obvious decay caries experience between children in SIMD 1 and SIMD 5 decreased to 28.8% in 2020. (Public Health Scotland, 2020).
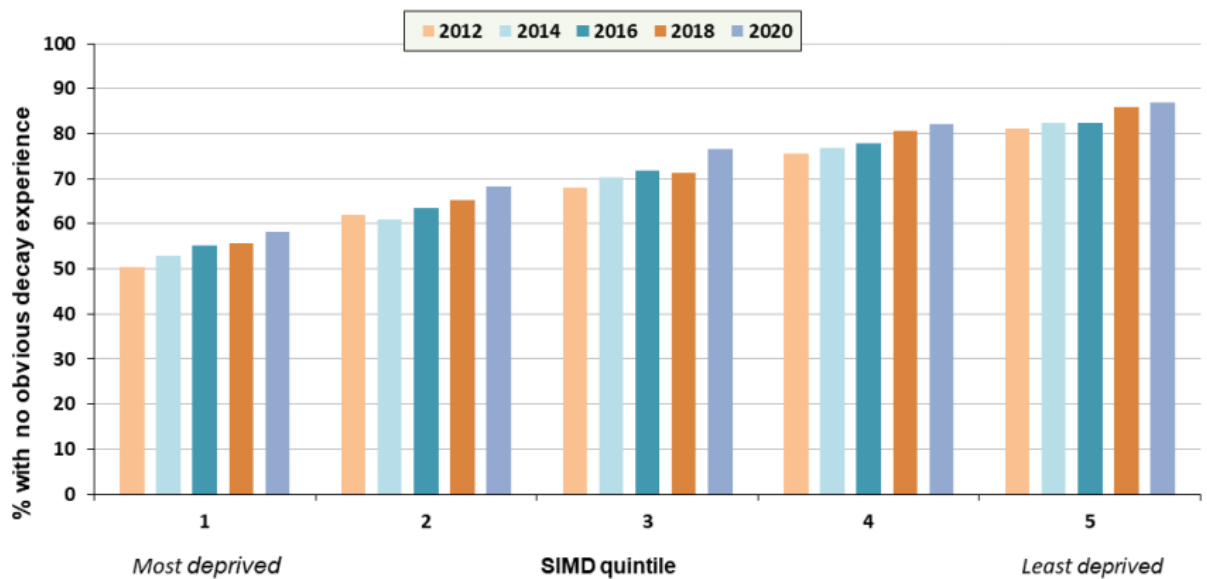
Figure 1-2: Change in the percentage of P1 children in Scotland with no obvious decay experience; by SIMD fifth (Public Health Scotland, 2020)

1.2.2 Attendance at dental practice of children in Scotland

With regards to NHS dental registration, the most recent data published in 2022, found that the registration rates for children living in the most deprived areas was similar to that of those living in the least deprived areas (Public Health Scotland, 2022). However, children from more deprived areas were less likely to have seen a dentist in the previous two years compared to those from less deprived areas (55.3% compared to 73.1%). There was also a large decrease seen in the numbers of 0-2 year old children being registered with a dentist, with a 14% drop between 2019 and 2020. There was a decrease in the percentage of children registered with a dentist, with 87.7% being registered as of 30th September 2021 compared with 91.4% in 2020. This is likely due to disruptions to

dental services caused by the Covid-19 pandemic meaning children were not registered with a dentist for the first time. On 23rd March 2020, dental practices suspended all dental treatments as the country entered a period of lockdown. Dentists reopened on 22nd June 2020 for emergency care only before expanding their service to being able to see all patients for non-aerosol generating procedures from 12th July 2020 (Scottish Dental, 2023a). It is important that children in the youngest age group do not miss out on important anticipatory preventative care as this is a time when life-long health behaviours can be established. (Shaw et al., 2009)

1.3 Impact of caries on children and families

Children are at risk of developing caries from eruption of the first deciduous tooth at around 6 months old. Newly erupted teeth are more susceptible to decay as the enamel is less resistant until further matured and due to difficulties with cleaning. As a result, children are more vulnerable to developing caries (Reich et al., 1999). In addition, inappropriate feeding practices, such as night time bottle feeding, can put infants and toddlers at risk of developing caries known as nursing caries or early childhood caries. (Colak et al., 2013) Early childhood caries (ECC) has been defined as "the presence of one or more decayed, missing, or filled tooth surfaces in any primary tooth in a child at 71 months of age or younger" (p.157) (Anil and Anand, 2017).

1.3.1 Impact of caries on children

Caries can negatively impact on a child's quality of life (Bonecker et al., 2012). Children with tooth decay are significantly more likely to experience tooth or mouth pain than those without decay (White et al., 2006). It has also been seen that an increase in the severity of the decay is associated with an increased risk of infection (Pine et al., 2006). Pine and colleagues (2006) investigated the relationship between untreated carious teeth and dental sepsis in five year old children in Scotland. The study reported on 6,694 children and found that children in which dental sepsis was present had a mean dmft of 6.30 (SD = 3.63) in contrast to children without sepsis who had a mean dmft of 2.36 (SD = 3.25). Untreated tooth decay was a significant factor in the presence of dental sepsis.

Zaror et al (2022) conducted a systematic review and meta-analysis exploring the impact of early childhood caries on oral health related quality of life. The review identified 35 studies which reported on caries in children under 6 years old using validated measures. The report included 24 studies comprising 21,555 participants in the meta-analysis. The results reported that children with early childhood caries had a higher likelihood of reporting an impact on their oral health related quality of life than children who didn't have caries (Odd Ratio (OR): 1.99, 95% Confidence Interval (CI): 1.51-2.62; 6 studies). This effect was higher in children with severe caries (dmft>5) (OR: 5.00, CI: 3.70-6.74; 8 studies). The review included 8 studies in the meta-analysis of the oral health related quality of life domains which are measured by the Early Childhood Oral Health Impact Scale (ECOHIS). ECOHIS is a questionnaire which is used to evaluate children's oral health-related quality of life (Pahel et al., 2007). It was found that the symptom (having oral or dental pain) and psychological (having trouble sleeping or being irritable or frustrated) domains were most impacted by caries. The authors of the review did acknowledge however, that the evidence quality for outcomes assessed was very low as a result of limitations in the risk of bias and imprecision (Zaror et al., 2022)

The pain and infection from decayed teeth can result in problems with eating and sleeping (Low et al., 1999). In addition, a 2012 study asked 5 year old children about their oral health and found that compared to children with no obvious decay experience, those with caries were more likely to report problems with their teeth which limited their ability to eat, drink, sleep, play or smile (Tsakos et al., 2012). The authors used a self-reported oral health related quality of life measure developed for 5-year-old children and included 332 children. 49% indicated at least one oral impact on their daily life, 28.7% reported difficulties with eating, 18.5% had difficulty sleeping, 14.9% avoided smiling due to toothache and 12.5% avoided smiling due to appearance. A United Kingdom based study also reported on the issues children with dental caries experience (Knapp et al., 2021). Knapp et al (2021) carried out an investigation of 85 children (age 5-16 years) with dental caries awaiting general anaesthetic treatment. They found that 56% of those included reported their

teeth causing them to cry and 91% had problems with food getting stuck in their teeth.

Tooth decay can also lead to missing time from school and poorer school performance (Jackson et al., 2011), which could potentially have more long term consequences. A US based study analysed data from the National Survey of Children's Health for 45,711 children aged 6-17 years and found that those with tooth decay had 1.54 greater odds of being absent from school (95% confidence interval: 1.28-1.85) (Guarnizo-Herreno et al., 2019). In addition, systematic reviews have shown that children suffering from tooth decay are more likely to have both worse school attendance and worse school performance than children without caries (Ruff et al., 2019, Bessa Rebelo et al., 2019).

1.3.2 Impact of caries on family

Dental caries in children can also have a wider impact on other members of the family. One study looked at the family impacts of severe tooth decay in children in the United Kingdom (Abed et al., 2020). It used data of 3859 school age children, extracted from the 2013 Children's Dental Healthy Survey (CDHS). The CDHS is a nationally representative cross-sectional survey of children (age 5, 8, 12 and 15 years old) in England, Wales and Northern Ireland. The impact of severe decay on family life was measured using items from the Family Impact Scale of the Parental-Caregiver Perceptions Questionnaire. The Family Impact Scale assesses factors such as need to take time off work, parental sleep being disturbed and parents' feeling stressed or guilty. The study found that severe dental caries in children had a significant negative impact on family life (Odds Ratio: 6.00, 95% CI: 3.34-10.78). Parents of children with severe tooth decay were more likely to require to take time off work and report that the child required additional attention. These parents also had greater odds of feeling guilty, stressed or having normal activities and sleep disrupted. These findings were independent of child and family sociodemographic circumstances. Knapp et al (2021) also surveyed parents of children who required treatment for tooth decay and reported that 45.9% had needed to take time off work and 58.8% had had their sleep disturbed.

1.3.3 Treatment and financial impact of caries

It can often be difficult to treat young children with tooth decay in a dental practice setting either due to the extent of the decay or difficulties in managing child behaviour. As a result, treatment is often required to be carried out under general anaesthetic, which is required to be carried out in a hospital setting in the United Kingdom. Dental caries is the most common reason for children to be admitted to hospital for general anaesthetic in the United Kingdom (Knapp et al., 2017). For the financial year 2021 to 2022, there were 26,741 caries related tooth extractions in 0-19 year olds in hospitals in England (Office for Health Improvement & Disparities, 2023). The estimated cost for these extractions is £50.9 million. In Scotland there were 1788 hospital procedures for tooth extractions under general anaesthetic carried out in children aged 0-4 years between 2015 and 2016 (ISD Scotland, 2019). The estimated cost of a child tooth extraction under general anaesthetic in Scotland in 2015 was £653.26 (Anopa et al., 2015). Extractions under general anaesthetic is a high-risk procedure and can be traumatic for children (Knapp et al., 2017). Following the procedure, many children suffer from pain, distress and require painkillers (Needleman et al., 2008). Waiting times for treatment under general anaesthetic are often long and many children suffer from repeated occurrences of pain during this period, often requiring regular visits to their general dental practitioner (North et al., 2007).

There has been an increase in the length of waiting times for dental treatment under general anaesthetics as a result of the COVID-19 pandemic. (Elsherif et al., 2021). The pandemic resulted in the cancellation of several appointments and additionally the disruption of routine dental care. Between 20th March and 30th June 2020, 1,456 children in the South East of England had their appointments for tooth extraction under general anaesthetic cancelled. There were concerns by community dental services staff members that these cancellations, and associated longer waiting time for treatment, would lead to children being more likely to experience pain and require repeated prescriptions for antibiotics (Elsherif et al., 2021).

1.4 Risk factors for caries in young children

There are multiple factors that can impact on a child's oral health and likelihood of developing dental caries. Fisher-Owens et al (2007) described a conceptual model which depicted a relationship between child, family and community factors as having an influence on child oral health outcomes (Fisher-Owens et al., 2007) (Figure 1-3).
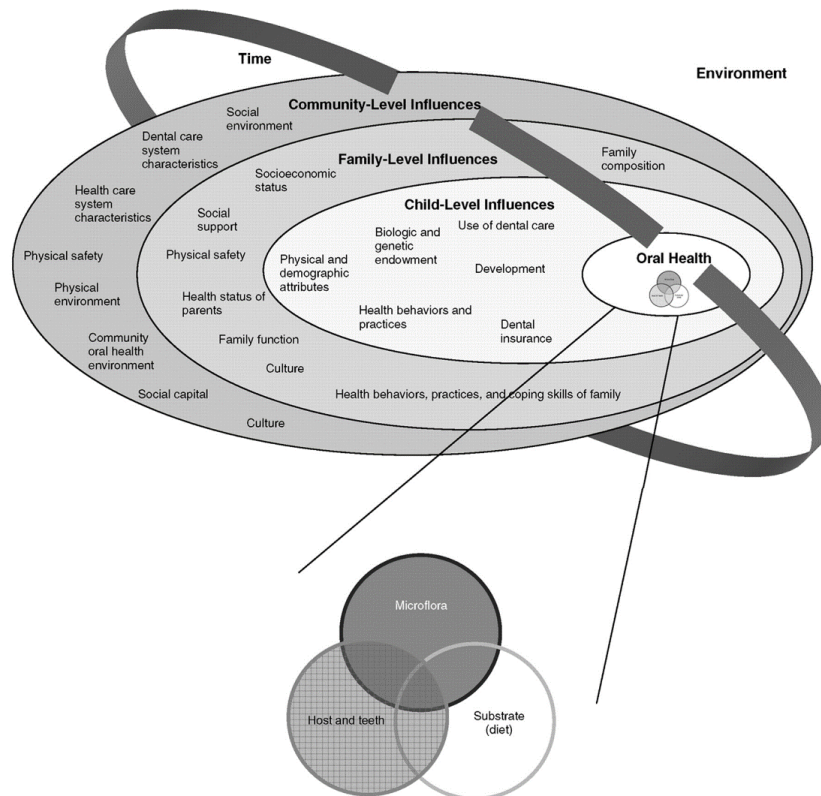
Figure 1-3: Child, family, and community influences on oral health outcomes of children. (Fisher-Owens et al., 2007)

1.4.1 Diet

The consumption of free sugars is an essential dietary factor in the development of dental caries (World Health Organisation, 2017). The UK Scientific Advisory Committee on Nutrition defines free sugars as "All monosaccharides and disaccharides added to foods by the manufacturer, cook or consumer, plus sugars naturally present in honey, syrups and unsweetened fruit juices" (p.17) (Scientific Advisory Committee on Nutrition, 2015). Free sugars exclude those found naturally in milk and fresh and most processed fruit and vegetables.

A systematic review explored the relationship between sugar intake and dental caries (Moores et al., 2022). In addition, the review examined the impact of limiting sugar consumption to <10% and <5% of energy intake on dental caries (based on WHO recommendations. This systematic review was an update of a previous systematic review exploring the same area. The updated review included a total of 78 articles. The results of the review found that there is an increased risk of dental caries associated with an increased consumption of free sugars. Additionally, restricting sugar intake to <10% and <5% of energy intake leads to a decrease in risk of developing dental caries. It was not possible for the authors of this systematic review to undertake meta-analysis due to the heterogeneity of the characteristics of the included studies (Moores et al., 2022). Another systematic review examined the association between nutritional factors, including sugar intake, and its effect on early childhood caries (Sandy et al., 2023). The review assessed six studies which focused on children 6 years old and under. The results found that children who ate sugary foods more than five times a day were more likely to experience early childhood caries (OR 3.24; 95% CI 2.59, 4.03).

A high frequency of sugar intake in particular, leads to an increased caries risk due to an extended exposure to an acidic environment, irrespective of the amount of sugar consumed (Abou Neel et al., 2016). If teeth are exposed to sugar regularly throughout the day, the rate of tooth demineralisation, as described previously, will surpass the rate of remineralisation, increasing the risk of caries (Colak et al., 2013). To reduce the risk of caries, it is therefore advised to limit sugars to mealtimes only and to consume only sugar free or low sugar snacks and drinks between meals.

1.4.2 Toothbrushing with fluoride toothpaste

Poor oral hygiene has been associated with higher occurrence of dental caries in children as reported in systematic reviews. (Harris et al., 2004, Kirthiga et al., 2019). In a systematic review and meta-analysis, Kirthiga et al (2019) demonstrated the increased odds of developing early childhood caries associated with poor oral hygiene (OR: 3.12 95% CI: 1.77-5.49). One key factor in the

prevention of caries is twice daily toothbrushing with fluoride toothpaste, which should be carried out under parental supervision in young children. Several systematic reviews have demonstrated the impact of fluoride toothpaste in the reduction of the development of dental caries (Marinho et al., 2003, Twetman et al., 2003, Walsh et al., 2010). A systematic review found that use of toothpaste containing 1500ppm fluoride resulted in a reduction in the amount of new caries in the primary dentition when compared with non-fluoridated toothpaste (Walsh et al., 2020).

In addition, twice daily toothbrushing has been shown to be more effective than brushing only once a day as reported in a systematic review by Marinho and colleagues (Marinho et al., 2003). This review reported a 14% increase in the prevented fraction of decay, missing and filled surfaces when once daily toothbrushing with fluoride toothpaste was increased to twice daily. The prevented fraction for this review was defined as the mean difference in caries increment between the control group and the experimental group, divided by the mean increment in the control group (Marinho et al., 2003).

Guidelines in the United Kingdom recommend that toothbrushing should be supervised until the child is 7 years of age, described as parental-supervised toothbrushing (PSB) (SDCEP, 2018, SIGN138, 2014).

1.4.2.1 Parent/carer supervised toothbrushing

Parental or carer involvement in toothbrushing can lead to a reduction in caries and has a greater impact when commenced before the age of one (Pine et al., 2004). A cross-sectional study carried out internationally of 2822 children aged 3.5-4.5 years old found that when toothbrushing was started during the child's first year of life, brushing was carried out twice a day, and an adult was involved in the toothbrushing process, there was a 50% reduction (p=0.10) in the odds of the child having dental caries (Pine et al., 2004). Many young children brush their teeth without input from a parent with multiple different studies (Huebner and Riedy, 2010, Mattila et al., 1998, Hinds and Gregory, 1995, Blinkhorn et al., 2001, Zeedyk et al., 2005) describing a broad range (9%-72%) of children aged between 1.5 to 5 years brushing by themselves. A small study involving eighteen families (average age of child=2.5 years) reported that when a child is left to

brush their teeth by themselves, the brushing time is insufficient, with the mean active brushing time being recorded as just 10 seconds (Zeedyk et al., 2005). In addition to concerns regarding lack of sufficient plaque removal, when parents are not involved in the toothbrushing process, they may not also be aware of the amount of toothpaste that is being used. This has therefore raised concerns regarding lack of supervision to prevent a child ingesting toothpaste, potentially resulting in fluorosis (Aliakbari et al., 2020).

Children who experience caries in their deciduous teeth are more likely to develop decay in their permanent teeth at 12 years of age (Peres et al., 2009). A Brazilian population-based cohort study included 359 children and carried out dental examinations and interviews at age 6 years and 12 years old (Peres et al., 2009). This study found that children with a DMFT of 1–3 (Risk Ratio (RR): 2.01; 95% CI: 1.33-3.03) and 4–19 (RR: 2.66; 95% CI: 1.81-2.53) at 6 years old had a higher level of caries at 12 years old. It is therefore important that good oral hygiene measures are established in the early years of childhood. Parental-supervised toothbrushing is a dyadic process in that parents must brush their child's teeth and the child must allow their teeth to be brushed (Elison et al., 2014). The parental-supervised toothbrushing process is complex with factors at individual and interpersonal levels influencing behaviour (Gray-Burrows et al., 2016). There are several factors which can impact on the likelihood of a parent regularly carrying out toothbrushing on their child and these will be explored in depth elsewhere in this thesis.

1.4.3 Socioeconomic circumstances

Socioeconomic circumstances can also influence the likelihood of a child developing caries, with those from a more deprived background being more likely to experience tooth decay. A systematic review assessed the relationship between a child's caries experience and the socioeconomic status of the family (Schwendicke et al., 2015). It found that children with lower socioeconomic circumstances had an increased odds of having caries experience in comparison to those from a higher socioeconomic background. The review reported that the odds of having any carious lesions or caries experience (decay missed filled teeth > 0) was higher in individuals with low personal or parental educational or

occupational background or income (OR: 1.21 95% CI: 1.43-1.63). This relationship was increased in highly developed countries. The authors did note however, that as a result of risk of bias from the included studies, most of the studies which were available were graded as low quality. Several studies have also reported that toothbrushing frequency is lower in children from lower socioeconomic circumstances (Van Anh et al., 2021, Arora et al., 2020, Baumgartner et al., 2022).

1.5 Health inequalities

Health inequalities are the avoidable, unjust differences in health between specific groups of people (Public Health Scotland, 2019). Examples of health inequalities include differences in life expectancy and the age at which an individual gets a preventable disease or other health condition. The differences between groups may be social, geographic or biological (The King's Fund, 2020). These inequalities in health are as a result of socioeconomic inequalities and work towards tackling them requires action across the social determinants of health (Marmot, 2020). Social determinants of health are "the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life" (World Health Organisation, 2019). Examples of social determinants of health include education, working conditions, housing, income, unemployment and access to health services (The Marmot Review team, 2010). These social conditions within a society have been cited as a cause for health inequalities (Phelan et al., 2010) along with the "unequal distribution of power, prestige and resources among groups in society" (p.17) (Solar and Irwin, 2010). Marmot (2010) also acknowledged the existence of a social gradient in which the lower a person's social circumstances are, the worse their health outcomes will be. This gradient is linear in nature and impacts across all levels of society, in all countries (Marmot, 2004).

Health inequalities reflect a defined social gradient in that those individuals with a lower socioeconomic position have the worst health outcomes (The Marmot Review team, 2010). In *Fairer Society, Healthy Lives* (2010), it was recommended that in order to tackle the steepness of the social gradient in health, actions should not target only those from the most disadvantaged

backgrounds, but society as a whole. However, while these actions should be universal, the level and strength of action should be in proportion to the level and need of disadvantage (The Marmot Review team, 2010). This concept is known as proportionate universalism.

A European wide systematic review explored the link between early childhood health and developmental outcomes and specific social factors and included 201 studies from 32 countries (Pillas et al., 2014). It identified several social factors which were associated with adverse childhood health and developmental outcomes. These include lower parental income, educational attainment, occupational social class, neighbourhood deprivation, housing instability and parental unemployment.

1.5.1 Oral health inequalities

The health inequalities seen in general health are also apparent with regards to oral health. Individuals from the most disadvantaged and vulnerable groups in a society are disproportionely affected by oral diseases, including dental caries. (Watt, 2012, Schwendicke et al., 2015, Peres et al., 2019). Again, as with general health, the social gradient is also reflected in oral health. A 'stepwise' relationship is seen across all levels of society (Watt et al., 2019) with oral health status being worse with lower socioeconomic position (Sabbah et al., 2007). The differences in oral health, known as oral health inequalities have been described as "unfair and unjust" (p.245) (Watt et al., 2016) as these differences are avoidable and unneccesary (Tsakos et al., 2023). The social determinants of health relating to general health inequalties also apply to oral health inequalities, due to diseases of the oral cavity sharing mutual determinants with other non-communicable diseases (Petersen and Kwan, 2011, Watt and Sheiham, 2012). Oral health behaviours such as toothbrushing, sugar consumption and smoking are socially patterned and contribute to oral health inequalities (Watt et al., 2016). However, the differences in oral health outcomes cannot solely be attributed to these behaviours (Sanders et al., 2006, Sabbah et al., 2009). The choices and options which are available to an individual are determined by the social, political and physical environment which consequently results in oral health inequalities (Watt and Sheiham, 2012).

1.5.2 Approaches to address oral health inequalities

Due to oral health inequalities being caused by social determinants of health, it has been recommended that there should be a focus on upstream, looking at structural determinants of oral health and midstream, which considers day to day circumstances and living conditions, as well as downstream individual behaviours (Watt and Sheiham, 2012). Actions taken to improve oral health within a population should be concentrated on the underlying causes of oral health inequalities (Lee and Divaris, 2014). Watt and Sheiham (2012) pointed out that while health policy makers acknowledge that actions should be focused on the upstream wider social determinants of health, there is a tendency that efforts instead end up more concentrated on the individual behavioural aspects. This is known as "lifestyle drift". Interventions which focus solely on individual behavioural factors do not result in long term, sustained improvements in health behaviours when they are without any changes to the social environment which result in behavioural patterns (Smedley and Syme, 2001). Instead, efforts which are concerned only with behaviour, actually result in an increase in health inequalities as they benefit groups within a society who are able to and have the resources to change their health behaviours (Macintyre, 2007, Watt and Sheiham, 2012).

The updated Marmot Review (Marmot, 2020) stressed the importance of health improvement strategies which focus on the early years, highlighting that it is during the early years that iterventions to tackle inequalities are most effective. As previously mentioned (1.5 Health inequalities), proportionate universalism has been proposed as an approach to tackle health inequalities (Marmot et al., 2010). It has been described as an approach which provides a link between universal and targeted approaches (Francis-Oliviero et al., 2020). The Childsmile programme focuses on the improvement of the dental health children in Scotland, combining both universal and targeted elements.

1.6 Child oral health improvement approach in Scotland: Childsmile

In response to the growing issue of poor child oral health in Scotland, in 2005 the Scottish Government published "An action plan for improving oral health and modernising dental services in Scotland" (The Scottish Government, 2005). This led to the development of the Childsmile programme, the main aims of which are to improve children's oral health and reduce inequalities in both oral health and access to dental services (Macpherson et al., 2010). Its approach involves a move towards preventative dental care and health promotion from an early age. Childsmile uses evidence-based methods including common risk factor approach, upstream and downstream systems, working with multi-agencies and proportionate universalism (Macpherson et al., 2015).

The basis behind the common risk factor approach is that a number of chronic diseases including heart disease, cancers and oral disease share risk factors and a number of risk factors are applicable to multiple chronic diseases (Sheiham and Watt, 2000). Figure 1.4 demonstrates common risk factors between multiple chronic diseases. A small number of risk factors may be managed by promoting general health, which could have a large effect on a greater number of diseases. This may have higher efficiency and effectiveness and at a lower cost than focusing on individual diseases (Sheiham and Watt, 2000). Diet and nutrition is a shared risk factor for dental caries and several other chronic conditions such as heart disease and diabetes. The Childsmile programme has had involvement in the development of nationwide strategies and policies regarding diet and nutrition (Macpherson et al., 2019b). An example of this is Childsmile's membership of a working group comprising of several disciplines, which created government policies relating to healthy eating in schools and nurseries (Scottish Government, 2008). In addition, Childsmile aims to support the inclusion of oral health in national policies regarding obesity and sugar control (Scottish Government, 2017). The Childsmile programme makes use of upstream, midstream and downstream approaches.

The involvement of the Childsmile programme in the development of national policies which promote oral health is an example of utilising an upstream approach. Upstream approaches target the underlying factors which result in poor health and usually aim to tackle the social determinants of health (Dawson et al., 2022). This is often achieved by implementing interventions at the structural, political level (Macpherson et al., 2019a). A further example of Childsmile employing an upstream approach is having influence on national policy resulting in a change to the national primary dental care contract for children which encouraged a focus on prevention (Macpherson et al., 2019b). This resulted in payments being introduced within the NHS primary dental care contract in Scotland for preventative care items (Scottish Government, 2011). These include the provision of diet and oral hygiene guidance and the application of fluoride varnish.
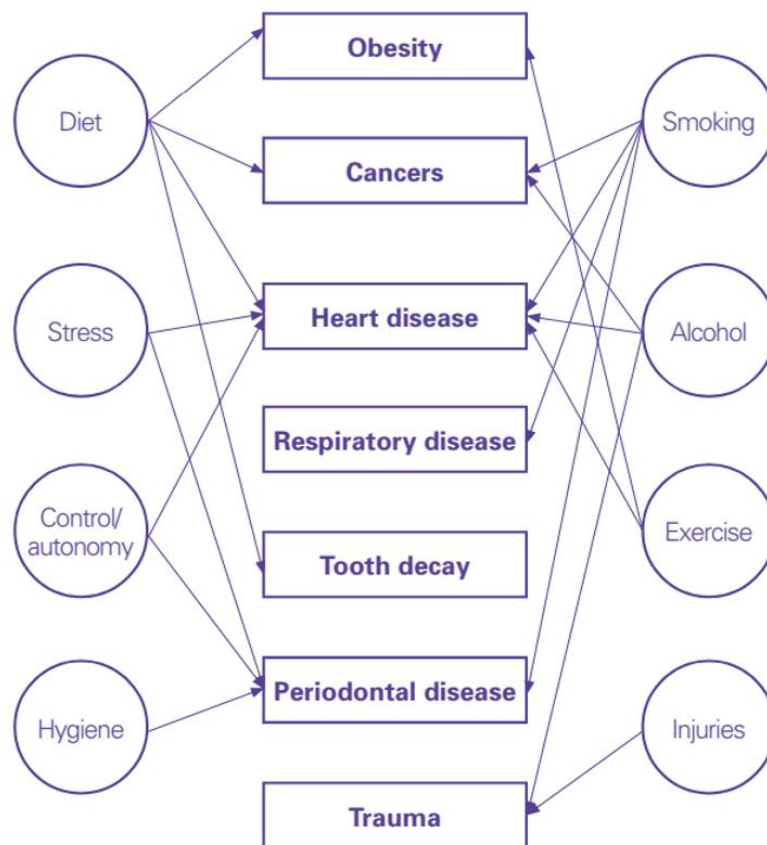
Figure 1-4: Common risk factor approach (NHS Health Scotland, 2012), Adapted from (Sheiham and Watt, 2000)

Childsmile also uses a number of midstream approaches. Midstream focuses on the community level and it has been suggested that midstream approaches can

lead to improvements in resilience, self-esteem, health behaviours and health (Macpherson et al., 2019a). Examples of midstream approaches within the Childsmile programme include the supervised toothbrushing programme in nurseries and schools and the provision of toothbrushes and toothpaste. In addition, oral health training and guidance is provided for the wider workforce including nursery and school staff and health visitors (Macpherson et al., 2019c).

Downstream approaches include one to one interactions, such as the provision of oral health guidance or clinical prevention such as fluoride varnish application, diet advice and toothbrushing demonstration given by a dentist or other dental care professional.

The Childsmile programme utilises proportionate universalism by blending both universal and targeted approaches. Universal components include the supervised toothbrushing programme in nurseries and provision of dental packs containing fluoride toothpaste and a toothbrush. In addition, all children receive diet advice and oral hygiene instruction and six monthly application of fluoride varnish in a dental practice setting (Ross et al., 2023). Families will also receive oral health guidance from the health visiting team.

Targeted components of the Childsmile programme include support from dental health support workers who provide oral health support and facilitate the registration and attendance of the child at a dental practice. Dental health support workers can also link families to community-based support, organised when needed. Additional targeted approaches include supervised toothbrushing in targeted schools for Primary 1 and 2 children (age 5-6 years) and application of fluoride varnish in targeted nurseries and primary schools for children in Primary 1 and 2 (Ross et al., 2023).

1.6.1 Childsmile components

The components of the Childsmile programme are based within dental practice, schools and nursery and the community setting.

1.6.1.1 Dental Practice (Universal)

Taking a universal approach, all children aged 0-17 years in Scotland, attending a general dental practice are expected to receive elements of the Childsmile programme, as outlined in the Statement of Dental Remuneration (Scottish Dental, 2023c). Clinicians will deliver treatment to prevent and manage caries as outlined in guidance provided by the Scottish Dental Clinical Effectiveness Programme (SDCEP) (SDCEP, 2018). Preventative advice regarding diet and toothbrushing should be delivered by a member of the dental team. In addition, clinical prevention such as the application of fluoride varnish twice a year from the age of two years (until 17 years of age) is incorporated into this component of the Childsmile programme. Some dental practices also have in place extended duty dental nurses (EDDN), who have been trained to provide oral health support and the application of fluoride varnish. It is intended that preventative input given in the dental practice setting is tailored to the specific needs of the child and family (Macpherson et al., 2019c, Childsmile, 2023b)

1.6.1.2 Distribution of Dental Packs (Universal)

Every child in Scotland is expected to receive a dental pack and a free flow cup from their health visitor at around the age of six months old. Oral health packs will again be provided a further four times until the age of two years. Children aged between 3 and 4 years at nursery should receive a further two packs per year. Finally, all children in Primary 1 will be given an oral health pack (Childsmile, 2023a). The pack contains fluoride toothpaste (1450ppmF) and a toothbrush. The packs are distributed via education, health and other community settings. (Macpherson et al., 2019c).

1.6.1.3 Supervised Toothbrushing Programme (Universal)

This element of the Childsmile programme involves both universal and targeted components. The universal approach involves the provision of daily supervised toothbrushing to all children in nursery schools in Scotland. This is applicable to children attending private, local authority or voluntary (parent or charity led) nurseries. Supervised toothbrushing is also available to 2 year old children who receive a free nursery place. In addition, the targeted component involves the facilitation of supervised toothbrushing for children in Primary 1 and 2 (5-6 year

olds) attending schools situated in the areas of highest need. The supervised toothbrushing is standardised across the country and adheres to national standards (Childsmile, 2023a).

1.6.1.4 Fluoride Varnish Programme in Nurseries and Schools (Targeted)

Fluoride varnish is applied twice yearly to the teeth of children aged 3 to 8 years via schools and nurseries using a targeted approach. This is targeted towards children living in the most deprived areas of Scotland, covering at least 20% of children from each health board (Macpherson et al., 2019c).

The team who provides this intervention is made up of Extended Duties Dental Nurses (EDDNs), who have been trained in the application of fluoride varnish, and Dental Health Support Workers (DHSWs). This team also identify children who may be in need of further dental assessment and care and will subsequently inform parents of any suspected dental concerns (Macpherson et al., 2019c).

1.6.1.5 Dental Health Support Workers (Targeted)

Each newborn child in Scotland is linked to Childsmile via the Universal Health Visitors Early Years Pathway (Scottish Government, 2015, Macpherson et al., 2019c). As part of this pathway, families will receive eight visits from a health visitor during a child's first year of life. At these visits, the health visitor will assess the health and wellbeing of the child and family and link or refer to additional services if required. As part of the health visitor pathway, there is a universal 6-8 week assessment, during which the health visitor will determine the oral health needs of the family and, if required, refer to a Dental Health Support Worker (DHSW) to provide additional oral health support. A DHSW is a community-based health worker who supports families to achieve good oral health behaviours, facilitates registration and attendance at a dental practice and who can link to other services in the community if required. It was reported that DHSWs will usually make contact with a family when the child is 3 months old following referral from a health visitor (Hodgins et al., 2018). They carry out home and community visits and can signpost families to community health initiatives. The nature and level of support a DHSW will provide to a family should be specific to the needs of the family (Hodgins et al., 2018). DHSWs

receive training via NHS Education Scotland (NES). DHSWs are required to complete a six module course which includes areas such as inequalities, preventing dental disease, toothbrushing and fluoride, diet and nutrition, behaviour change and supporting child wellbeing (NHS Education for Scotland, 2023).

The role of DHSWs within Childsmile Community and Practice was inspired by the positive outcomes of oral health interventions based in the community which were delivered by both professional and lay people. The Glasgow based 'Starting Well' initiative used home visiting with an aim to improve the health of children in areas of high deprivation and inequality (Mackenzie et al., 2004). An outcome of this initiative most relevant to Childsmile was that intensive home visiting resulted in higher levels of dental registration (Shute and Judge, 2005). 45.1% of children from families who had received the Starting Well intervention were reported to be registered with a dentist at six month follow up compared to 26.0% of children in the comparison group (95% CI 9-28.3, p<0.001). These figures, however, were based on a relatively low sample size of 359 children in total (213 in intervention group, 146 in comparison group). In addition, the measure of dental registration was based on self-reporting from the mother and therefore there is the potential for social desirability bias. A further programme which had an influence on the implementation of DHSWs within Childsmile is 'Time to Smile', an oral health initiative which was undertaken in two of the most socio-economically disadvantaged areas in Glasgow (Blair et al., 2006). 'Time to Smile' used voluntary community activists to provide oral health promotion activities in the community. They provided support to communities to identify ways in which they could reduce behaviours which may lead to caries, while increasing the frequency of behaviours which have a caries-protective factor. There was an increase in the percentage of children with no obvious decay experience associated with the implementation of the initiative, an effect not seen in children in areas where the intervention was not rolled out. In the first area where 'Time to Smile' was piloted, the proportion of children with $d_3mft=0$ increased from 20% to 32% (p<0.001). In the second pilot area, the $d_3mft=0$ increased 34% to 42% (p<0.001).

1.6.2 The evaluation of the Childsmile programme

The national evaluation of Childsmile is an integral aspect of the programme. The evaluation process is wide-ranging and theory based. Several approaches are taken for evaluations to ascertain the extent to which the programme is functioning and being delivered as it was originally intended (Macpherson et al., 2019c, Ross et al., 2023). The Childsmile programme is considered a complex public health population-based intervention due to its delivery and evaluation taking place across several different levels and in multiple settings and utilises several research methods (Skivington et al., 2021, Shahsavari et al., 2020). It therefore follows the principles of the Medical Research Council's (MRC) framework for complex interventions which provides guidance on appropriate methods for designing and evaluating complex interventions (Skivington et al., 2021).

The findings of these evaluations allows for aspects of the programme to be adapted and optimised. The continuous evaluation of Childsmile is carried out by the Childsmile Evaluation and Research Team (CERT) based within the University of Glasgow Dental School. Key evaluation questions include: can the programme improve oral health?; can it reduce oral health inequalities?; which aspects of the programme result in the largest improvements?; is the programme operating as intended and reaching those intended? Formative and summative strategies are incorporated into the evaluation process to assess the impact of programme activities.

The Childsmile programme and the evaluation are guided by logic models, developed through the analysis of several sources including document analysis and observations. In addition, the logic models were informed by workshops with multiple stakeholders including programme directors, managers and co-ordinators, dental health support workers, members of the community, representatives from government and local health boards, academics and dental team members (Ross et al., 2023). The Childsmile Community and Practice logic model, which outlines the input of DHSWs within the programme is shown in Figure 1-5.

Childsmile Practice Logic Model

Activities | Outputs/target group[1] | Short term outcomes | Interim outcomes | Long-term outcomes

Activities underlying integrated programme

- CS data collected & linked with new comprehensive national data base/monitoring
- Pathway, resource development, & identification of target groups
- Partnership development & collaborative working/ Linkage with Child Health
- Accredited, national training programme developed. Staff recruitment/training/ ongoing CPD & audit of practice. CS ethos installed in curriculum for Dental Students.
- Financial incenitves package developed & implemented for GDPs

Practice interventions

- Awareness raising, marketing, communication,engagement from antenatal onwards
- HVs/PHNs routinely link all newborns to CS & identify those needing support from DHSW/PCDS
- Enhanced home/community visits & packs for targeted families by DHSW or EDDNS Routine care (6 monthly checks) for non targeted
- Oral health advice (0-3) [from DHSW & practices] & clinical prevention (FV, fissure sealants) from 2 years via PCDS for those targeted
- Targeted families linked to community health improvement activity via DHSW

Outputs/target group:
- Robust monitoring data routinely available to key stakeholders
- Child-focused OH protection pathway developed: linked to national OH & child health systems. At risk children/families identified & followed-up (Longitudinal record of care)
- Staff capacity appropriate, Staff (DHSW/EDDN) trained & practicing. Increased % of practices/ GDPs recruited & implementing programme. Increased % of PHNs delivering CS. Professional signposting/ networking for common outcomes
- Tailored communication campaign/strategy targeting staff & families
- All children encouraged to register & attend PCDS as appropriate for need
- Increased % of children identified as at risk in receipt of appropriate, advice support/treatment (Increased % receiving enhanced support/ FV[2]/ fissure sealants)
- Target children & families linked into & in receipt of community based advice/ opportunities

Short term outcomes:
- Learning used for programme improvement
- OH increasingly prioritised within Child Health
- Stuctural/organisational shift within PCDS to support CS model
- Increased clarity of roles & enhanced collaborative gain from partnership working. (GDPs benefit from 'skills mix' approach. PHN/DHSW partnership)
- Increased awareness of CS/ causes of poor OH & behavioural & clinical means of prevention among children/families & professionals
- Increased motivations & skills to improve children's oral health in families
- Increased motivations & skills to improve children's oral health in workforce (inc GDS) (holistic model of health & preventative ethos adopted)
- Increased (& habituation of) toothbrushing in children
- Greater % of children registered & attending PCDS with fz. appropriate for need (& receiving early treatment if required)
- Reduced barriers to engaging with OH services (apathy/dental anxiety)
- Increased % of eligible children in receipt of FV/fissure sealants
- Reduced consumption (& fz. of consumption) of sugar in foods & drinks

Interim outcomes:
- Best practice from CS is embedded in mainstream DHS & Child Health Systems
- DHS are reorientated towards prevention/ anticipatory care rather then reactive/treatment (structural and cultural change)
- All children in Scotland are supported to protect/improve their OH
- Good OH practice is embedded throughout the Scottish population
- Good OH practice is embedded in key target groups (SIMD 3-5)
- Increased % of children in Scotland exposed to recommended levels of fluoride
- More equitable access to DHS & prevention of poor oral health

Long-term outcomes:
- Potential secondary outcomes: improved toothbrushing & reduced sugar intake in families (parents/siblings); improved general health in children/wider population
- Increased cost-effectiveness of OH activity[1]
- Reduced reactive treatments, hospital admissions for reactive OH treatment, general anaesthesia (for extractions) amongst children
- Improved OH and OHrQOL in children in Scotland (maintained into adulthood)
- Reduced dental decay in all children in Scotland
- Reduced inequalities in OH from birth [reduced dental decay in children residing in SIMD 3-5]
- Reduced inequalities in uptake of OH services & OH treatment for children in Scotland

Note:
[1] Targets will be specified further once appropriate base-lines are known. Implementational targets will be specific to individual NHS Boards.

[2] 60% of 3 and 4 year old children in each SIMD quintile to receive at least 2 applications of FV per year (by March 2013).

Figure 1-5 Childsmile logic model, Chilsmile 2010

To evaluate outcomes within Childsmile and assess the programme's impact, several study designs are utilised such as embedded randomised controlled trials, economic evaluations and population-level cohort studies utilising data linkage. Routinely collected health and education data and data from Childsmile interventions are linked to analyse the impact of the programme on oral health inequalities and wider outcomes.

Kidd et al (2020) carried out a data linkage project to evaluate the Childsmile programme across Scotland. The study aimed to investigate the impact of the Childsmile programme on the caries experience of a cohort of children (Kidd et al., 2020). The cohort was comprised of 50,379 children attending local authority schools in 2014/5 and who received an inspection as part of the NDIP programme. To form this cohort, NDIP data were linked to four Childsmile interventions: supervised toothbrushing and fluoride varnish application in the nursery setting, contacts with DHSWs and visits to primary care dental practice. The study found that 15,032 (29.8%) children had caries experience. The universal interventions were able to reach a high proportion of the population: supervised toothbrushing in nurseries (89.1%) and visits to dental practice (70.5%). In contrast, it was found that the targeted interventions tended to benefit children from more deprived areas. For SIMD 1 (most deprived), DHSWs contacts was 29.5% in comparison with 7.7% in SIMD 5 (least deprived). The figure for fluoride varnish applications in nursery was 75.2% for SIMD 1 compared with 23.2% in SIMD 5.

Children who had participated in nursery toothbrushing for 3 or more years had lower odds of caries experience (adjusted odds ratio (aOR)=0.60; 95% CI 0.55 to 0.66). In addition, children who attended 6 or more visits at a dental practice had lower odds of caries experience (aOR=0.55; 95% CI 0.50 to 0.61) when compared to children who had never attended. The authors summarised that there is a strong association between the universal interventions, supervised nursery toothbrushing and regular dental practice attendance and lower odds of caries experience amongst the cohort. Moreover, they found that participation in nursery toothbrushing was associated with lower odds of caries experience in children living in the most deprived areas (aOR=0.49; 95% CI 0.39 to 0.60) than

children living in the least deprived areas (aOR=0.70; 95%CI 0.56 to 0.88) (Kidd et al, 2020). This study also looked at the effect of the targeted application of fluoride varnish in nurseries within the Childsmile programme on caries experience. It found that these applications of fluoride varnish were not associated with a reduction in the odds of caries experience when compared to children who did not receive any fluoride varnish applications (aOR: 0.97; 95% CI 0.89-1.06). This was found to be the case regardless of number of applications of fluoride (Kidd et al., 2020).

An economic evaluation of Childsmile's supervised nursery toothbrushing programme was carried out across all Scottish health boards (Anopa et al., 2015). The time period for the cost analysis was 1999/00 to 2009/10. It considered the cost of this element of the Childsmile programme compared with the costs for avoidance of dental treatment. The cost of the nursery supervised toothbrushing programme was estimated to be £1,762,621 per year. The findings of the study showed that there was a saving of £4,731,097 associated with the nursery toothbrushing programme, with the largest saving being seen in children from areas of highest levels of deprivation. Over time, the savings of the programme were estimated to be two and a half times that of the cost of the programme.

A randomised controlled trial was carried out to determine the effectiveness and cost-effectiveness of the targeted fluoride varnish application in children in nurseries as part of the Childsmile programme (McMahon et al., 2020). Children who received fluoride varnish also received the treatment as usual Childsmile interventions (including supervised nursery toothbrushing), acted as the intervention group, while the control group was made up of children who were not part of the target group to receive fluoride varnish and received treatment as usual only. Randomisation of children to either group took place in their first year at nursery at age 3 and follow up took place for 24 months, until the child reached their first year at primary school. The primary endpoint for each child was the development of new caries between the baseline and 24 month follow up. This was measured by recording any increase in $d_3$mft over this time period. 1,150 children were evaluated as part of the study (557 in the fluoride varnish group and 573 in the treatment as usual group). Children in both groups had

similar levels of caries at baseline. In the fluoride varnish group, 26.9% of children had worsened d_3mft compared with 31.6% in the treatment as usual group (odds ratio = 0.80 (0.62–1.03), p = 0.078). The number needed to treat was calculated as 21 and it was estimated that there was a cost of £686 to prevent a single worsening of d_3mft. The number needed to treat is defined as "average number of patients who need to have the treatment or other intervention for one of them to get the positive outcome in the time specified" (National Institute for Health and Care Excellence, 2014b). This means that there would have to be 21 applications of fluoride varnish to prevent one worsening of d3mft. The authors concluded that as the reduction in worsening of caries in the fluoride varnish group compared to the control group was modest and not statistically significant, it is unlikely that the fluoride varnish intervention in nurseries is an effective and cost-effective component of the Childsmile programme. The application of fluoride varnish in this context is in addition to the universal nursery supervised toothbrushing programme, which as discussed earlier, has been demonstrated to be effective (Kidd et al., 2020).

A quasi-experimental approach was taken to explore the effectiveness of Dental Health Support Workers working within the Childsmile programme at linking families to primary dental care services by investigating a cohort of children born between 2010 and 2013 (Hodgins et al., 2018). This cohort was made up of 35,236 children, of whom 33% (n=11,495) had been assessed by a health visitor and referred to a DHSW as being considered in need of additional support regarding dental health. Of these referred children, 44% (n=5,087) went on to receive an intervention and support from a Dental Health Support Worker. The families who received the intervention were more likely to attend a dental practitioner and the attendance rates at the dentist for those who had been referred and received an intervention from a DHSW was 88% in comparison to 82% for those who had been referred but hadn't received support from a DHSW. In addition, children whose family had received support from a DHSWs first attended a dental practice 9 months earlier when contrasted with children who had been referred for an intervention from a DHSW but hadn't received it. Therefore, DHSWs working in the community were found to be effective at linking targeted families to primary care dental services, and at an earlier age, to receive preventative care.

Following research and evaluation, recommendations are made which are used to optimise implementation and development of the programme (Hodgins, 2017).

There are currently some limitations in the evaluation of the Childsmile programme. For example, there is limited detail known regarding intermediate outcomes of the programme, such as toothbrushing or dietary behaviours in the home. There is also a lack of information on how some components of the programme run in practice such as detail regarding the depth and quality of interventions related to giving advice in the dental practice or home setting (Ross et al., 2023).

A recent PhD thesis explored the DHSW role with regards to undertaking community linking, which involves the linking of families experiencing wider social or economic issues with appropriate external services or resources (Karamat, 2023). The project took a mixed-methods approach and included analysis of secondary data to investigate community linking practice within Childsmile and a national survey of DHSWs to explore acceptability and feasibility of community linking. The secondary analysis of population-wide individual-level linked routine administrative data and health data found that amongst families referred to a DHSW, there was an increase in the percentages of those linked to external community services from 1.8% (219 out of 12169 families) in 2011 to 21.0% (1227 out of 5833 families) in 2015. The main support services that families were referred to related to diet and nutrition, and parent and baby support groups. In addition, families who lived in the most deprived areas and who were deemed by DHSWs as having greater support needs, were most likely to be linked with external services and resources. The survey of DHSWs demonstrated that there was a high awareness of community linking among DHSWs with 72% (n=42) having experience of community linking within their role. In addition, 85% (n=50) said they would be able to identify appropriate community services to refer families to. There were however barriers to community linking identified relating to DHSW workload and time. The importance of collaborative working, staff training and active facilitation of families in accessing support services were highlighted as key factors by DHSWs

in the facilitation community linking. Community linking is an important area to consider for future Childsmile implementation research, as the project found there is a requirement to tailor links based on need, encourage integrate working and ensure there are clear communication routes between those making referrals and community organisations (Karamat, 2023).

1.7 Child home-based oral health interventions

1.7.1 Oral health education

Traditional oral health education includes giving advice and persuading patients to change their behaviour (Weinstein et al., 2004). While education can increase knowledge levels, it has been found to be insufficient at improving oral health long term and at motivating behaviour change (Kay and Locker, 1996). Moreover, it has been suggested that oral health education initiatives may in fact lead to an increase in inequalities due to being utilised by those with higher socioeconomic status and resources, which can be more difficult for those from a more disadvantaged background (Macpherson et al., 2019a, Macintyre, 2007, Schou and Wight, 1994).

Schou and colleagues examined the impact of a dental health campaign on the oral hygiene and gingival health of 5 year old children in Edinburgh in relation to deprivation (Schou and Wight, 1994). The study included 486 children from 92 primary schools. Each class was given a 20 minute information session and children were given toothbrushes and reading material to take home. In addition, encouragement was given to teachers to continue dental health promoting activities in class. Clinical examinations were carried out immediately before, one month after, and four months following the information session. There were statistically significant improvements seen in plaque scores one month following ($p<0.05$) and four months following ($p<0.01$) the session. There were also improvements recorded in gingival health one month and four months after the session ($p<0.01$, $p=0.001$ respectively). These improvements, however, were seen only in children from non-deprived schools. It was recorded that 31% children in non-deprived schools and 18% of children in deprived schools had a plaque score of zero recorded before the information session were carried out.

At four months following the session, 41% of children in non-deprived schools and 19% of children in deprived schools had a plaque score of zero. The authors therefore concluded, that while the campaign was successful at a population wide level, it resulted in dental health inequalities between children from deprived and non-deprived schools (Schou and Wight, 1994). Similar findings were reported in a study by Qadri et al (2018). They carried out a study to investigate the impact of an oral health promotion programme on primary school children in Germany. The study included 740 children aged 9-12 years across 18 primary schools. The programme consisted of general and oral health education being delivered to teachers in intervention schools who then conveyed this information to their pupils. No training or education was given to teachers or pupils in control schools. Mean DMFT values were recorded at baseline and 19 months after the programme had been in place. The results found that there was a significant incident rate ratio found between caries increment with children in the control group having a 35% higher risk of developing caries ($p<0.05$). It was also seen that there was a significant relationship between the parent's socioeconomic status (SES) and child caries increment ($p=0.002$). The programme was found to be highly protective from developing caries for children from high SES backgrounds but not for middle or low SES children. The caries incidence rate ratio for the intervention group when compared to the control group was 0.06. 0.82 and 1.58 ($p<0.001$) for children from high, middle and low SES backgrounds respectively. This campaign was also successful at reducing caries at a population wide level but resulted in an increase in inequalities in caries levels between children from high and low SES circumstances (Qadri et al., 2018).

1.7.2 Home toothbrushing interventions

A recent systematic review (Aliakbari et al., 2020) explored interventions designed to promote home-based toothbrushing practices and reduce dental caries in young children (less than 8 years old), which identified 42 studies. The majority of studies focused on targeting oral health in general with just five studies promoting solely home toothbrushing behaviours by parents. These are described in this section.

One study considered the effect of an intervention on the uptake of healthy dental behaviours and severity and prevalence of dental caries in young children in Manchester, England (Davies et al., 2005). This randomised controlled trial was conducted with 1,545 children aged between 8 and 32 months who received a clinical examination. 168 parents/carers completed a questionnaire. The intervention consisted of the provision of a drinking cup, toothbrush, 1450ppm F toothpaste and advice delivered to parents on attendance at dental or health clinics. Additional toothbrushes and toothpaste were delivered to children's homes. Children in both intervention and control groups received a clinical examination at 3-4 years old. The prevalence of caries in children in the intervention group was 16.6% in comparison with 23.5% in children in the control group, a reduction of 29% (p=0.003). For children in the intervention group, mean dmft was 1.17 while the prevalence of general caries experience was 28.7%. These figures were significantly lower when compared with children in the control group who were reported to have a dmft of 1.72 and caries prevalence of 39.2% (p=0.001). The results also found that the intervention had had an impact on self-reported toothbrushing behaviours. In the intervention group, 45% of parents reported starting brushing before the child's first birthday compared with 27% in the control group. Twice daily toothbrushing was reported to take place for 52% of children in the intervention group contrasted with 34% in the control group.

The intervention used above by Davies and colleagues (2005) was again examined in a study conducted in 2007 (Davies et al., 2007). A randomised controlled trial was again conducted with 842 children aged between 0-18 months (intervention group n=253, control group n=286). Follow up was carried out via a clinical examination when the child was 5 years old. Outcome measures recorded included caries prevalence and dmft. The results found that the prevalence of caries experience in children in the intervention group was 54% in comparison with 64% in the control group (p=0.03). Additionally, children in the intervention group had a mean dmft of 2.23 compared with 3.72 in children in the control group (p<0.0001), which was a difference of 40%. When authors looked at the impact at a community level however, they found that effect of the intervention was not seen. It was thought that this was due to a high level of

non-participation amongst participants in the intervention group, which resulted in a dilution of the effects of the intervention.

Whittle et al (2008) carried out a randomised controlled trial to assess the effect of oral health education on the dental health of young children in the north west of England (Whittle et al., 2008). The intervention was delivered by a health visitor who had received additional training in dental health education. Children were recruited at their eight month hearing test and were then randomised to either the intervention (n=250) or control group (n=251). Families in the intervention group then received a home visit from a health visitor who provided them with dental health advice based on recommendations from the Health Education Authority. In addition, parents were given an advice leaflet, child's toothbrush and toothpaste containing 440ppm F. A second home visit took place for the intervention group when the child was 20 months old where toothbrushing advice was again given alongside the same leaflet and a toothbrush and toothpaste. Parents of children in the control group received the standard level of care normally delivered by their health visitor. Each child's teeth were examined when they were three years old and again when they were five years old as part of a census survey. At three years old, the mean decayed, missing and filled tooth surface (dmfs) for children in the intervention group was 2.03 (95% CI: 1.39-2.67) and was 2.19 (95% CI: 1.41-2.97) for children in the control group. When examined at five years old, children in the intervention group had a mean dmfs of 3.99 (CI: 2.54-5.04) while those in the control group had a dmfs of 4.84 (CI: 3.39-6.29). There were no significant differences found in mean dmfs between children who had received the intervention from a health visitor and those who hadn't. The intervention in this study however, focused on providing dental health advice which in isolation is not sufficient to bring about behaviour change and improve oral health (Kay and Locker, 1996). In addition, the toothpaste provided to families contained 440 ppm F while guidance recommends that children should use toothpaste containing at least 1000ppm F toothpaste (SDCEP, 2018) and a 2019 Cochrane review found that toothpaste of 1000ppm F or higher can prevent caries in both the primary and permanent dentition (Walsh et al., 2020).

A further study which targeted parental home toothbrushing practices was conducted by Vichayanrat et al (2012) in Thailand. They utilised a quasi-experimental approach and looked at the effect of an intervention on caries levels (Vichayanrat et al., 2012). The control group received enhanced dental health education and services at a health centre and the intervention group received, in addition, three monthly home visits by lay health workers to provide social support. The lay health workers provided information and support to caregivers on how to look after and improve oral health. Additionally, community mobilisation took place whereby local community members received education on and had discussions surrounding early childhood caries and its impact. Outcomes measured included caries levels, supervised toothbrushing and use of fluoride toothpaste. One hundred and fourteen children between the ages of 6-36 months and their caregivers took part in the study. At one year follow up, it was found that there had been an increase in caries in both groups, however the caries prevalence and dmft were not significantly different between the groups ($p>0.05$). There was also no statistically significant differences in supervised toothbrushing recorded between or within the groups after one year. It was found, however that there was a significant difference in the use of fluoride toothpaste between the groups following the intervention. Fluoride toothpaste was used, following the intervention by 89.5% of caregivers in the intervention group and by 59.6% in the control group ($p<0.01$). In addition, it was reported that carers in the intervention group received more social support by lay health workers and health centre staff than those in the control group ($p < 0.001$) (Vichayanrat et al., 2012).

Makvandi et al (2015) considered the impact of an oral health intervention on the dental cleaning behaviours and knowledge of mothers of young children in Iran (Makvandi et al., 2015). A randomised controlled trial was carried out with 90 mothers of children aged between 1-2 years attending daycare centres, who were randomly allocated to either the control (n=45) or intervention group (n=45). The intervention consisted of three information and discussion sessions regarding child toothbrushing with researchers, a booklet and mobile phone text message reminders. The primary outcome measured was change in parental brushing of the child's teeth while a secondary outcome measure was change in Theory of Planned Behaviour (TPB) cognitions. Follow up was completed at 10

days and 3 months. After 3 months, it was found that there was a significant difference found in self-reported toothbrushing in mothers between the groups. Toothbrushing in the intervention groups increased from 24% to 87.5% (p=0 .001) compared with an increase from 29% to 46.3% (p=0.116) in the control group. Mothers in the intervention group also reported significant differences in knowledge (P=0.001), attitude (P=0.004), and perceived behavioural control (P=0.008). The authors concluded that the theory based intervention was moderately effective at improving self-reported parental toothbrushing in the study population (Makvandi et al., 2015).

Additionally, a recent study examined the impact of an oral health intervention in which health visitors deliver toothbrushing advice to parents of children aged between 9-12 months old in West Yorkshire, England (Giles et al., 2022). The HABIT (Health visitors delivering Advice in Britain on Infant Toothbrushing) intervention involves the provision of training to health visitors on the delivery of the intervention and the provision of materials to parents including a website, videos, leaflets and toothbrushing demonstrations. 35 parents and 11 health visitors were recruited for this mixed-methods, non-controlled study. The study aimed to explore the feasibility of the intervention as well as its impact on optimal oral health behaviours, including toothbrushing. Self-reported brushing behaviours were collected, along with plaque scores and a video recording the duration of toothbrushing. A three month follow up was conducted after the intervention was delivered and found that there was an increase in self-reported toothbrushing from 30% (95% CI 0.13 to 0.47) to 68% (95% CI 0.50 to 0.86). There was also reported to be a statistically significant decrease in plaque scores going from 42% (95% CI 0.23 to 0.61) at baseline to 19% (95% CI 0.02 to 0.36) after three months. In addition, there was found to be an increase in toothbrushing duration from 36 seconds (SD=23.9) at baseline to 47 seconds (SD=23.6) at three month follow up. The authors reported that the delivery of the intervention in the home setting was feasible. They did note however, that there was potential for selection bias, as those who volunteered to participate in the study may be more motivated and 'aware' (Giles et al., 2022). Additionally, the study contained no control group making it difficult to ascertain to what extent changes in oral health behaviours were as a result of the intervention due to the potential for confounding factors (Paulus et al., 2014).

A previous tool called Chatterbox was developed for use within the Childsmile programme which aimed to aid DHSWs with supporting families to attend dental practice in Scotland (Nanjappa and Freeman, 2013). Chatterbox involved the use of a toolkit of cards and was based on interactive storyboarding. The aim was to allow parents to explain to DHSWs difficulties they were having which resulted in them not attending dental practice. The toolkit consisted of 72 cards with simple illustrations and pictures representing daily routines and parents laid these out to create a timeline and visual representation of an average day. This timeline was photographed to be used at future visits. DHSWs then discussed with parents any particular difficulties arising during the day which impacted on dental practice attendance. The DHSW would then work with the parent to suggest any solutions which could help address these challenges. The problems which were identified and solutions discussed were then transferred on to an appointment postcard which could also serve as a reminder for the parent's next Childsmile visit. Chatterbox was tested out by DHSWs during home visits with parents who had been identified as requiring supporting with taking their child to dental appointments (Nanjappa and Freeman, 2013). Nine families were included in this trial. DHSWs were able to help parents identify times within their routine where it might be most manageable to attend dental practice and offered practical solutions such as attending the appointment with the family to assist with childcare when this had been pointed out as causing difficulties. These solutions resulted in the parent attending their dental appointment with their child. There were, however, other families where the parent failed to attend their dental appointment and DHSWs were unable to further contact them for follow up. While the use of Chatterbox tool was able to successfully lead to some families attending dental practice, potential limitations in its use were identified. These included difficulties maintaining contact and engaging with some families, particularly those from socioeconomically deprived backgrounds. The Chatterbox intervention was not further rolled out across the Childsmile programme and therefore no further evaluation was carried out.

The studies published in the literature therefore suggest that interventions which aim to improve home toothbrushing for young children can be effective at improving brushing behaviours, and in some cases having a positive impact on

caries levels. Several of the interventions were delivered by non-dental professionals including those delivered by lay health workers and health visitors. There are also only a small number of interventions currently which specifically focus on improving home-based toothbrushing behaviours by parents. In addition, very few of the reported interventions appear to be theory-based.

1.8 Uitblinkers: a practice based toothbrushing support tool

A further intervention which focuses on targeting parental home toothbrushing behaviours for young children is the Uitblinkers (translation "brilliant stars") project which was developed by the Academic Centre for Dentistry Amsterdam (ACTA) in 2017. It involves semi-structured conversations being carried out with parents of children aged 2-10 years old by dental care professionals (dentist, dental hygienist or dental therapist) in a practice setting. It aims to improve parental toothbrushing behaviours by providing tailored support to parents. It was developed by a group of researchers which included individuals with knowledge and expertise in the domains of paediatric dentistry, dental public health, educational psychology, behavioural therapy and pedagogy. Some of the components of the intervention were adapted from the Dutch 'BeeBOFT' programme which is an intervention which aimed to prevent childhood obesity by improving parenting skills (Raat et al., 2013). There are two sections of the intervention: the first involves the identification of any difficulties that parents are having which prevent them from carrying out toothbrushing for their child and the second focuses on exploring possible strategies which could help overcome the toothbrushing barrier identified by the parent. The techniques delivered to parents employ principles from learning theory to promote specific parenting strategies. Key strategies which are utilised are stimulus control and operant conditioning, concepts from behavioural psychology which theorise that behaviour change can be brought about by repeated connections between stimuli and response (Butryn et al., 2011).

Stimulus control can be used to limit unwanted behaviour in children. Parents are advised to set up conditions at home in a way that promotes the particular desired behaviour of the child (Butryn et al., 2011). This is achieved by structuring time and space, implementing set rules and habits and delivering

requests to children clearly and consistently. In order to structure time and space, daily activities such as bathing, brushing teeth and putting on pyjamas, should take place in a fixed order and place. This establishes predictability and routine which makes it easier for a child to go along with what is expected of them.

Operant conditioning involves parents being able to shape a child's behaviour by reinforcing desired behaviour and punishing or ignoring unwanted behaviour. Operant conditioning has been described by Skinner (Skinner, 1963) and Bandura (Bandura, 1977) as the process by which a person's behaviour changes as a result of the consequences that behaviour has. The provision of a reward following certain behaviour increases the likelihood that the child will display that behaviour again. A negative stimulus, such as taking something nice away, reduces the chance of repetition. This may also work in reverse, for example, if a parent gives in to a child repeatedly asking for sweets or refusing to brush their teeth, the negative behaviour may be maintained as the child has learned that this behaviour can work. It is therefore important that, while often challenging, parents remain consistent. This means giving the child's desired behaviour positive attention and not rewarding negative behaviour by ignoring it.

The key aim of the conversation process between the dental care professional and the parent is also to create a welcoming, non-judgemental atmosphere. This is achieved by expressing empathy and understanding throughout, asking open-questions and delivering advice centred on the parent (de Jong-Lenters et al., 2019). Many of these conversation techniques are also utilised in motivational interviewing. Motivational interviewing was created as an alternative to advice giving and persuading patient to change. It is a brief counselling technique which uses patient-centred approaches to support motivation for behaviour change (Weinstein et al., 2004). Motivational interviewing was first developed for the treatment of alcoholism and was later expanded to target a range of physical and mental health behaviours (Borrelli et al., 2015). Motivational interviewing has since been used in interventions which aim to reduce early childhood caries. A systematic review and meta-analysis found that motivational interviewing can lead to a modification in knowledge and behaviours and a reduction in caries in

young children, particularly in populations with high-caries experience (Colvara et al., 2021). The review found that interventions which utilised motivational interviewing could prevent an average of 3.15 (95% CI: −6.14, −0.17) dmfs in high-caries experience groups.

Nine cards were created for use during the Uitblinkers intervention, which have illustrations and text describing common barriers to toothbrushing (Figures 1-5 and 1-6). As part of the process, parents are asked to select which card with which they most identify. The purpose of the cards is to make parents aware that these are common barriers also experienced by others and also to support the conversation, particularly in parents with lower levels of literacy.

Each card has a script on one side to be used by the dental care professional, which facilitates a discussion with the parent to find an approach to tackle the barrier based on parenting and educational principles. An action plan is then created and follow up by telephone takes place around one week later. One month following this, the process can be repeated to identify a second barrier to toothbrushing.

Poetsen is moeilijk als *mijn kind te moe is*

Poetsen is moeilijk als *mijn kind te moe is*

Achtergrond
Stimuleer poetsen door het indelen van tijd en ruimte (stimuluscontrole).

Aanpak
Ga met het kind poetsen voordat het kind te moe wordt. Zorg voor een slimme, vaste avondroutine.

Kernadviezen
• Leg uit dat jonge kinderen drukker en lastiger kunnen worden, als ze moe zijn. Dit maakt poetsen moeilijker.
• Kijk samen hoe het poetsen naar voren gehaald kan worden door een andere volgorde in de routine te bespreken. (bijv. direct na het eten poetsen). Als dit gebeurt voordat het kind moe is, en niet meer wil, voorkomt dit onnodige strijd.
• Geef ouders informatie over het belang van het consequent invoeren van deze nieuwe basisroutine.

Wat levert het de ouder op?
De sfeer is beter en het poetsen wordt makkelijker. Het kind gaat rustiger slapen.

Blinkers

Toon begrip ★ Complimenteer waar mogelijk ★ Vraag toestemming voordat je iets uitlegt ★ Gebruik humor

Poetsen is moeilijk als *ik moe ben of stress heb*

Poetsen is moeilijk als *ik moe ben of stress heb*

Achtergrond
De effectiviteit van een opvoeder is groter als het hem of haar lukt om eigen zorgen op het gebied van financiën, relaties en isolement niet met het kind te delen. Een neutrale of positieve stemming van de ouder helpt de goede sfeer te behouden. Kinderen voelen de stress van de ouder (stemverheffing, beetje hardhandig worden). Kinderen doen dat na (schreeuwen en tegenwerken). Dat maakt poetsen nog moeilijker.

Aanpak
Zorg dat ouders begrijpen dat rustig en positief blijven in het contact met hun kind het poetsen kan vergemakkelijken. Leg uit dat een wisselend patroon van poetsen: dan weer wel/dan weer niet, onduidelijk is voor een kind. Blijf consequent en hou vol!

Kernadviezen
• Toon begrip en geef een compliment waar mogelijk. Besef dat ouders écht stress hebben. Fijn dat ze het poetsen wel belangrijk vinden!
• Leg uit wat rust bewaren hen op kan leveren. Het kind blijft dan ook rustiger en zo zal het tandenpoetsen beter verlopen.
• Zorg dat de ouder de stress van zichzelf niet tot de stress van het kind maakt. Kinderen doen alles van een ouder na; als de ouder moppert, moppert het kind ook.
• Poetsen overslaan werkt averechts, omdat een kind dan beloond wordt voor dwars gedrag. De dag erna doet het kind dan weer hetzelfde.

Wat levert het de ouder op?
Door de positieve sfeer zal de ouder meer vertrouwen krijgen in zichzelf. De verandering levert voor iedereen minder stress op.

Blinkers

Toon begrip ★ Complimenteer waar mogelijk ★ Vraag toestemming voordat je iets uitlegt ★ Gebruik humor

Figure 1-7: 'Uitblinkers' barrier card with tips on reverse side: Toothbrushing is challenging when my child is too tired

Figure 1-6: 'Uitblinkers' barrier card with tips on reverse side: Toothbrushing is challenging when I am tired or stressed

A feasibility study of the Uitblinkers intervention was carried out with 21 dental therapists across 12 general dental practices in Amsterdam (de Jong-Lenters et al., 2020). Each therapist undertook the intervention with the parent of ten 3 year old children who were randomly selected from the patient list. The feedback from the dental therapists was that they felt it was fairly feasible to implement the Uitblinkers intervention but there were some challenges getting used to using the intervention. The time taken to complete the intervention (28 minutes on average) was an issue for some although for others this was similar to the length of time for a normal consultation. There were difficulties in recruiting the target population of parents of children with high caries risk and those from a lower socioeconomic background and it was found that motivated parents were more likely to participate. The therapists were generally positive about the interview method and found that it facilitated the giving of more tailored advice and allowed parents to be more involved in the discussion. The cards and script were described as being useful aids to identify barriers and techniques although some therapists preferred to use these only as a back-up to the interview. The feedback from the parents was that they appreciated the interview, liked the personal attention and did not mind the extra time taken. However, some parents could not recall that an action point had been discussed. The study did not report on how dental therapists selected which parents they used the intervention with, and as stated there were difficulties recruiting parents of children with high caries risk. In addition, the intervention targets parents of children from 2 years old, whereas toothbrushing behaviours as likely initiated prior to this age.

1.8.1 Early scoping work on Uitblinkers in Scotland

Early scoping work was carried out by Childsmile regional researchers in 2019 to explore the possibility of introducing the Uitblinkers cards within Childsmile. This preliminary work was carried out prior to the commencement of this PhD project. They carried out five focus groups with 21 parents in total across four towns in Fife, Scotland. Additionally, focus groups were conducted with 12 Childsmile staff who delivered components of the programme in the NHS Scotland health board areas Fife, Ayrshire & Arran and Grampian. When shown

the Uitblinkers cards, participants stated that they were attractive, colourful and the use of pictures in place of text as useful. In addition, several participants thought that the cards were beneficial to demonstrate that these are common issues which many parents may struggle with. They also felt the cards could be useful in some situations to facilitate a conversation, where the parent may otherwise struggle to express the difficulties they are having. However, many participants did not like the style and content of a number of the illustrations depicted on the cards, with several reporting that it was difficult to understand what the image was trying to represent. It was also pointed out that there was a lack of diversity represented in the cards. The researchers also asked parents about barriers they experienced with toothbrushing and while many of these barriers were represented in the Uitblinkers cards, there were some which were missing such as family circumstances where children may be living between more than one home. In addition, a workshop was carried out in Dumfries, Scotland with members of the dental team including dentists, dental nurses, and dental therapists. This workshop also took place prior to the commencement of this PhD. Feedback was sought regarding the Uitblinkers card and the general approach. It was felt that this was would be a useful tool and way to address toothbrushing with parents. However, it was felt that the dental practice setting would not be an appropriate setting to deliver this intervention in Scotland.

1.9 Project Rationale

While in Scotland there have been improvements in child caries experience over the past 10 years, many children still suffer from tooth decay and inequalities remain. Proportionate universalism has been suggested as being the most effective approach to reduce inequalities. A further reduction in decay experience and narrowing of inequalities requires, in addition to the current Childsmile programme, a more targeted approach based in a home setting in order to reach children and establish preventive behaviours at a young age. It is important that support is targeted towards those most in need. Many families with young children who require additional toothbrushing and oral health support may not yet be attending dental practice, therefore the home setting

may be an alternative means to reach these families. Many children experience dental caries before they reach nursery age and in addition, a social gradient exists wherein those living in the most deprived areas have a higher caries experience than those living in the least deprived areas. To tackle persistent inequalities in caries experience in 5 year old children in Scotland, more targeted interventions are needed in early life, prior to children attending nursery schools where they receive supervised toothbrushing. The provision of additional support targeted towards those families most in need is in line with the principles of proportionate universalism, where more intense support is directed towards those who most require it.

Childsmile is well placed to provide this targeted and tailored support in the home setting of children who require it via the DHSW component of the programme. Currently DHSWs provide support via home visits to families who have been identified by their health visitor as benefiting from additional oral health support. Additionally, toothbrushing has been shown to be a more effective intervention than the application of fluoride varnish (Kidd et al., 2020). As demonstrated in the published literature, interventions carried out in the home setting targeted towards improving toothbrushing in children have been moderately successful at improving both self-reported toothbrushing behaviours and caries experience (Davies et al., 2005, Davies et al., 2007, Whittle et al., 2008, Vichayanrat et al., 2012, Makvandi et al., 2015, Giles et al., 2022). DHSWs provide support to parents of young children to promote healthy oral health behaviours including toothbrushing. We know that supervised toothbrushing is a complex behaviour requiring a theory informed approach delivered to parents to promote child toothbrushing. Support provided by DHSWs in the home setting has previously been found to be effective at linking families to dental practice, with children from families who have received DHSW input attending dental practice earlier than those from families who did not receive DHSW support (Hodgins et al., 2018). However, there is scope to enhance this role and provide support to DHSWs to provide more targeted and tailored interventions to families who require extra input (Hodgins, 2017, Young, 2017). An additional tool for use by DHSWs could be an effective means to approach the optimisation of the provision of targeted support by DHSWs. DHSWs working within the Childsmile programme do not currently have a tool which they can

use with families in need of additional toothbrushing support during home visits and it may be possible to adapt the Uitblinkers tool for this purpose.

Subsequently, the Uitblinkers intervention, was considered as a potentially useful addition to the current support and interventions provided by DHSWs during home visits. However, it was recognised as requiring adaptation before this can take place. Additionally, the Uitblinkers intervention targets families who attend dental practice and is aimed at the parents of children aged 2-10 years old. As previously stated, in order to prevent dental caries from occurring, it is necessary to ensure preventive behaviours are developed from a very young age which would have to be in the home setting before the child reaches nursery age (2-3 years old). Moreover, many families may not yet be taking their young child to a dental practice and therefore would not benefit from a practice based intervention. It was reported that as of September 2022, 73.1% of children aged 3-5 years were registered with an NHS dentist in Scotland in comparison to 28.1% of children aged 0-2 years (Public Health Scotland, 2023). The registration of the child with a dentist is one of the key aims of a DHSW when they visit a family. It is therefore necessary in the Scottish context of families who require additional support from a DHSW, that the Uitblinkers intervention is adapted and developed to be carried out during home visits and targeted towards children of a younger age (0-3 years), following the principles of proportionate universalism with the aim of tackling inequalities.

Chapter 2

2.1 Aims

The primary aim of this study is to develop a theory-informed home-based tool, by adapting an existing practice-based tool ('Uitblinkers'), to optimise toothbrushing behaviours for young children from families in need of additional support in Scotland. The tool will be designed to facilitate a conversational intervention delivered by Childsmile's Dental Health Support Workers to parents/carers brushing their children's (aged 0-3 years) teeth. This is in addition to the Childsmile Dental Health Support Workers' current practice in relation to the provision of toothbrushing support. The desired outcome is that this tool will be able to be refined so that it can be evaluated and implemented in the Childsmile programme.

2.2 Objectives

To meet that aim there are a number of specific objectives:

Objectives 1 to 5

1. Collate and present current state-of the-evidence on barriers that parents/carers face in the home when carrying out toothbrushing for their child.
2. Recruit experts in the area of child home toothbrushing to form a Delphi panel.
3. Organise and deliver online modified Delphi process.
4. Gain expert consensus to prioritise the barriers with regards to level of importance to be addressed by new toothbrushing intervention through a modified Delphi process.
5. Gain expert consensus on the behaviour change strategies, based on those utilised in the Uitblinkers intervention, which should be used to address the prioritised toothbrushing barriers to aid the development of a new toothbrushing intervention via a modified Delphi process.

Research questions associated with these objectives are:

- What are the main barriers that parents/carers face in toothbrushing their children's teeth?
- Are the techniques and overall approach of the Uitblinkers intervention appropriate to address these barriers and within a home-support tool context?

Objectives 6 to 9

6. Recruit DHSWs to take part in in-depth qualitative interviews.
7. Identify the barriers and facilitators for effective implementation of the intervention via interviews with DHSWs.
8. Design illustrated barrier cards for prototype intervention, alongside collaborating DHSWs.
9. Develop the strategies and wording for each barrier card, alongside collaborating DHSWs.

Research questions associated with these objectives are:

- How can the resources from the Uitblinkers intervention be adapted to be suitable for the new context of use by DHSWs in the home setting?
- What are the main barriers and facilitators to effective implementation of a new home toothbrushing intervention, adapted from an existing intervention, from a DHSW perspective?

Objectives 10 to 14

10. Recruit parents and DHSWs to participate in a workshop to test the feasibility and acceptability of the new intervention.
11. Develop training for DHSWs on the use of the new intervention.
12. Deliver workshop wherein DHSWs can test out the new intervention with parents in a simulated setting.
13. Gain insight and feedback on the use of the new intervention from DHSWs and parents.

14. Follow up with parents via telephone interviews six weeks following the workshop, to see if they report any short-term benefits.

Research questions associated with these objectives are:

- Is the intervention feasible and acceptable to DHSWs and parents when carried out in a simulated setting?

- Are there any short-term benefits reported by families following use of the intervention in a simulated setting?

Chapter 3   Overarching methodology

This chapter outlines the overarching methodological approach that guides the studies described in the proceeding chapters. This project is comprised of three studies and a brief outline of each of these is provided in this chapter, with further specific detail on the methods and procedures being described in Chapters 4 to 6.

3.1.1 Pragmatism

The overarching aim of the research was to develop a home-based intervention, by adapting an existing practice-based tool ('Uitblinkers'), to optimise family toothbrushing behaviours for families-in-need in the early years in Scotland. The goal is for this tool to be used in the real-world setting by DHSWs, to fit in with well established current practices. Therefore, a pragmatic approach was taken which focuses on the outcome of the research and utilisation of the most appropriate research methods to explore real world problems (Andrew and Halcomb, 2006, Brierley, 2017). This therefore lends itself to the use of different research approaches, both qualitative and quantitative in order to answer the research question, particularly where there is a need to address complex social problems (Allemang et al., 2022).

The paradigm of pragmatism came about as a result of a need to address real world practical problems through investigation and exploration (Feilzer, 2010, Biesta and Burbules, 2003). Pragmatism puts forward that in order to make sense of an event, experience is required (Denzin, 2012). Therefore, research carried out based on pragmatism, prioritises the experiences of individuals with the goal of building up a broader picture of a situation, rather than depending on "absolute truths" (Hildebrand, 2011, Allemang et al., 2022). Pragmatism encourages the researcher to consider the events occurring within a particular setting and address the research questions by using the most beneficial research methods (Hothersall, 2019, Johnson and Onwuegbuzie, 2004). The pragmatic paradigm proposes that social issues should be specified by those who are experiencing them, therefore resulting in the creation of research questions to be actioned (Johnson and Gray, 2010, Hall, 2013). A key element of any philosophical viewpoint is the theory of knowledge, known as epistemology

(Audi, 2010). In pragmatism, an emphasis is placed on action, which is thought to be the simplest form of knowledge (Biesta and Burbules, 2003), and in particular the thought processes behind, and outcomes of actions (Denzin, 2012). The creators of pragmatism also put forward that knowledge is gained through the interaction of individuals with their surroundings, a term described as 'transactional realism' (Allemang et al., 2022, Biesta and Burbules, 2003). Pragmatism proposes that knowledge is closely associated with experience (Hildebrand, 2011), and acknowledges the significance of different aspects of social, psychological and physical phenomena (Johnson and Onwuegbuzie, 2004). Knowledge has been described as being "both constructed and based on the reality of the world we experience and live in" (p.18) (Johnson and Onwuegbuzie, 2004), so it can therefore be assumed that while knowledge may exist in the 'external world', it should be experienced by individuals (Allemang et al., 2022).

Within the pragmatic paradigm, there is no importance placed on any type of research method over another. Rather, it emphasises that those undertaking research should give thought to how interests can be served in certain circumstances when a certain type of knowledge is applied (Cornish and Gillespie, 2009, Allemang et al., 2022). This approach, therefore, accepts and recognises as being valid, various different types of, and approaches to knowledge. As there is no emphasis placed on any one specific type of evidence, in-depth thought can be given to which form of knowledge would be best suited to a particular group of people within a specific context (Allemang et al., 2022). Subsequently, pragmatism advocates the utilisation of various exploratory methods in order to approach issues in the most appropriate manner, viewing methodologies as a means to gain understanding in the world (Onwuegbuzie and Leech, 2005).

3.1.2 Implementation science

In addition to pragmatism, principles from implementation science have also been used as the overarching approach to meet the aims of the research. Implementation research seeks to address a wide range of implementation issues. It has been defined as "the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practice into

routine practice and, hence, to improve the quality and effectiveness of health services" (p.1) (Eccles and Mittman, 2006). Implementation research in health systems was developed due to a need to see the actual public health impact of interventions (Bauer et al., 2015). It was previously reported that only around half of evidence-based practices ever reached widespread usage clinically (Balas and Boren, 2000).

Any aspect of implementation can be considered including factors affecting implementation, methods of implementation and the results of implementation. Implementation research is interested in the what, why and how interventions work in the 'real world' instead of looking at ways to control for or remove these factors or conditions (Peters et al., 2014). It is therefore important that such research involves the groups of people or population who will be affected by a particular intervention. It is also an implication of implementation research that users of the research are closely involved in the different stages such as study design and conduct rather than just being given the dissemination of results. Implementation science aims to identify barriers and facilitators to uptake of interventions across a range of contexts, including not only the patient level but also taking into consideration the provider, organisation and other stakeholder groups (Bauer and Kirchner, 2020). Following this, strategies to overcome the barriers and enhance the facilitators are developed and applied to increase the uptake of the intervention. Implementation science can offer recommendations on the implementation of the subject of interest and in order to put forward these recommendations, a systematic approach is required towards implementation analysis and evaluation (Wensing et al., 2020).

Implementation research which has been carried out without the use of a theoretical framework limits the ability of the researcher to generalise and apply the findings to other settings or circumstances (Kirk et al., 2016). The use of a framework can help guide the research process throughout, from the design stage to interpretation of findings (Moullin et al., 2020). Implementation frameworks and models may also help to detect any areas which require specific targeting and gaps in strategies to implementation (Villalobos Dintrans et al., 2019). Without the use of a framework to guide implementation research, it may

be challenging to identify the reasons why implementation was successful or not and which factors contributed to the successful outcome (Nilsen, 2020).

It has been proposed that there are five categories of theoretical frameworks and models which can be used in implementation research (Nilsen, 2020). It has been highlighted that there is a lack of consistency in the use of the terms framework, models and theories and these terms are often used interchangeably (Nilsen, 2020, Field et al., 2014). However, Rycroft-Malone and Bucknall (2010) argued that frameworks are more wide-ranging and factual while models and theories have a more narrow scope and may be useful for testing hypotheses (Rycroft-Malone and Bucknall, 2010). The five categories put forward by Nilsen (2020) are:

- Process models
- Classic theories
- Implementation theories
- Evaluation frameworks
- Determinant frameworks

3.1.2.1 Process Models

The function of process models is to provide an explanation of the stages that are required in order to translate research into practice. This can include both the implementation and use of the research and some models known, as 'action models', can also contain practical guidance on strategies at different stages in order to facilitate implementation. Some process models were developed based on the creators' own experiences of implementing new approaches, while others came about as a result of studying literature reviews on various theories, frameworks and models, as well as individual studies to ascertain which factors were important for successful implementation. Some examples of process models are the K2A Framework (Wilson et al., 2011), the CIHR Model of Knowledge Translation (Canadian Institutes of Health Research, 2014), the ACE Star Model of Knowledge Transformation (Stevens, 2012), the Stetler Model (Stetler, 2010), the Iowa Model (Titler et al., 1994, Titler et al., 2001), the Knowledge-to-Action Framework (Graham et al., 2009), the Quality

Implementation Framework (Meyers et al., 2012) and the Ottawa Model (Logan and Graham, 1998).

For example, the Knowledge-to-Action Framework (KTA) was developed by a team in Canada in response to the fact there was growing evidence that the outcomes and findings of research were not translating into real-life practice within healthcare settings, alongside a growing desire for healthcare that is cost-effective and accountable (Graham et al., 2009). In addition, there was confusion over the various multiple terms used when discussing the knowledge to action process. Knowledge to action refers to the process of translating the evidence gained from research ('knowledge') in to real-life applications (action). In order to develop their framework, the authors reviewed 31 existing planned action theories regarding the process of change. The resultant conceptual framework following this review process was designed to tackle the issues of a lack of clarity within the field of Knowledge-to-Action and make clear the core principles of the Knowledge-to-Action process. The KTA Framework is made up of two components which although separate, are linked. The Knowledge Creation component, which involves knowledge inquiry and synthesis, is encircled within the Action Cycle component. Both of these components incorporate a number of different stages, which are described by the authors as being 'dynamic' and having an influence on one another (Graham et al., 2009). The Action Cycle process involves outlining the functions required for the application of knowledge in practice, how this knowledge is adapted to the relevant setting and then assessing any potential barriers or facilitators to this knowledge being used in practice. It is also key that there is engagement of stakeholders and adaptation of the knowledge to the needs of those who will use it. Field et al (2014) conducted a systematic review looking at if and how the KTA Framework is used in practice. The results included 146 studies, in which the KTA Framework had been used to varying extents, ranging from being referred, to being fully incorporated as a method. Within 10 of these studies the KTA Framework was fundamental to the implementation process. All 10 of these studies stated the utilisation of the Action Cycle component, while 7 studies made reference to the Knowledge Creation component. While the KTA was able to be incorporated, the review authors stated that the framework provides a practical guide which can be used flexibly and with 'theory fidelity', allowing it

to be used in unique ways. The authors pointed out, however, that there was a lack of evidence regarding the framework being used in real-life practice to bring about change in implementation efforts and further research is required to analyse how frameworks such as KTA can be used to add value to real-life implementation efforts (Field et al., 2014).

3.1.2.2 Classic theories

Classic theories are those which were developed outwith the field of implementation science in areas such as psychology, sociology and organisational theory. They are known as classic theories so that they can be distinguished from research to practice models (Graham et al., 2009). These types of theories are somewhat passive in nature relative to action models as they explain the ways in which change can take place, but do not outline how this change can or should be brought about. Examples of these types of theories include the Theory of Diffusion (Rogers et al., 2008), the Social Cognitive Theory (Bandura, 1977), the Theory of Planned Behaviour (Ajzen, 1991) and the Situated Change Theory (Orlikowski, 1996).

For example, the Theory of Diffusion was made popular through Rogers' (2008) work which focused on the spread of innovations (Nilsen, 2020). Rogers created a model in which he provided an explanation for the process through which people gain new knowledge, implement new knowledge and how new knowledge can become incorporated into practice long term (Fisher, 2005). The theory proposes that there are five factors which have an influence on the adoption of new behaviours or knowledge (termed 'innovations'):

1. Relative advantage (the extent to which the new innovation is seen as being an improvement over that which it replaces)

2. Compatibility (how well the innovation aligns with the current practices and needs of the new users of the innovation)

3. Complexity (the ease or difficulty of the new innovation to use or understand)

4. Trialability (the degree to which the new innovation can be tested or tried out before being brought in to use)

5. Observability (the ability for tangible results to be observed resulting from the new innovation)

The Theory of Diffusion has been used widely in both implementation science and determinant frameworks (Aubert and Hamel, 2001, Foy et al., 2002, Völlink et al., 2002, Damschroder et al., 2009, Greenhalgh et al., 2004, Gurses et al., 2010). It has been proposed that some limitations to the theory include the fact that it does not take into account the influence of an individual's access to resources or social support network on their ability to uptake a new innovation or behaviour (LaMorte, 2022).

3.1.2.3 Implementation theories

Implementation theories were created by researchers working in the field of implementation science to explain and provide detail on various stages of the implementation process. These theories were either developed originally by the researchers themselves or adapted from existing theories and models. Examples of implementation theories are COM-B (Capability, Opportunity, Motivation and Behaviour) (Michie et al., 2011), Implementation Climate (Klein and Sorra, 1996), Normalization Process Theory (May and Finch, 2009), Organizational Readiness (Weiner, 2009) and Absorptive Capacity (Zahra and George, 2002).

For example, the Normalization Process Theory (May and Finch, 2009) focuses on the identification of factors which can either inhibit or facilitate how new practices are incorporated into healthcare or other institutional settings. The theory puts forward that new interventions or practices become routine within social settings (and therefore normalised) due to people working, both individually and together, to apply them. There are four main components to the theory which it is proposed leads to a practice becoming normalised:

1. Coherence (making sense of a particular practice or behaviour so it is therefore possible to share and partake in the practice)

2. Cognitive participation (the engagement of individuals which allows them to participate in the new practice)

3. Collective action (the work which is carried out in order to allow the new practice to take place)

4. Reflexive monitoring (the formal and informal monitoring and evaluation of the benefits and costs of the new practice)

These four components are not intended to be carried out linearly and can overlap and interact with one another at different stages of the process. The Normalization Process theory has, however, been criticised for not giving enough attention to the organisational contexts in which the implementation is occurring (Clarke et al., 2013) and for focusing too much on those carrying out implementation of a practice (e.g. nurses) with not enough thought given to those who will receive an intervention (e.g. patients) (Segrott et al., 2017).

3.1.2.4 Evaluation frameworks

Evaluation frameworks provide a guide to the process of evaluating an implementation effort in order to determine its success. Some examples of these are RE-AIM (Reach, Effectiveness, Adoption, Implementation and Maintenance) (Glasgow et al., 1999), PRECEDE-PROCEED (Predisposing, Reinforcing and Enabling Constructs in Educational Diagnosis and Evaluation Policy, Regulatory, and Organizational Constructs in Educational and Environmental Development (Green and Kreuter, 2005) and a framework developed by Proctor and colleagues (Proctor et al., 2011).

For example, RE-AIM is a planning and evaluation framework which was introduced in order to address issues surrounding the translation of scientific knowledge and advances into practice, particularly within the fields of public impact and policy. RE-AIM provides a specific focus on the stages or factors involved in the design, distribution and application of a process or intervention which can promote or inhibit the extent to which gaining an impact at population level can be achieved (Glasgow et al., 2019). The framework considers five dimensions of individual and setting level outcomes which may

have an impact on the outcome of a programme or intervention and how it can be sustained (Kwan et al., 2019):

1. Reach (the numbers and subsequent representativeness of those who take part in the intervention under focus)

2. Effectiveness (the extent to which the intervention has had an influence on key outcomes such as quality of life and economic outcomes)

3. Adoption (the numbers and subsequent representativeness of the settings and organisations in which the intervention has been adopted)

4. Implementation (the extent to which the intervention has been delivered as intended and associated time and costs)

5. Maintenance (the degree to which the intervention is sustained and becomes routine practice within a setting or organisation)

The RE-AIM framework has been widely used with a recent systematic review reporting on 157 articles where the framework has been incorporated into planning and evaluation efforts (D'Lima et al., 2022). However, there have been some reported challenges in using the framework, including difficulties differentiating between some of the dimensions and issues with reporting on all evaluation criteria (D'Lima et al., 2022).

3.1.2.5 Determinant frameworks

Determinant frameworks outline different types of determinants which can act as barriers or facilitators to the outcome of implementation efforts, with some frameworks looking at connections between different determinants. The main aim of these types of frameworks is to look into the reasons why implementation is successful or not, and factors which can impact upon the outcome. Determinant frameworks often point towards a systems approach to implementation as they recognise that there are multiple levels of influence and connections between different determinants. As with implementation theories, determinant frameworks are generally developed in two ways. Some were developed by cumulating results from several implementation studies or existing

frameworks or theories, while others were developed based upon the creators' own experiences. Some examples of determinant frameworks include Active Implementation Frameworks (Blase et al., 2012, Holmes et al., 2012), i-PARIHS (Integrated - Promoting Action on Research Implementation in Health Services) (Harvey and Kitson, 2016), PARIHS (Kitson et al., 1998, Rycroft-Malone, 2010), Ecological Framework (Durlak and DuPre, 2008), Conceptual Model (Greenhalgh et al., 2004), Understanding-User-Context Framework (Jacobson et al., 2003), Consolidated Framework for Implementation Research (CFIR) (Damschroder et al., 2009) and Theoretical Domains Framework (Michie et al., 2005).

Two different determinant frameworks were chosen to use within this research as it involves the adaptation and development of a new tool to sit within the existing DHSW home visit programme. It is also necessary for it to be suitable and acceptable for both DHSWs and parents so requires consideration across more than one level.

3.1.3 Theoretical Domains Framework

The Theoretical Domains Framework (TDF) (Michie et al., 2005) is an integrative framework which was designed to provide an overarching theoretical framework, incorporating constructs from several different theories (McGowan et al., 2020). It was created as a means to apply these theoretical approaches to interventions focussed on behaviour change. It aimed to simplify and bring together numerous behaviour change theories so that they can be used in many different areas of interest. The TDF was created through an expert consensus process which aimed to explore psychological and organisational theories related to health practitioner clinical behaviour change (Francis et al., 2012). It was developed by 18 psychological theorists, alongside 16 health service researchers and 30 health psychologists. The TDF draws upon 33 theories of behaviour change incorporated into 128 constructs relevant to health behaviour change, brought together to form a framework of 12 domains of theoretical constructs. These 12 domains are: Knowledge, Skills, Social/professional role and identity, Beliefs about capabilities, Beliefs about consequences, Motivation and goals, Memory, attention and decision processes, Environmental context and resources, Social influences, Emotion, Behavioural regulation and Nature of the behaviours.

A validation exercise was carried out on the original TDF by Cane et al (2012) using an independent group of behavioural experts, whereby they aimed to optimise the content and structure of the framework (Cane et al., 2012). This validation process resulted in an increase in the number of domains to 14 and retained 84 of the original constructs. The 14 constructs from the updated TDF are: Knowledge, Skills, Social/professional role and identity, Beliefs about capabilities, Optimism, Beliefs about consequences, Reinforcement, Intentions, Goals, Memory, attention and decision processes, Environmental context and resources, Social influences, Emotion and Behavioural regulation. Both the original version and the updated TDF are used in research and practice. It has been proposed that due to their similarity, either is suitable for use and can be chosen based on the researcher's familiarity or preference (Atkins et al., 2017). The TDF can be used both to carry out in-depth exploration into difficulties with implementation and to consider behaviours with the aim of planning and developing implementation interventions (Lynch et al., 2017). The TDF has frequently been used in studies which explore different aspects of behaviour change (Atkins et al., 2017, Francis et al., 2012). In particular, it has often been used to investigate barriers and facilitators to carrying out the behaviour of interest. Marshman et al (2016) used the TDF to guide analysis process of their qualitative research which explored the factors affecting parents' ability to carrying out toothbrushing for their child (Marshman et al., 2016). 27 semi-structured interviews were carried out with parents of children under 7 years old living in two deprived areas in England. The study reported a range of barriers and facilitators to parental supervised toothbrushing (PSB) across all the TDF domains and the authors reported that the use of the TDF resulted in the reporting of findings not seen in previous studies on PSB. The authors acknowledged that a limitation of the use of the TDF is that it can make the focus of interviews too narrow although they reported that this wasn't a concern for their study as all TDF domains were covered. There were findings from the interviews such as those regarding dental attendance which were outwith the scope of TDF domains, however the authors felt these were not relevant to the aims of the study. The authors concluded that the findings of this study would be used in the development of a behaviour change intervention aimed at encouraging PSB (Marshman et al., 2016).

While the TDF has often been used to explore determinants associated with behaviour change, it is less commonly used when developing and designing interventions (Cowdell and Dyson, 2019). In addition, there is a lack of guidance on how the TDF should be used to design interventions (Atkins et al., 2017, Francis et al., 2012). The TDF has been reported to be mainly focused on individual level determinants, with less focus on those at an organisational level (Atkins et al., 2017, French et al., 2012, Birken et al., 2017).

3.1.4 Consolidated Framework for Implementation Research

The Consolidated Framework for Implementation Research (CFIR) was developed as a means to aid the translation of evidence-based practices into real-world practices (Damschroder et al., 2009). The creation of the CFIR came about as the authors felt that there was considerable overlap between the many published implementation theories and that there were several missing important constructs. A snowball sampling method was used to identify 19 established, theories models and frameworks and constructs were combined across these. The CFIR is described as a meta-theoretical framework which provides a repository of constructs related to implementation which can be applied across several different contexts (Damschroder et al., 2009, Kirk et al., 2016). It is made up of 39 different constructs across 5 domains which can have an impact on the implementation of an intervention. The 5 CFIR domains are:

1: Intervention characteristics. This domain is made up of eight constructs and is concerned with the qualities of the intervention which can impact upon the implementation outcome. The constructs are: intervention source, evidence strength and quality, relative advantage, adaptability, trialability, complexity, design quality and packaging, and cost.

2: Outer setting. This domain is comprised of four constructs and considers the social, economic and political contexts in which the organisation sits. The constructs for this domain are: patient needs and resources, cosmopolitanism, peer pressure, and external policies and incentives.

3. Inner setting. This domain is made up of five constructs and is related to the characteristics of the organisation in which the intervention will be implemented. The constructs are: structural characteristics, networks and

communications, culture, implementation climate, and readiness for implementation.

4. Characteristics of individuals involved. This domain is comprised of five constructs and is concerned with the attitudes, perceptions and attributes of the people involved. The constructs for this domain are: knowledge and beliefs about the intervention, self-efficacy, individual stage of change, individual identification with organisation, and other personal attributes.

5. Implementation process. This domain is made up of four constructs and considers different stages involved in the process such as planning, application and evaluation. The constructs for this domain are: planning, engaging, executing, and reflecting and evaluating.

Figure 3-1 illustrates the CFIR domains and constructs.
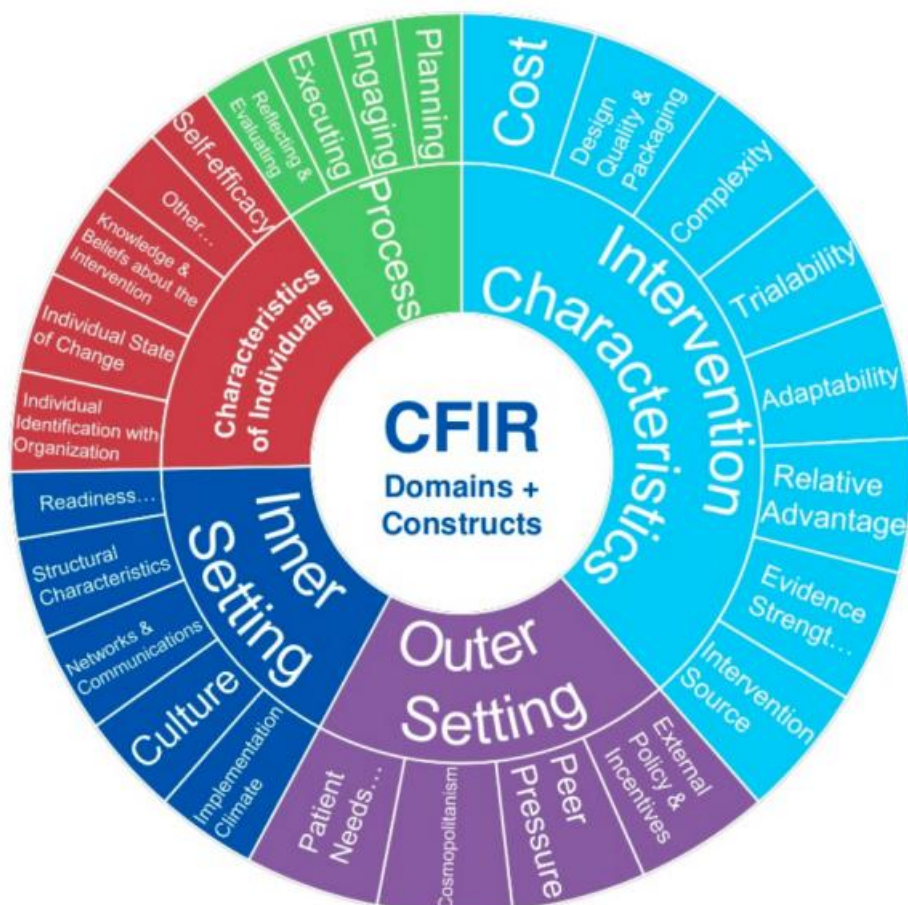

Figure 3-1 CFIR domains and constructs (*(Isomi Miake-Lye et al., 2017)*

The CFIR has been used in a number of studies across a range of settings (Kirk et al., 2016, Damschroder et al., 2022). Kirk et al (2016) undertook a systematic

review of studies which made use of the CFIR. The review aimed to investigate the types of studies the CFIR is used in, the ways in which the CFIR is utilised and how much the CFIR contributes to implementation research. A framework analysis approach was used to guide the abstraction and synthesis of the papers included in the review. The review considered 26 studies which the authors described as having used the CFIR in a meaningful way. It was found that these studies employed most commonly mixed (n=13) or qualitative (n=10) research methods and the CFIR was also most often used in the post-implementation phase (n=15). There was a wide range found in the ways in which the CFIR were applied and evaluated within the included studies although there was a lack of detail on how or why these constructs were selected. Most studies (53.8%) included used the CFIR as a means to aid data analysis. The review stated that there has so far been little evidence of the advancing contribution of CFIR to implementation science although the authors suggested that this was likely due to the fact that, at the time of review publication, the CFIR had only been published for six years. The authors concluded that further, future in-depth use of the CFIR, could lead to advancements in implementation science.

Additionally, the originators of the CFIR carried out a literature review (Damschroder et al., 2022) on the use of the CFIR and found it had been used across settings such as healthcare, public health, education and agriculture. They also found that the framework was used across several stages of the implementation process including to guide the data collection process, data analysis, data interpretation and to design an implementation strategy. The CFIR has been used by several authors to report barriers and facilitators to implementation in areas such as improvement of colorectal cancer screening (Lam et al., 2021), guidance to prevent falls in hospital (Breimaier et al., 2015) and policies to encourage healthy eating and physical activity (Lobczowska et al., 2022).

It has been reported that a limitation of the CFIR is that some of the constructs overlap and definitions described in such a way that it could be difficult to pinpoint which areas were most important to focus on (Jorgenson et al., 2022, Breimaier et al., 2015, Ilott et al., 2013). Additionally, some consider the framework to be too complex due to the number of constructs and domains

which may inhibit its utility (Safaeinili et al., 2020, Sorensen and Kosten, 2011). An updated version of the CFIR was published in 2022, with the authors acknowledging criticism regarding the reported complexity of the original tool and lack of guidance regarding monitoring and improving implementation outcomes (Damschroder et al., 2022).

Many implementation efforts combine the use of both the TDF and the CFIR (Birken et al., 2017). The reason for this is that the TDF is mainly concerned with constructs at the individual level while the CFIR is more so focused on organisational level constructs. A decision was therefore made, with regards to this research project, to use the TDF to map the individual level barriers, related to parental supervised toothbrushing, which were to be used within the adapted intervention to understand the range of barriers which are required to be addressed. The CFIR was then selected to be used to consider how the new intervention would be implemented by DHSWs in the home setting to assess which factors may have an impact on implementation.

3.2 Outline of studies

The following chapters will provide more detail on the methods for each study. However, a brief outline of each study is provided here. A project flow diagram is shown in Figure 3-2. In Study 1, a modified Delphi process led to the development of a set of barriers and associated behaviour change strategies to address these barriers, to be used in the new tool. In Study 2, DHSWs then further validated the barriers and strategies as being relevant and appropriate during qualitative interviews. In addition, DHSWs gave feedback on the most suitable format the new tool should take. A prototype toolkit was then designed and produced, co-produced with DHSWs for use in simulation testing. During Study 3, The STAR tool was tested with DHSWs and parents in a simulated environment.

Background
- Improvements in overall caries levels in children overall past several years but inequalities remain
- Childsmile nursery toothbrushing programme effective at reducing caries levels but many children experiencing decay before nursery age
- Targeted and tailored support provided by DHSWs required to address inequalities
- Existing tool to improve toothbrushing in families with young children requires adaptation to Scottish context

Overarching aim
To develop a home-based intervention, by adapting an existing practice-based tool ('Uitblinkers'), to optimise family toothbrushing behaviours for families-in-need in the early years in Scotland.

Study 1: Identifying barriers to parental supervised toothbrushing and strategies to address them for adapted tool (Chapter 4)
Modified-Delphi study to gain expert consensus on the key parental supervised toothbrushing barriers and appropriate psychological approaches to be included in new tool

Study 2: Development of the tool alongside DHSWs (Chapter 5)
Qualitative interviews with DHSWs to identify barriers and facilitators to effective implementation of new intervention. Co-design of new tool and associated resources alongside DHSWs

Study 3: Simulation testing of the tool to assess feasibility and acceptability (Chapter 6)
Design and deliver training on the new tool to DHSWs. Simulation testing of tool with DHSWs and parents and short term follow up with parents

Thesis synthesis Chapter 7

The STAR tool was designed to improve toothbrushing in the home setting in families with young children in Scotland. DHSWs will use the tool during home visits to provide tailored toothbrushing support to families who require additional input.
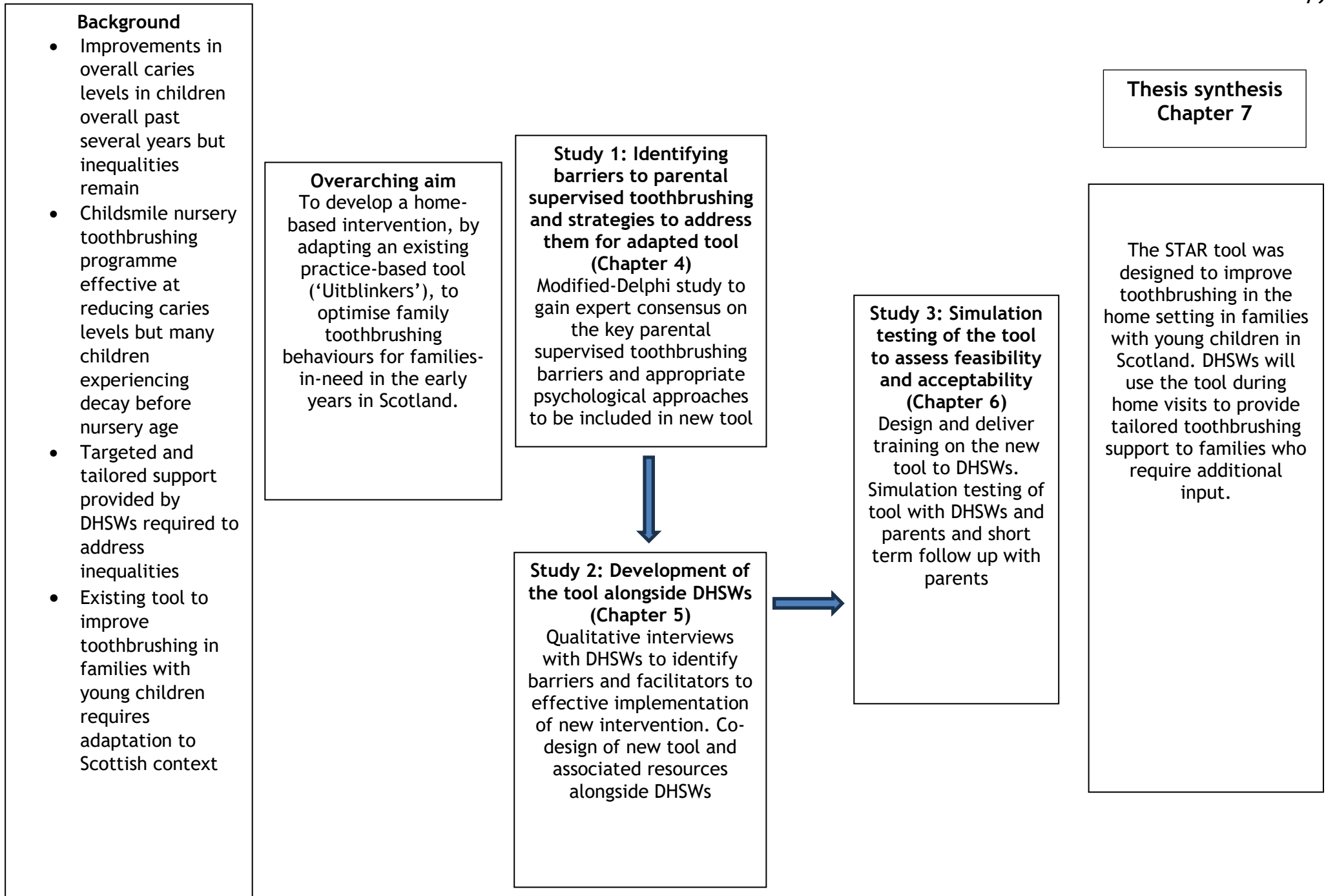
Figure 3-2: Project flow diagram

3.2.1 Study 1: Identifying barriers to parental supervised toothbrushing and strategies to address them for adapted tool

This study aimed to address the research objectives:

- Collate and present current state-of the-evidence on barriers that parents/carers face in the home when carrying out toothbrushing for their child.
- Recruit experts in the area of child home toothbrushing to form a Delphi panel.
- Organise and deliver online modified Delphi process.
- Gain expert consensus to prioritise the barriers with regards to level of importance to be addressed by new toothbrushing intervention through a modified Delphi process.
- Gain expert consensus on the behaviour change strategies, based on those utilised in the Uitblinkers intervention, which should be used to address the prioritised toothbrushing barriers to aid the development of a new toothbrushing intervention via a modified Delphi process.

An in-depth literature review using a detailed search strategy on peer-reviewed and grey literature informed a Delphi exercise that was underpinned by the Theoretical Domains Framework (see section: 3.1.3 Theoretical Domains Framework).

This process then led on to the development of an online modified Delphi exercise. This utilised an expert panel to prioritise the barriers to be included in the intervention and gain consensus on the model of delivery and appropriate strategies.

3.2.2 Study 2: Development of the tool alongside DHSWs

This study aimed to address the research objectives:
- Recruit DHSWs to take part in in-depth qualitative interviews.

- Identify the barriers and facilitators for effective implementation of the intervention via interviews with DHSWs.
- Design illustrated barrier cards for prototype intervention, alongside collaborating DHSWs.
- Develop the strategies and wording for each barrier card, alongside collaborating DHSWs

In order to test acceptability and factors affecting implementation, qualitative semi-structured interviews were carried out with Dental and Oral Health Support Workers with the CFIR being used to guide the analysis process. Following this process, new resources were developed, drawing upon the input and feedback from DHSWs throughout the design process.

3.2.3 Study 3: Simulation testing of the tool to assess feasibility and acceptability

This study aimed to address the objectives:

- Recruit parents and DHSWs to participate in a workshop to test the feasibility and acceptability of the new intervention.
- Develop training for DHSWs on the use of the new intervention.
- Deliver workshop wherein DHSWs can test out the new intervention with parents in a simulated setting.
- Gain insight and feedback on the use of the new intervention from DHSWs and parents.
- Follow up with parents via telephone interviews six weeks following the workshop, to see if they report any short-term benefits.

In order to address the objectives surrounding feasibility and acceptability of the tool, a workshop was carried out wherein testing of the new resources could be carried out in a simulated environment. DHSWs and parents/carers were both involved in this study to carry out a practice test of the revised tool 'as live' but in a protected environment to control for issues within the home visit such as interruptions or non-attendance. This process gained feedback from participants

and allowed for the refinement of the tool and recommendations to be made for a future pilot in the home setting.

3.3 Ethical considerations

The Delphi survey was approved by the University of Glasgow College of Medical, Veterinary and Life Sciences ethical committee (Project number MVLS200150076). For the subsequent stages of research involving DHSWs and parents, a decision on the type of ethical approval required was informed following discussion with a manager from the West of Scotland Research Ethics Service. It was advised that NHS ethics would be required, and an application was made using the Integrated Research Application System (IRAS).

The NHS Research Ethics Committee application form, along with the research protocol and supporting documents were submitted via the IRAS system (IRAS project ID: 290031)

Ethical approval was granted following some alterations to the application guided by the NHS Research Ethics Committee (REC reference: 21/WM/0066). A favourable ethical opinion on the research was granted by the West Midlands - Black Country Research Ethics Committee (Appendix 1). The role of current and future Covid restrictions had to be incorporated in to the application process with some aspects of the research being undertaken online where appropriate or possible.

3.3.1 General ethical considerations

All data which were collected was gathered, processed and stored in alignment with the University of Glasgow Community Oral Health department's data security protocol (Appendix 2) which is compliant with the UK General Data Protection Regulation (GDPR 2018).

Data were stored on the University of Glasgow's shared drive which can be accessed only by members of the research team, on university password protected computers.

Chapter 4   Identifying barriers to parental supervised toothbrushing and strategies to address them for adapted tool

4.1 Aim and research questions

This chapter aimed to explore what is currently known about the barriers that parents face when carrying out toothbrushing for their young children and gain expert consensus to prioritise the barriers with regards to level of importance to be addressed by the new toothbrushing intervention. In addition, expert consensus was gained on the behaviour change strategies which should be used to address the prioritised toothbrushing barriers, to aid the development of a new toothbrushing intervention.

The research questions addressed by this study are:

- What are the main barriers that parents/carers face in toothbrushing their children's teeth?
- Are the techniques and overall approach of the Uitblinkers intervention appropriate to address these barriers and within a home-support tool context?

The Uitblinkers intervention is a behaviour change intervention for parents to promote twice daily toothbrushing for their children and is delivered in a dental practice setting in the Netherlands. The methodology of the Uitblinkers intervention might also be suitable for Childsmile's DHSWs to provide support for targeted families in the home setting to improve supervised toothbrushing behaviours. This study was designed as a modified Delphi process to prioritise barriers and techniques for an adapted intervention so that it may meet the needs of the target population of parents of young children in need of additional toothbrushing support.

4.1 Background: Modified Delphi

There is no agreed objective way to assess the relative importance of the various barriers that present (alone, together, constantly or intermittently etc.) for toothbrushing behaviour. But it is possible to draw from literature and to obtain consensus, akin to guideline development, where direct evidence is lacking.

The study was designed as a modified Delphi process. This methodology was selected as a means to prioritise which barriers to parental supervised toothbrushing should be included in the new intervention. In addition, the modified Delphi approach was also used as a means to gain consensus on and validate the most appropriate strategies for use in the new intervention. As the intervention, based on the Uitblinkers intervention approach, is designed in a way in which each barrier is represented by an individual card, brought to a home visit by Dental Health Support Workers, the researchers felt that it would be important to have a practical number of barrier cards. It was therefore necessary to prioritise the most important barriers which should be included and addressed by the intervention. However, researchers were also aware of the need to not exclude any potentially significant barriers and consequently there was no set number of barriers which was aimed to be included. It has been proposed that the Delphi method may be appropriate where there are no precise analytical techniques which can be applied to the research issue but subjective judgements on a collective basis may be beneficial (McKenna, 1994, Linstone and Turoff, 1975).

The Delphi method is a structured method to gain opinions on a certain topic from a group of experts in order to gain consensus. It involves a series of rounds wherein the questions for each round are informed by the findings of the previous rounds which allows the study to evolve with each subsequent round (Barrett and Heale, 2020). The group responses can be fed back to the Delphi panel participants allowing them to reflect on the views of others and review their own responses. (Keeney et al., 2006). The Delphi method was developed to be used in business forecasting, whereby a collaborative discussion by an expert panel took place and worked on the basis that group ideas and decisions are more meaningful than individual ones.

One of the first uses of the Delphi methodology was in the 1950s by the United States Army during the Cold War (Dalkey and Helmer, 1963). It was developed by two research scientists who worked at the RAND Corporation. They created the technique as a means to forecast future enemy attacks by using a succession of in-depth questionnaires combined delivered to a group of experts including economists, systems analysts and electrical engineers, with controlled opinion feedback.

While the Delphi technique was first developed to predict the impact of technology on warfare (Trevelyan and Robinson, 2015), it is now widely used across of range of areas including healthcare research (Nasa et al., 2021). There are no set guidelines for how a Delphi study should be carried out but there four key elements included in the process: anonymity, iteration with controlled feedback, statistical aggregation of group response and expert input (Goodman, 1987).

The modified Delphi is broadly similar to the full Delphi in that they both follow a similar procedure by carrying out a sequence of rounds with expert participants and they both seek to gain consensus on a subject. However, a key difference is that the process of a modified Delphi begins with a set of previously selected items, while the opening round of a traditional Delphi is open-ended and may start by asking participants to generate their own list of items (Custer et al., 1999). The pre-determined items in a modified Delphi can come from a variety of sources including review of the literature, focus groups, guidelines and other preparatory work (Nasa et al., 2021, Custer et al., 1999, Boulkedid et al., 2011).

4.1.1 Panel members

The individuals who take part in the anonymous process of answering Delphi rounds are known as panellists and the selection of these panel members is a key part of the Delphi process (Green et al., 1999). Previously published Delphi studies use a range of methods to both identify and select panel members and

there are no standard criteria for who these panel members should be (Diamond et al., 2014).

4.1.2 Expert panel

A feature of Delphi studies is that they do not use a random sample which is representative of the target population but instead a group of 'experts' make up the panel members. In general, most Delphi panel members are obtained through purposive or convenience sampling (Taylor, 2020), although most studies don't have a uniform selection criteria (Nasa et al., 2021). There is also little guidance on who should be considered an expert although Jones and Hunter have suggested that participants "each must be justifiable as in some way 'expert' on the matter under discussion" (p.378) (Jones and Hunter, 1995). It has also been proposed that a statistically representative panel is not required, instead more importance is placed upon the qualities of the panel members rather than numbers (Powell, 2003). Heterogeneity of the panel can be a significant factor in generating reliable responses and having a diverse panel can allow for a wide-ranging perspective and a more generalised consensus (Boulkedid et al., 2011, Powell, 2003). Previous studies have used more than one relevant expert panel groups such as Cole et al who included both professionals and academics (Cole et al., 2013). They carried out a Delphi process which aimed to aid the development of a typology of social values of ecosystem services in coastal environments. They brought together an expert panel comprised of professionals from government, private industry and non-governmental organisations. In addition, the panel contained academics working in research and education related to the field of interest. The authors stated that the inclusion of both professionals and academics allows a balance to be sought between the different perspectives on 'knowledge' (Cole et al., 2013). Some studies also include those from varied academic and professional backgrounds and end-users in the Delphi process (Santaguida et al., 2018). On the other hand, having a more homogenous group may be useful in order to resolve issues in a more focused subject area (Nasa et al., 2021).

4.1.3 Size of panel

As with the definition of an expert panel member, there are also no standard rules or guidelines on how many individuals should make up the panel. The published literature on the ideal numbers which should be included also varies. Dalkey and Helmer found that reliability increased linearly between 3 and 11 participants and there was a continued growth in accuracy up to maximum tested group size of 29 (Dalkey and Helmer, 1963). Most Delphi studies have between 15 and 20 participants (Hsu and Sandford, 2007) although it has been suggested that 5 panellists would offer a sufficient level of control for chance agreement. However, it is possible for a panel as small as 3 to be used (Lynn, 1986). A systematic review of Delphi studies (Boulkedid et al., 2011) reported the minimum number of panel members to be 3, with a median panel size of 17 and the maximum was over 400 panellists. Delphi studies with a panel size of over 100 is uncommon, however, and can lead to issues regarding data management (Nasa et al., 2021), can be costly (Fink et al., 1984) and a large group may result in lower response rates (Fink et al., 1984, Hsu and Sandford, 2007).

4.1.4 Anonymity

A core aspect of the Delphi process is the anonymity of panel members whereby panellists do not know who the other panel members are and how they have individually responded. An advantage of an anonymous response over face to face or group discussion is that it can reduce issues regarding dominance of some members and group conformity. Participants may also feel more comfortable to comment anonymously on uncertain or controversial issues (Nasa et al., 2021). A potential drawback of having anonymous Delphi responses is that it is difficult to clarify interpretations or disagreements (von der Gracht, 2012).

4.1.5 Format of Delphi rounds

As previously stated, Round 1 of a traditional Delphi will begin with an open-ended statement to generate opinions, ideas and information which can then be used by researchers to formulate a survey for Round 2. Having such as wide

range of initial responses can, however, be difficult to manage (Taylor, 2020). The modified format of beginning with pre-selected items also allows for the gathering of additional elements, clarification of statements and removal of items which are considered irrelevant or unnecessary (Eubank et al., 2016, Cole et al., 2013). There is also a variation in the number of rounds a Delphi study may contain but the most common number of rounds found in an analysis of systematic reviews of Delphi studies was 2 or 3 rounds (Niederberger and Spranger, 2020).

In terms of evaluating the content and group responses, most Delphi studies use a Likert-type scale (Taylor, 2020). The Likert scale (Likert, 1932) was developed in 1932 to measure attitudes, often using a 5- point or 7- point ordinal scale which those responding can use to rate the extent with which they agree or disagree with a statement (Sullivan and Artino, 2013). With ordinal scales, it is possible for responses to be ranked or rated, however the distance between the ratings cannot be measured. Therefore, it cannot be assumed that the differences between responses are equidistant, despite numbers being assigned to the responses which are. While there has been disagreement on the inclusion of a midpoint (for example "Don't Know or "Neither Agree nor Disagree") on the Likert scale, it has been suggested that it may be appropriate to provide a midpoint option when participants are familiar with the topic, in order to present a neutral opinion (Chyung et al., 2017).

There is variation across published studies as to how to establish agreement amongst Delphi participants with a number of different methods being used to establish consensus. It was reported in a systematic review of Delphi studies, (Boulkedid et al., 2011) that one third of the reviewed studies used both median and percentage agreement to determine consensus. Other studies included in the review used median or percentage agreement individually, or interpercentile range as means to determine consensus.

4.2 Methods

4.2.1 Design

A two-round modified Delphi technique was used to gain consensus on the most appropriate barriers and strategies for delivery in the home setting with families who are receiving additional support from DHSWs.

4.2.2 Participants

Participants were selected to have research or practical experience in the area of child toothbrushing in the home setting. The expert panel included researchers and clinicians who have relevant publications regarding child toothbrushing and DHSWs working within the Childsmile programme who carry out home visits to families with young children. The involvement of different groups as participants has previously been suggested to ensure heterogeneity and provide a broader range of insights (Keeney et al., 2010).

Expert researchers and clinicians were identified from a review of the literature on child toothbrushing barriers and purposively selected (Palys, 2008) as being able to inform the aims of the study. A snowball method (Parker et al., 2019) was used by asking all those invited to take part for suggestions of colleagues with similar expertise who may be willing to take part. Email invitations were sent to 37 participants for Round 1 and 41 participants for Round 2.

4.2.3 Identifying the barriers to include for prioritisation

Several sources informed the content of the initial round of the Delphi survey. First, as is conventional for generating information for a Delphi study (Woodcock et al., 2020), a review of the existing literature was carried out to identify published barriers to parental supervised toothbrushing. The search strategy was adapted from a recent systematic review looking at home toothbrushing interventions for young children (Aliakbari et al., 2020). Databases used were PubMed, MEDLINE, Embase and Web of Science using the search terms including 'toothbrushing', 'children' and 'parent/carer' The search was carried out between July and August 2020. The search strategy is included in Appendix 3. Inclusion criteria were: reporting of parental identified barriers/challenges to

toothbrushing for their child aged 7 years or younger; and availability in English language. Seven years was chosen as the cut off age as UK guidance recommends that parents aid children with toothbrushing until this age (SDCEP, 2018, SIGN138, 2014). Studies were excluded if: there was no parental involvement; the setting was not in the home (e.g. school or nursery); they examined toothbrushing in children with disabilities (learning, physical, medical) which required long-term parental involvement in toothbrushing. A decision was made to exclude studies investigating toothbrushing in children with disabilities as it is a complex area and it was felt this would require more specialist input and further specific study in the future. The reference lists of identified articles were also checked by hand for relevant studies. In addition, a Google search was carried out to identify grey literature.

Identification of items for the initial Delphi survey also drew from the original nine barriers contained in the Uitblinkers intervention, and feedback following a preliminary workshop with Scottish dental teams and from focus carried out by regional Childsmile researchers with DHSWs and parents in 2019 (1.8 Early scoping work on Uitblinkers in Scotland). At the workshop and focus groups, participants were asked to identify factors which they considered as presenting a barrier to parents being able to carry out toothbrushing for their child. All identified barriers across these sources were collated with duplicates removed and then mapped against categories from the Theoretical Domains Framework (TDF) (Michie et al., 2005). The TDF was originally created for implementation research to identify influences on health professional behaviour in relation to implementation of evidence-based recommendations (Atkins et al., 2017). It is a determinant framework for ensuring coverage of potential barriers to identified health behaviours. The barriers identified from this process and mapping to TDF domains is shown in Appendix 4.

The final list of barriers was reviewed by the research team alongside a home toothbrushing advisory committee. The advisory committee members include: three DHSWs, an associate professor in Dental Public Health and paediatric dentist from ACTA who created the Uitblinkers intervention, and a psychologist and lecturer and a Professor of Dental Public Health both of whom are involved

in the development of recent interventions to improve home toothbrushing in children in deprived areas in England.

The behaviour change strategies incorporated into the Uitblinkers intervention were included in the second round of the Delphi to be rated by the expert panel with regards to the appropriateness of these techniques to address the list of barriers generated in the first round. Further, more specific behaviour change techniques relating to each barrier were developed at a later stage, outlined in Section 5.5.3.

4.2.4 Procedures

Potential participants were sent an invitation email from the PhD student which included a brief study outline, participant information sheet and privacy notice (Appendix 5). This included what participation would involve and the time period over which the study would take place. The email also included a link to take part in the online Delphi survey. The survey was designed using Microsoft Forms, a secure online platform, which allows the use of open-ended questions and single answer scale responses (Microsoft, 2024).

A reminder email was sent out 2 weeks following the initial invitation to those who had not yet completed the survey as is recommended in previous Delphi survey literature (Keeney et al., 2010, De Leeuw et al., 2012). The initial survey was open for 5 weeks before responses were aggregated.

The modified Delphi survey can be seen in Appendix 6.

4.2.4.1 Delphi Round 1a: Consensus on barriers

Round 1 of the modified Delphi survey used a structured questionnaire. The first section comprised of study information and a participant consent statement. In the following sections 13 barriers were presented to participants for consideration of prioritisation. These were categorised in to three areas: child, parent/carer and family environment related factors.

The barriers included in the initial survey round were:

Child related barriers

-       Difficult child behaviour/non-compliance
-       Child too tired/falling asleep
-       Child appears upset

Parent/carer related barriers

-       Parent/carer knowledge
-       Parent/carer capability
-       Parent/carer attitudes and motivation
-       Parent/carer self-care

Family environment related barriers

-       Time constraints
-       Social setting and influences
-       Structures and routines
-       Family resources
-       External input
-       Cultural barriers

Appendix 7 contains a description of each barrier as presented to participants of the Delphi survey.

Participants were asked to rate each barrier based on their level of agreement that the barrier should be included in the intervention. A five-point Likert scale was used with the anchors: 1 – Strongly Disagree, 2 – Disagree, 3 – Neither Agree nor Disagree, 4 – Agree, 5 – Strongly Agree. Open-ended questions were also included for each barrier category to allow participants the opportunity to comment on any barriers they felt were missing or provide other feedback.

Consensus was set a priori at 75% agreement of importance for inclusion where respondents selected either 4 – Agree or 5 – Strongly Agree. The selection of the consensus percentage is in keeping with previously published Delphi studies

(Keeney et al., 2006, Woodcock et al., 2020). In the case where barriers did not reach 75% agreement, they were presented to the expert panel in the next round for consideration of removal.

Anonymous rating data were exported from the online survey software into a Microsoft Excel spreadsheet. The percentage agreement and median were calculated for each statement. The median was chosen as it is appropriate for ordinal scales such as Likert (Murphy et al., 1998). Open ended responses were exported to a Microsoft Word document for content analysis. The first transcripts were read and re-read by the PhD student and supervisor, and following this, open coding was performed by labelling relevant text with a code. Codes were subsequently organized into themes.

4.2.4.2 Delphi Round 1b: Consensus on barriers

In the following round, a validation survey was sent to those who had completed the first round. This survey presented the barriers which had been highest rated in order of priority for inclusion from the previous round. Yes/No responses required participants to indicate whether they felt the barrier list was comprehensive and that barriers did not overlap too much. Each question was also followed up by a free-text option to allow participants to expand on their answers.

The lowest priority barriers from round one were presented and participants were asked to rate to what extent they agreed that these barriers should be excluded using a five-point Likert scale, with the same anchors as used in the previous round.

4.2.4.3 Delphi round 2a: Consensus on appropriate strategies and ideas to support implementation

The next round of the Delphi study aimed to gain participants' views on appropriate behaviour change techniques and ideas on the model of delivery of the intervention. These techniques were based on those included in the Uitblinkers intervention. This round widened the expert panel to include those from backgrounds other than child oral health but with experience of family health behaviours and interventions such as those pertaining to nutrition and

diet (Gillespie et al., 2020, Taveras et al., 2012) in order to gain a broader range of input.

After being introduced to the project and details of the proposed intervention, these participants (as well as the original oral health panel) were asked for level of agreement with regards to parents' receptiveness to overall approach, suitability of proposed behaviour change techniques and other considerations for delivery in the home setting. This was rated via a five-point Likert scale using the same anchors as in previous rounds (1 – Strongly Disagree, 2 – Disagree, 3 – Neither Agree nor Disagree, 4 – Agree, 5 – Strongly Agree).

The behaviour change techniques included in Round 2 were:

- Stimulus control
- Operant conditioning
- Goal setting
- Motivational interviewing

4.2.4.4 Delphi round 2b: Consensus on appropriate strategies and ideas to support implementation

A follow up validation survey was sent out to participants of round 2. Participants were presented with the results of the level of agreement from the previous round and were asked via yes/no questions whether they agreed that the overall approach and behaviour change techniques were appropriate to include in the intervention.

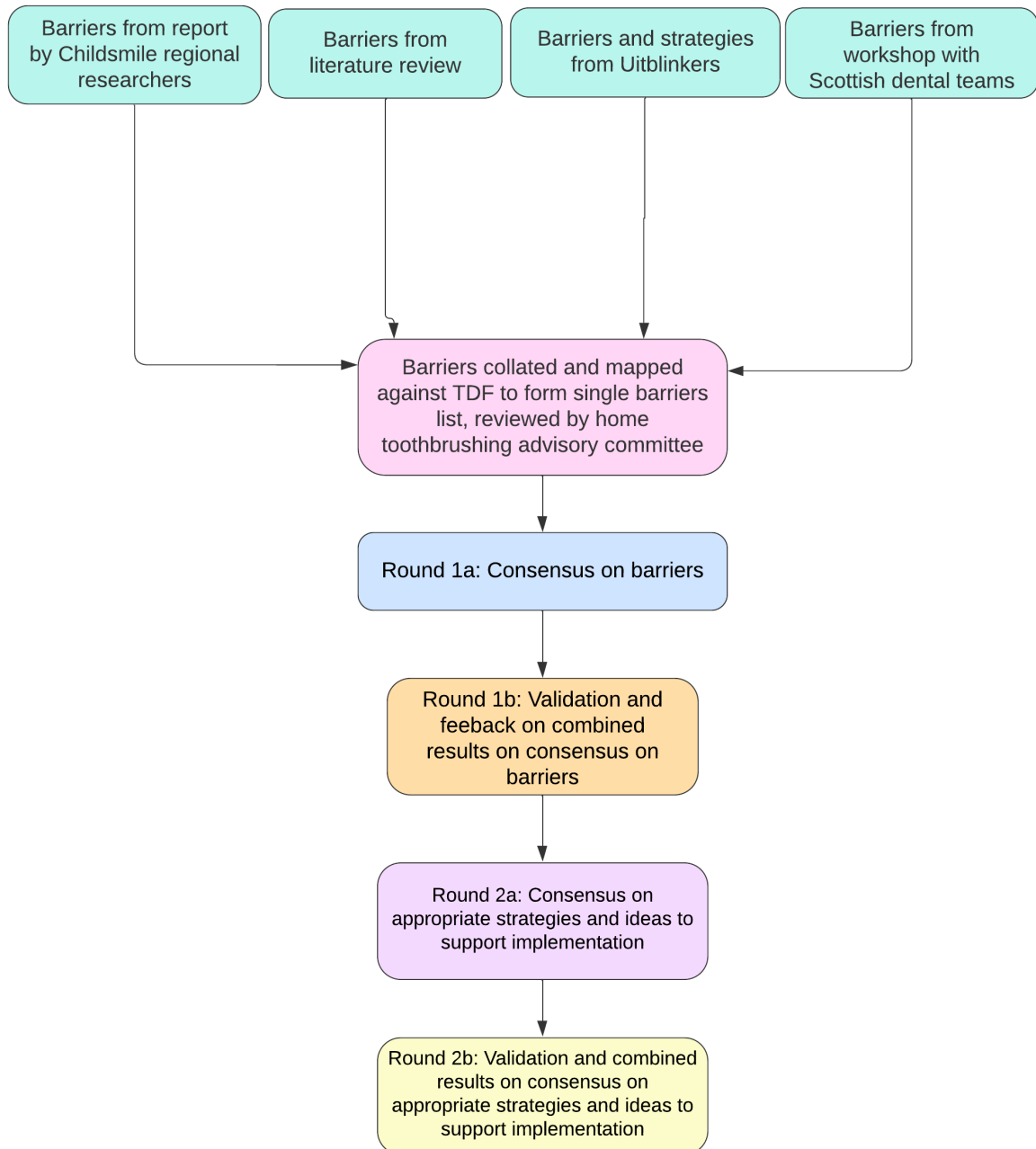A flow diagram outlining the modified Delphi process is shown in Figure 4-1.

Figure 4-1: Modified Delphi flow chart

4.3 Results

A total of 21 participants (response rate 57%) including Dental Public Health academics (n=8), psychologists (n=6), dentists (n=4) and DHSWs (n=3) completed the first round. A range of barriers across the child, parents and family/social related barriers were validated as being important for inclusion with 'Difficult child behaviour' and 'structures and routines' being indicated as having the highest level of priority.

4.3.1 Round 1: Consensus on barriers

The process identified 18 relevant papers from which toothbrushing barriers were extracted. The PRISMA flow diagram (Figure 4-2) shows an overview of the papers collected by the search terms.
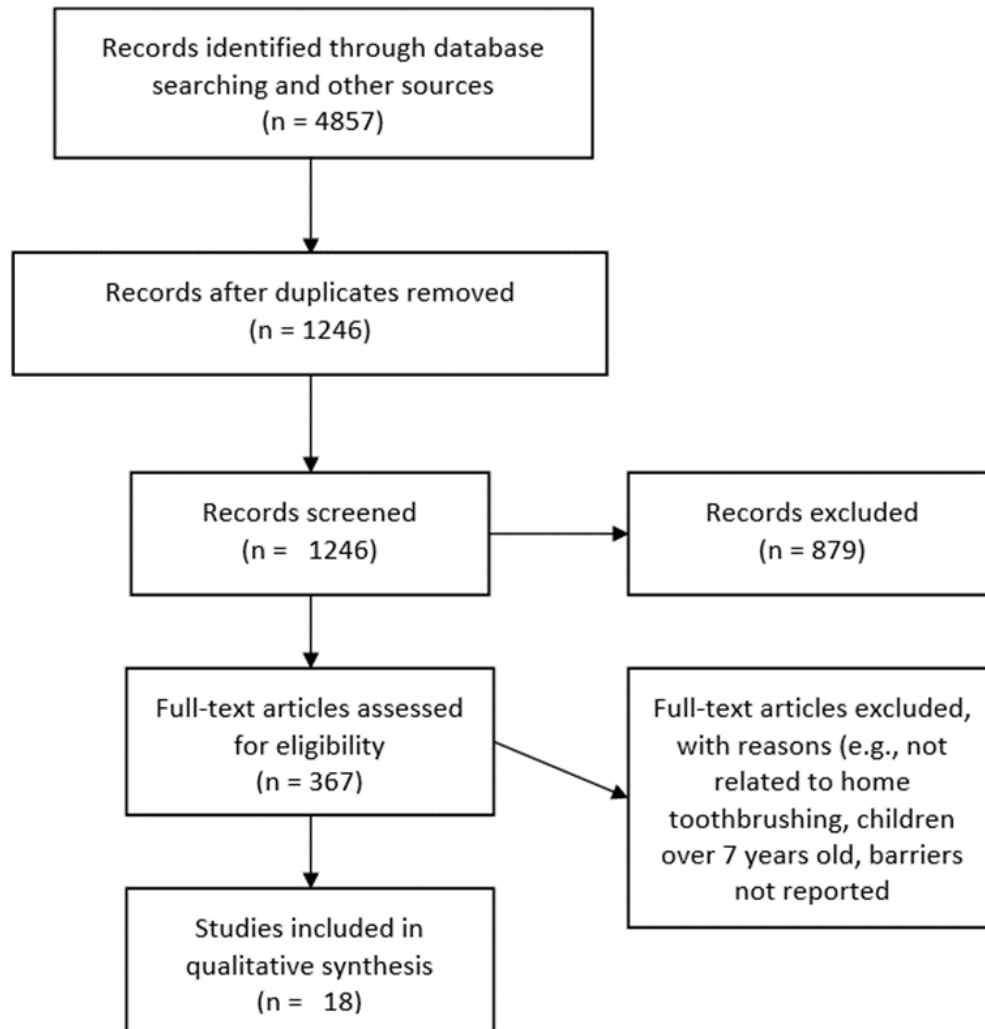

Figure 4-2: Literature search on home toothbrushing barriers PRISMA flow diagram

Following the rating of the presented 13 barriers, there were 3 barriers which did not meet the 75% level of consensus agreement. Table 4-1 presents each barrier by percentage of agreement for inclusion (rated 4 – Agree or 5 – Strongly Agree) and median and five number summary. A five number summary is an exploratory data analysis technique, used when examining one or more data set (Čižmešija, 2014). It contains a set of descriptive measures: median, minimum value, maximum value, first quartile (Q1) and third quartile (Q3).

Table 4-1: Results from Delphi Round 1a: "How much do you agree that each barrier is a priority for inclusion in the home-based toothbrushing intervention?"

Barrier	Percentage agreement (% respondents agreeing or strongly agreeing)	Median	Min	Max	Q1	Q3
Difficult child behaviour/non-compliance	100% (n=21)	5	4	5	5	5
Structures and routines	100% (n=21)	5	4	5	5	5
Parent/carer capability	95% (n=20)	5	3	5	5	5
Social setting and influences	95% (n=20)	5	3	5	4	5
Parent/carer attitudes and motivation	86% (n=18)	5	3	5	4	5
Time constraints	86% (n=18)	4	2	5	4	5
Cultural barriers	86% (n=18)	4	2	5	4	5
Child appears upset	81% (n=17)	4	2	5	4	5
Parent/carer self-care	81% (n=17)	4	2	5	4	5
Family resources	76% (n=16)	4	3	5	4	5
75% consensus cut-off						
External input	72% (n=15)	4	2	5	3	5
Child too tired/falling asleep	67% (n=14)	4	2	5	3	4
Parent/carer knowledge	62% (n=13)	4	2	5	3	5

Following discussion with the research team, it was proposed that the three barriers which fell below the 75% agreement percentage would be excluded: Child too tired/child falling asleep, Parent/carer knowledge and External input. Therefore 10 barriers were presented to participants in the next follow up round.

Eighteen participants (90%) completed the follow up validation round. Ninety-four percent (n=17) of participants agreed that the list formed a comprehensive

set of child home toothbrushing barriers faced by families who may be in need of additional support. Twenty-two percent of participants felt that there was a lot of overlap between the barriers on the list.

There was a lack of consensus amongst panel members that the three previously mentioned barriers (Child too tired/child falling asleep, Parent/carer knowledge and External input) should be excluded from the intervention. Table 4-2 shows the results from this round regarding percentage of participants agreeing that the presented barriers should be excluded from the intervention.

Table 4-2: Results from Delphi Round 1b: "To what extent do you agree that these barriers can be excluded from the list?"

Barrier	Percentage agreement for barrier exclusion (responding agree or strongly agree)
Child too tired/child falling asleep	33% (n=6)
Parent/carer knowledge	25% (n=5)
External input/confusing advice	56% (n=10)

In order to incorporate all significant barriers, following discussion with home toothbrushing advisory group members, a decision was made to combine barriers resulting in 'child tired' being combined with 'child upset', and 'parent knowledge' was combined with 'external input/confusing advice'. Subsequently, a set of 11 barriers (Table 4-3) was created to be brought forward for inclusion in the intervention.

Table 4-3: List of barriers prioritised for inclusion in intervention following Delphi Round 1

Prioritised barriers
1= Difficult child behaviour
1= Structures and routines
2= Parent/carer capability
2= Social setting and influences
5 Parent/carer attitudes or motivation
6 Time contraints
7 Parent/carer self-care
8 Cultural barriers
9 Child appears upset/child tired
10 Family resources
11 Parent/carer knowledge and complicated advice

Content analysis of free text responses resulted in 7 major themes. These themes were Prompt, Engagement, Common barriers, Tailored advice, Build rapport, Trust and Non-judgemental. A description of these themes can be seen in Table 4-4.

Table 4-4: Description of themes from free text responses from Delphi Round 1

Theme	Description
Barriers	
Prompt	Cards can act as a prompt for parents to discuss toothbrushing issues
Engagement	Parents may be encouraged to engage more by using cards
Common barriers	Cards may allow parents to realise they are not the only one having these issues
Tailored advice	Parents choosing a specific barrier allows them to be given tips relevant to their situation
Overall approach/method of delivery	
Build rapport	Opening the conversation by discussing positive behaviours can help build a positive relationship between DHSW and parent
Trust	Encouraging the parent to be involved in the process promotes trust in the DHSW by the parent
Non-judgemental	The overall approach allows toothbrushing issues to be approached in a non-judgemental way

4.3.2 Round 2: Consensus on appropriate strategies and ideas to support implementation

Twenty-one participants (response rate 51%) responded to the first Round 2 survey. Qualitative analysis of free text responses showed that respondents agreed that the format of opening the conversation with positive behaviours was

a useful approach although some felt there may first need to be a rapport established with the parent before the conversation can take place.

"I think it is good to establish a rapport first if possible by asking some general questions about non-oral health related topics, but I think it is good to ask about the positives first when talking about brushing as this will help to direct the conversation appropriately" Participant 3

Participants also liked the presentation of barriers to parents using a set of illustrated cards.

"Using cards would be a positive approach as it is sometimes difficult for people to engage when they feel they are answering a list of questions, but selecting from a set of cards would be more encouraging and less pressurised". Participant 10

All four behaviour change techniques which had been presented to participants were validated as being appropriate to use to tackle the barriers with a majority of participants responding either 'Agree' or 'Strongly Agree' to the following techniques: stimulus control (90% agreement), operant conditioning (86% agreement), goal setting (90% agreement) and motivational interviewing (81% agreement). Table 4-5 presents the level of agreement (participants responding 4 – Agree or 5 – Strongly Agree) on various aspects regarding delivery of the intervention in the home setting.

Table 4-5: Results from Round Delphi 2a: "How much do you agree with the following statements?"

Aspect of delivery	Percentage agreement (% respondents agreeing or strongly agreeing)	Median	Min	Max	Q1	Q3
'Support workers would need brief training in psychological theory to deliver the intervention'	95% (n=20)	4	3	5	4	5
'Online delivery such as via hand-held devices or tablets would be better than physical cards'	24% (n=5)	3	2	5	3	3
'This could realistically be delivered in the home setting'	95% (n=20)	4	3	5	4	5
'Resources/materials to leave with families (e.g. reminders, diaries) would help	100% (n=21)	4	4	5	4	5
'This could be delivered effectively remotely (e.g. video calls)	62% (n=13)	4	2	5	3	4

Participants agreed that training would be required to carry out the intervention, it could be delivered in the home setting and that the ability to leave reminder materials with families following the intervention would be useful. There was a lack of consensus on whether the intervention could be effectively delivered remotely and most disagreed that online delivery would be preferable to physical resources.

Seventeen participants (81% response rate) completed the Round 2 follow up validation survey. There was consensus among participants regarding the behaviour change techniques and approach which are appropriate to use in the intervention (Table 4-6).

Table 4-6: Results from Round 2b: "Are the following approaches/behaviour change techniques appropriate?"

Approach/behaviour change technique is appropriate?	Percentage agreement (responding yes)
Stimulus control	94% (n=16)
Operant conditioning	88% (n=15)
Goal setting	94% (n=16)
Motivational interviewing	82% (n=14)

4.4 Summary

In this study, the aim was to identify the most significant toothbrushing barriers that would be faced by parents/carers of young children deemed in need of targeted support and appropriate strategies to address these. The target population for the new tool in Scotland differed from that towards which the Uitblinkers intervention is aimed. In Scotland, the tool is designed to be used in the home setting with families who have been referred to a DHSW and who are in need of additional support. One key role of the DHSWs during these home visits is to help families register their child with a dentist. In contrast, the Uitblinkers tool is used in a general practice setting with families who bring their child to visit the dentist. In addition, the Uitblinkers intervention was designed to be used by families with children aged 2-10 years while the Scottish tool will be targeted towards the younger age group of 0-3 years. A younger target age group was chosen for the new intervention in Scotland due to the importance of establishing regular preventive behaviours to promote oral health at an early age.

There was therefore a need to study the barriers and techniques required for the Scottish context.

As the intervention is designed whereby each barrier is represented by an individual pictorial card, there was a need to balance exhaustiveness with practical considerations, hence to prioritise the set of barriers for inclusion, without excluding any barriers of importance. The modified Delphi process was implemented as a way to allow an expert group to prioritise barriers for inclusion and validate the overall approach and techniques used within the intervention.

Mapping of the barriers to the TDF domains, resulted in barriers being seen across all twelve domains. A systematic review by Aliakbari et al (2021) explored toothbrushing barriers and facilitators regarding parental toothbrushing of young children and identified barriers ranging across all twelve TDF domains, indicating that the Delphi process resulted in a wide level of coverage of barriers. All barriers from the original Uitblinkers intervention were incorporated. The proposed adapted intervention will be targeted towards a different population than Uitblinkers – families receiving additional home-based support from DHSWs in Scotland, compared with families attending dental practice in the Netherlands. As a result of the potential differing issues experienced by these different target groups, additional barriers were also included, particularly those regarding the family environment such as barriers regarding family resources and social setting and influences.

This appears to be the first study to use expert consensus to develop a concise set of toothbrushing barriers for parents of young children and appropriate strategies for use in a home-based toothbrushing intervention.

This study met its aims of identifying the main barriers that parents/carers face in implementing supervised toothbrushing, and appropriate strategies to address these, to be co-designed into a home-support tool.

The final set of barriers comprises a set of psycho-social and resource barriers which are appropriate for targeted support for a family population who may be having difficulty accessing dental services.

Further validation on the results of the modified Delphi study was gained via qualitative interviews with DHSWs which is detailed in Chapter 5.

Chapter 5   Development of the tool alongside DHSWs

5.1 Objectives and research questions

The objectives addressed by this study are:

1. Recruit DHSWs to take part in in-depth qualitative interviews.
2. Identify the barriers and facilitators for effective implementation of the intervention via interviews with DHSWs.
3. Design illustrated barrier cards for prototype intervention, alongside collaborating DHSWs.
4. Develop the strategies and wording for each barrier card, alongside collaborating DHSWs.

The research questions addressed by the study were:

- How can the resources from the Uitblinkers intervention be adapted to be suitable for the new context of use by DHSWs in the home setting?
- What are the main barriers and facilitators to effective implementation of a new home toothbrushing intervention, adapted from an existing intervention, from a DHSW perspective?

5.2 Background: design approach

5.2.1 Qualitative methods

A qualitative methodology was selected to answer the research questions for this study. Qualitative research has been described as "the systematic inquiry into social phenomena in natural settings" (p.669) (Teherani et al., 2015). While quantitative studies usually ask 'how many' or 'how much', qualitative research seeks answers to questions regarding the 'what', 'how' or 'why' of a phenomenon (Isaacs, 2014). Qualitative methods seek to explore experiences, behaviours and experiences from the viewpoint of the participant. This is often

achieved through small group discussions, interviews and analysis of documents and texts (Hammarberg et al., 2016). While quantitative methods have traditionally been used in health research, there is an increasing number of qualitative studies used, and seen as a necessity, in health care and public health research (Renjith et al., 2021, Stickley et al., 2022). Qualitative studies within public health can be used to investigate the factors which influence health and disease, explore interactions between stakeholders and examine how people and communities understand health and disease (Isaacs, 2014). A qualitative research methodology is viewed as appropriate when a new field of study is being investigated or when a researcher aims to determine and theorise key issues (Corbin and Strauss, 2008). Qualitative methods have also been said to score highly in terms of internal validity as they provide detailed descriptions of people's experiences and so can be seen to display an accurate representation of the phenomena under study (Pope et al., 2002). The new tool that is being developed is a complex intervention and thus what works, for whom, when, in what circumstances are important considerations (Skivington et al., 2021). The analysis of feasibility and acceptability is key to its development, and also to the wider Childsmile programme.

For these reasons, a qualitative approach was chosen as the most appropriate method, as the aim was to gain insight in to DHSWs' experiences and opinions on the intervention design and structure.

5.2.2 Semi-structured interviews

Interviews in qualitative research are "attempts to understand the world from the subjects' point of view, to unfold the meaning of peoples' experiences, to uncover their lived world prior to scientific explanations"(p.3) (Kvale, 1996). The interviews develop as the interviewee is asked questions by the researcher to collect information on a certain topic or experience. In qualitative research, the most common type of interview used is the semi-structured interview.

The overall purpose of semi-structured interviews as a data collection method is to gain information from key informants on the topic of interest. The interviews can be used to gather new, exploratory data connected to the research subject

area, triangulate data from other sources or to validate findings via member checking such as gain feedback from participants about research results (DeJonckheere and Vaughn, 2019). Semi-structured interviews are guided by a set of open ended questions along with follow-up questions and probes, and can be used flexibly. These types of interviews are most often cross-sectional and can be with either an individual or a group. The interviews follow an interview guide which allows the researcher to explore the subject with the participant in a more systematic and comprehensive way and also helps keep the interview stay relevant to the topic of interest (DiCicco-Bloom and Crabtree, 2006)

Semi-structured interviews were used as the method of data collection for this study to permit us to gain detailed responses from participants on the issues relevant to the research questions as well as allowing the flexibility to allow respondents to mention other related salient topics.

5.2.3 Sampling and recruitment

In order to answer the research questions, we aimed to recruit a purposeful, stratified sample of DHSWs who carried out home visits as part of their role. In addition, a sample was taken from four different health board areas across Scotland, with the purpose of trying to capture any variation seen between these areas. The health board areas were selected to give a range of views from DHSWs working in both urban and rural areas. In addition, in some health boards, DHSWs sit within, and are managed by the Public Health Nurse or Health Visiting team, while in others, DHSWs are based within the dental services team. Moreover, we wanted to speak to DHSWs with single or a dual role, meaning they carry out either a single or multiple aspects of the Childsmile programme as part of their role.

Purposive sampling is widely used within qualitative research. It involves the identification of individuals or groups who have particular knowledge or experience of a certain subject of interest. Purposive sampling considers participants as 'key informants' and selects them based on their ability to inform on the area or questions of interest (McGrath et al., 2019). In addition to this, another important factor is the availability and willingness of participants to take part and be able to communicate their points of view (Bernard, 2002,

Spradley, 1979). It has been suggested that the main objective of purposive sampling is to obtain a sample which could logically be assumed to be representative of a particular population (Lavrakas, 2008). This is usually achieved by the application of knowledge to the population to select in a non-random way, a sample of features that represents a cross-section of the population. Purposive sampling was used in this study to acquire a sample of DHSWs across four different health boards with different characteristics, whose role involves visiting families in the home setting.

Recruitment of DHSWs was facilitated by Childsmile regional health board co-ordinators. The health boards included were NHS Greater Glasgow and Clyde (GG&C), Tayside, Ayrshire and Arran and Highland. Co-ordinators disseminated details of the research study to DHSWs and the co-ordinator then passed on the contact details of those interested in taking part to the research team. Interested DHSWs were contacted to provide further details and a copy of the participant information sheet. It was aimed to interview 12 participants across the four health boards, or until data saturation had been achieved. A recent systematic review found that saturation in qualitative data was typically reached after between 9 and 17 interviews (Hennink and Kaiser, 2022). Data saturation refers to the stage in data collection when no new additional themes or insights are emerging and there is repetition in the data, such that further data collection is deemed redundant (Hennink et al., 2017). This indicates that a sufficient sample size has been reached. Saturation is an important factor in determining that a sample is sufficient enough to have captured the depth of the subject under study and can thus demonstrate content validity (Francis et al., 2010). Reaching data saturation has been described as a key component in qualitative research which helps make data collection robust and valid (O'Reilly and Parker, 2013).

5.2.3.1 Impact of COVID-19

Due to the Covid-19 pandemic, there were some limitations with recruitment of DHSWs as some had been re-deployed to other areas and so weren't currently working as a DHSW at the time. As a result of this, we were only able to recruit one DHSW from NHS Tayside as others were re-deployed or otherwise couldn't take part. However, over the course of the interviews, no new themes were

emerging and no differences between health boards were identified, therefore we were satisfied that data saturation had been reached.

As a result of Covid-19 travel restrictions and differing working from home policies between health boards at the time, only the interviews with DHSWs based in Greater Glasgow and Clyde were able to be carried out in person. The interviews with the DHSWs from the other three health boards took place online using Microsoft Teams.

5.2.4 Interview guide preparation

An interview guide was developed based on the research aims and questions. The questions were intended to be open and not leading. It has been stated that leading questions should be avoided as they can "give the interviewee hints about what would be a desirable or appropriate kind of answer" (p.353) (Patton, 2014). There are concerns that leading questions can therefore introduce bias and lead to doubts over the fidelity of the findings (Cairns-Lee et al., 2022). The potential influence on the research findings is important when considering the confirmability, which is concerned with providing evidence that the researcher's interpretations of participants' constructions are rooted in the participants' constructions and… the degree to which the results of the study are based on the research purpose and not altered due to researcher bias" (p.112) (Jensen and Given, 2008).

It was aimed that the interview guide could be used flexibly to permit variability in question order, in reaction to how DHSWs responded to questions or any other related topics they wished to discuss.

The interview guide can be found in Appendix 8. The interviews began by asking DHSWs to provide some information about themselves and their background and their role in providing oral health support to families as part of the Childsmile programme. This served the purpose of building rapport but also provided background information about each DHSWs' experience. DHSWs were asked about common child oral health issues that they see and what techniques or advice they currently recommend. The next set of questions focused on the introduction of the new proposed intervention and gathering DHSW insights and

feedback on this. The background and findings of the Delphi study (see Chapter 4) with regards to both the barriers list and overall model and behaviour change techniques were explained. DHSWs were given the opportunity to provide feedback on these and were asked how it matched their experiences during home visits. The penultimate set of questions aimed to gain DHSWs' feedback and ideas on the design of the cards themselves with regards to the style and images used and thoughts on various protype options presented to them. The final set of questions was concerned with the implementation of the tool and considerations regarding this. At the end of the interview, participants were given the opportunity to ask questions or bring up any topics not mentioned by the interviewer.

As previously mentioned, a section of the interview focused on obtaining DHSWs' opinions and feedback on the style and design of the images on the cards. In addition to showing DHSWs the original Uitblinkers cards, mock ups were designed of alternative prototype cards. The purpose of these was to show alternative options including cards with alternative illustration styles, real photographs as an alternative to illustrations and cards depicting both positive and negative imagery of the parent child toothbrushing process. For the in-person interviews, participants were shown a paper copy of these cards while the share-screen facility was used to display the cards during online reviews. Examples of these prototype cards can be found in Appendix 9.

5.2.5 Semi-structured interview process

Prior to the interviews, each DHSW had been emailed a copy of the participant information sheet and consent forms. Paper copies of these were brought to face-to-face interviews and written consent obtained. DHSWs taking part in online interviews emailed a signed copy of the consent form prior to the interview taking place. Participants were given the opportunity to ask questions before the recording started and were asked to confirm their permission for the recording to start.

All interviews were audio recorded using a digital recorder to allow for accurate transcription and to avoid the need for a large amount of note taking which

could result in distraction to replying to participants responses (Bryman, 2016). In addition, online interviews were also recorded using the Microsoft Teams recording facility to ensure the sound was more accurately picked up.

Interviews were arranged with 14 DHSWs who expressed interest in taking part. Two DHSWs were unable to take part and re-arrange their interviews, resulting in 12 interviews in total being undertaken. The face-to-face interviews took place in a private room in the health centre where each DHSW was based. The in-person interviews lasted between 58 and 134 minutes and the online interviews lasted between 59 and 86 minutes. The average duration of interviews was 80 minutes. Table 5.1 outlines the characteristics of the interview participants.

Table 5-1: Characteristics of interview participants

Participant ID	Health Board	Length of time as a DHSW	Interview format	Length of interview in minutes
1	GG&C	8 years	In person	112
2	GG&C	15 years	In person	82
3	GG&C	14 years	In person	134
4	GG&C	15 years	In person	80
5	GG&C	4 years	In person	58
6	Highland	13 years	Online (MS Teams)	86
7	Highland	10 years	Online (MS Teams)	73
8	Ayrshire and Arran	8 years	Online (MS Teams)	59
9	Ayrshire and Arran	10 years	Online (MS Teams)	81
10	Ayrshire and Arran	6 years	Online (MS Teams)	74
11	Highland	7 years	Online (MS Teams)	63
12	Tayside	10 years	Online (MS Teams)	59

5.2.6 "Prototype" barrier cards

During the course of the interviews, the participants were shown the Uitblinkers barriers cards and asked for their thoughts and opinions on these. In addition, alternative "prototype" barrier cards were also designed and shown to the

DHSWs (see Appendix 9). These cards were designed to show the DHSWs alternative options for ideas for how the Uitblinkers cards could be changed or adapted. For example, they featured examples of alternative illustration styles and also examples of cards which have photographs as opposed to illustrations and DHSWs were able to express their preference and opinions on these different styles.

5.3 Interview analysis

The audio recordings from each interview were transcribed into Microsoft Word documents. The PhD student carried out the majority (n=8) of the transcription in order to aid familiarisation with the data. Some interviews (n=4) were transcribed by a University of Glasgow approved transcription service. The interviews were transcribed verbatim in both cases. During the transcription process, anonymisation took place by replacing names with participant numbers.

5.3.1 Process

The framework analysis method (Ritchie and Spencer, 1994) is encompassed within a wide category of analysis methods frequently termed thematic analysis or qualitative content analysis (Gale et al., 2013). It was developed in the 1980s at the UK National Centre for Social Research (Ritchie et al., 2013) and has since become increasingly used within health services research. It was developed as a pragmatic way to approach real-life investigations (Ward et al., 2013). Framework analysis utilises both inductive and deductive methods. An abductive approach to analysis in that a 'middle ground' between inductive and deductive approach to coding is used. The abductive approach allows researchers to utilise existing theories and concepts (deductive analysis) and at the same time, derive new insights directly from the data itself (inductive analysis) (Vila-Henninger et al., 2022). It is developed to be a thorough and valid process which can produce results which can be clearly interpreted and easily implemented. The analysis process was guided by a framework adapted from the Consolidated Framework for Implementation Research (CFIR) (see section 3.1.4 Consolidated Framework for Implementation Research)

The analysis comprised of the following stages:

1. *Familiarisation with data*. Immersion in the data was achieved via transcription of most of the interviews and reading through each completed transcript.

2. *Identification of initial themes*. There was discussion on the general fit of the CFIR with the dataset and the specific content of each CFIR construct. The CFIR constructs were adapted to provide more relevance and context with the subject matter of the transcripts.

3. *Labelling the data*. Transcripts were uploaded to QSR International NVivo 12 and coding took place (see Appendix 10) to link each adapted CFIR construct to the section of data with which it related. There was further discussion on the boundaries and crossover between different constructs.

4. *Data sorted by theme*. Each coded data section was brought together and discussed.

5. *Data synthesis*. For each adapted CFIR construct, a thematic chart was created, containing data categorised under themes and sub-themes. There was further discussion between the PhD student and supervisory team and modification made where necessary to the charts.

The CFIR domains were used to guide the analysis process. Codes which emerged from the data were mapped on to the CFIR domains. These codes were then applied to the whole dataset and themes developed by exploring this coded data. A-priori themes were mapped under the related CFIR domains. The tool design is returned to in Section 5.5 but first there are a number of findings to relate in relation to context i.e. the setting for its eventual proposed implementation.

5.4 Reflexivity

Reflexivity in qualitative research refers to the researcher being aware of how they themselves may have an influence on the research and any possible impact

this may have on the study design, data collection or interpretation of findings (Ide and Beddoe, 2023). The PhD student who undertook the qualitative interviews with DHSWs and subsequent analysis is a qualified dentist. While carrying out the interviews, the interviewer introduced themselves as being a researcher and PhD student and did not specifically mention their dental background. It was hoped, therefore that this would minimise any potential impact the student's background would have on how participants would respond to questions, especially those regarding dental health. However, on some occasions participants asked about the student's background and were therefore made aware that the interviewer was also a dentist. It is possible in these cases, therefore, that participants may have responded to questions differently. In addition, the student's dental knowledge may have resulted in them asking different prompt and follow-up questions than if they otherwise had no dental background. Moreover, there may have been an influence on the analysis of the data given the student's experience of working in a dental setting. However, the data analysis was also discussed with and confirmed by a member of the supervisory team who is a qualified Psychologist which may balance any influence the student's dental background may have had.

5.5 Findings

5.5.1 CFIR Domain - Outer setting: Users/Families

The service users of the current DHSW home visit service and therefore the new toothbrushing tool are families with young children who have been referred to the service as they have been identified as requiring additional oral health support.

DHSWs provided context on the families who are supported by the home visit services, including some of the common issues experienced by families and issues DHSWs face while providing support.

5.5.1.1 Theme: Types of families seen

DHSWs provided details on the families they routinely encounter during home visits. They described how, despite the intent of an intervention targeted at families in need, they often see a wide range of families during home visits from different socioeconomic backgrounds and circumstances and who therefore have different support needs.

"It can range, usually it's really deprived families but it can really range to well off families as well. But the majority of the times it's families that are really needing that extra support" Participant 8, A&A

"Kind of a mix of people who already maybe had concerns or a mix of like new baby referrals as well" Participant 12, Tayside

"There's quite a big divide in terms of, you know, some people have got quite a lot of inequalities where some of them have got, you know, they've not really got financial issues" Participant 1, GG&C

"You get the 'yummy mummies', you get them and they'll keep you in the house forever and ask you all the questions. And then you've got the vulnerable […] So we get quite a lot of variety" Participant 6, Highland

While the families may come from a range of circumstances, most DHSWs described routinely seeing families from more disadvantaged backgrounds who may have more advanced needs.

"The families that I visit are mainly families where they're just above poverty or you know, they're on the poverty line" Participant 4 GG&C

"One mum couldn't get her money out of the bank and I was explaining to her how she could go about it or you get some people saying they're needing food and I explain to them to get in touch with the health visitors for vouchers" Participant 6, Highland

"Also families that have a lot of problems with alcohol. You know, drugs. You know, a lot of social work involvement with these families" Participant 2, GG&C

"Quite a lot of them would have the children on the Child protection register. And quite a lot of these are really deprived. You know it's really deprived housing estates. Poor wee children are quite deprived children. Some of the parents with addiction problems. Quite a lot of parents actually would have addiction problems" Participant 9, A&A

This theme suggests that there are several different needs experienced by parents when considering caring for their child's oral health, with varying levels of complexity. It is important therefore that consideration is given to the deeper, socioeconomic circumstances that may present a barrier to child oral health care when developing the new resources to address toothbrushing concerns and difficulties. The consideration around socioeconomic circumstances was not included amongst the barriers from the original Uitblinkers tool.

5.5.1.2 Theme: Oral health issues

There were many factors which impacted on a child's oral health and how parents approached oral health care.

5.5.1.2.1   Oral health not a priority

DHSWs explained the challenges they see when visiting families with regards to parents looking after their children's oral health. For some families, oral health was not a priority. There may be different reasons for oral health care not being a main concern within different families ranging from attitudes towards the importance of oral health, particularly looking after baby teeth and other issues taking precedence in their lives.

"I think a lot of the time, like not all the families, but a lot of the families, like oral health just hasn't been a priority in their life […] and they maybe don't see the baby teeth as important" Participant 12,Tayside

"And if the parents, it's not high on the priority list or they just can't be bothered, then kids aren't going to do it unfortunately" Participant 9, A&A

 "There are some families that maybe have got no interest in oral health […] there are other things in their life" Participant 6, Highland

Many DHSWs experience issues regarding parents/carers' lack of engagement. Often this was seen in the families who DHSWs feel most need support but parents refused additional support and therefore DHSWs were only able to provide limited levels of input regarding caring for their child's oral health.

"The ones who are really needing the help they say, no, just want registration and that's it. So, you're not getting there and that's where we end up in school educating the child because that's a baby we're going to see and if that mum doesn't take us onboard, that's why we're getting decay at age of three. So I just feel like we might say, we're failing going in there and doing it but really, we can only educate the mum as much as they'll take onboard. It's a hard one, isn't it?" Participant 6, Highland

5.5.1.2.2 Past experiences with oral health care

For other families, DHSWS explained how their approach to caring for their child's dental health was based on their own experiences as a child and they therefore do things the way their own parents did. For some families their experiences were based on their other, older children who have had problems with tooth decay in the past. Some parents may not be as concerned about decay in deciduous teeth as this is something that their older children have experienced and may be seen as inevitable. In other families, parents did not care for their own health and this attitude was then reflected towards their child's health.

"I'd say a lot of the parents, again because it's quite a deprived area, the parents are doing what their parents did. And I think a lot of it's lack of education on the parent's behalf" Participant 9, A&A

"It's difficult, the main thing is sort of a, it's like history repeating itself. It's sort of, go out to a family and you know nine times out of ten if you look on the system, there will be siblings that will have had issues before, maybe a GA. […] Maybe previous siblings have had decay in their teeth and they just look on it, just that it's just baby teeth and it's ok, it's not a huge big deal" Participant 10, A&A

"Like kind of cultural, you know, it's like, oh, it's okay, because he had his teeth out and she had her teeth out and it's more acceptable." Participant 1, GG&C

"Because usually they're not interested in looking after their own health. So, you know it's a knock-on effect. If you have a parent that's interested in your wellbeing and their own wellbeing, you know, they pass on these skills" Participant 7, Highland

5.5.1.2.3 Child behaviour

Child behavioural issues with regards to refusal to allow their teeth to be brushed was a common issue for many families seen by DHSWs. This theme is as mapped during the development of the barriers list and also included in the

original Uitblinkers tool. This would often lead to a child's teeth not being brushed as parents may not be able to persevere with this process if they are struggling due to time constraints.

"I mean it was not wanting to brush, simply kids not wanting to brush is a thing" Participant 10 A&A

"It's probably not brushing [...] if it's a child not keen on doing it, parents probably give up because they've maybe not got or they feel they don't have the time to spend" Participant 11, Highland

"For the parents, you know, most of the time it's the child not letting them brush their teeth" Participant 2, GG&C

5.5.2 CFIR Domain - Intervention characteristics

5.5.2.1 Theme: Views on overall approach

DHSWs provided feedback and thoughts on the overall approach the new tool will take. DHSWs were overall positive about the general approach of the new intervention, which begins by first asking about what is going well with toothbrushing. DHSWs felt it was a useful way to facilitate a conversation with parents/carers and address any issues they may be having with carrying out toothbrushing for their children.

DHSWs agree with using a non-judgemental manner to approach the topic of toothbrushing with parents and this fits with their current approach.

"Never go in like that. Do you know what I mean? You'll never win somebody's confidence over speaking to them like that [...] I always think support work is more for in the team and the professional side of it rather than the parent because I think we're here to help but not judge and that as well" Participant 6, Highland

"You can't just go in and point the finger at people, do you know, that doesn't work here" Participant 5, GG&C

DHSWs like the idea of opening the conversation with what is going well before moving on to finding out what problems there are.

"I like that starting off with what's going well with it [...] it's something that the parents are going to feel good about that they can mention, even if it's only one thing" Participant 3, GG&C

"I always go in with a positive thinking of like I would say, when I had my children, I would have toothbrushed twice a day and what bad habits I did and I didn't know this and rectify it. So it's always kind of, you know, like from a personal side without being personal, you know that way where I'm saying, I'm human too and so are you, we all make mistakes but let's make good ones now, you know. So, yes, definitely a positive side of it" Participant 6, Highland

DHSWs felt that most parents/carers would overall have a positive response to the use of the tool. However, some thought that the reaction would vary between different families with some perhaps not engaging as fully.

"That's a hit or a miss because if it's a yummy mummy you're going to get the, oh, yes, oh, yes. So a lot of people tend to, well, I just want my kid registered in a dentist near here, thanks for the pack and, you know. You can win them over but we don't always have the resources to keep going back all the time, you know" Participant 6, Highland

For some DHSWs, this approach was similar to their current practice while others felt this added more depth to the interaction than they would normally have.

"I think that's something that we kind of try to do anyway. To say, how are you getting on with the toothbrushing. Kind of try and engage them. Like you say you don't want to go in with saying you're doing everything wrong" Participant 12, Tayside

"I think what you're explaining's generally how you would conduct your visit anyway, and you'd be looking for them to lead the conversation and kind of keeping them on track in terms of what the end goal was, you know, kind of directing them." Participant 1, GG&C

5.5.2.2 Theme: Views on barriers list

Participants explained that the list of barriers presented matched their experience of what issues they see families face when they carry out home visits and encompassed the most common barriers they come across:

"I don't think there's anything within there that didn't seem to fit in with what could potentially be causes of parents not […] sort of following through with advice given" Participant 3, GG&C

"I think all very true. All of them. We've touched on most of them, really, just chatting, yes you know what the barriers are. We know what they are and just, I suppose it's tailoring it for each family because every family's individual, the child's individual as well, isn't it?" Participant 7, Highland

However, some mentioned an additional barrier may be faced by parents of children with additional needs.

"Every one of them yeah, I've come across every one of them […] What I find particularly difficult is there seems to be quite a few families now where their child is on the autistic spectrum […] ordinarily you would maybe get a child who refuses to brush their teeth but you know, that's transitory they'll eventually come out. Whereas autism is an ongoing thing" Participant 4, GG&C

A further additional barrier mentioned by DHSWs included a lack of engagement by some families with services.

"I think your list, apart from the fact, you know, like I'm saying there, you've got to get the commitment, the engagement, that's the only thing" Participant 6, Highland

"Families that don't engage, you know, and like I've…in fact, this week I got one, I remember how she never engaged with her older child, couldn't get in. The health visitor tried like to get…like to let me get in, but she wasn't engaging." Participant 2, GG&C

5.5.2.3 Theme: Views on strategies to address barriers

DHSWs felt the strategies would be useful for parents and provide relevant advice. Again, many participants thought that these techniques matched those which they currently use with parents. The overall approach was also thought to provide more structure to the advice that DHSWs currently give.

"I found them really helpful. I would imagine any parent would as well you know, especially if they're struggling. And most of the time parents will take advice and suggestions, maybe not so much advice but suggestions to say look, you say it and if you bite off a small chunk, that's manageable" Participant 4, GG&C

"I really like it because, although we would be there to guide and support, but I really like the idea that it's actually the parent, themselves, that are coming up with what's going to suit them, or what they want to try [..] And not that it just seems good, it's achievable, it's workable" Participant 3, GG&C

"I think they're pretty much in line with what you would…other than the kind of pictorial side of it, I think it's…it is the kind of same strategies that you would try and talk through, maybe not picked out in so much depth or revisiting it with the families, and keeping at it, but it is like the kind of…the grounds of what you would be doing" Participant 1, GG&C

"I think it is good because, you know, when we do have a health visitor it'll task us because there's problems, we've got something, you know, like we were giving them advice, but this is more like structure, you know" Participant 2, GG&C

Some also thought that while the strategies may be helpful, there may still be issues regarding engagement with some families, particularly those families who may need the most support.

"I think it sounds good. I think it's hard because I don't know, will the people that change be the people that you're wanting to get to change" Participant 12, Tayside

Despite the fact that many DHSWs do not currently routinely carry out follow up visits, the importance of a follow up was acknowledged as being vital as part of the process of using the new intervention.

"We, you know, we give them the tools and then, yes, of course you would have to follow it up. You know, that would be something, yes, it's a package, isn't it? And then you follow it up hopefully until like the parent, you know, manages to get to work with the child, you know." Participant 2, GG&C

5.5.2.4 Views on card design

DHSWs felt that cards would be useful for speaking with parents although they felt they would need to learn the tips on the back of the cards and find the best way to use them for particular families.

"It's like engaging in the house of how much you are going to get across to them too because, kind of simplify things, you know, sort of go down to the level of the person, that we're all the same and this is how we do it, sort of thing. So it's learning what's on the back of that card and what's there" Participant 6, Highland

DHSWs liked the concept of using the cards as a visual aid and the use of pictures would be useful to aid the conversation.

"I quite like all the different colours from obviously…from like a kind of ASN point of view, so for people to read the picture and the writing and all…you know, how obviously it's not black and white, you know, different things." Participant 1, GG&C

There was a range of opinions on preferences regarding whether the cards should feature illustrations or photographs to represent the barriers.

DHSWs preferred the cards to be kept at A5 size as that is the size of the current folder of resources they have at the moment so cards of that size would best fit in with that.

DHSWs also expressed a preference for barrier cards to be in a physical format rather than on, for example, shown to parents on a tablet. They had concerns over a tablet potentially getting damaged during a home visit and having to keep the tablet fully charged which may be difficult if they are away from their office on visits.

There was also a mix of opinions regarding the practicality of the number of barrier cards. Most DHSWs thought having eleven cards wouldn't be an issue for themselves or parents. Some however, felt this may be too many to display but stated they may choose instead to bring out only some cards at a time depending on the issues the parents were having.

"That [number of cards] wouldn't be a problem because, you know, you might find out what the problem is before you even pull out the cards so you'd maybe just pull out the card, you know, that you would need" Participant 2, GG&C

5.5.2.5 Parent response to use of intervention

DHSWs thought parents would generally respond positively to the use of the new tool and felt it would be beneficial to them. The use of the cards may make it easier for parents to discuss toothbrushing, especially if they may have otherwise found it difficult to explain.

"Sometimes it can be hard to find the words to say what's really the issue. So, if there's something like that there, that the parents can look at and just pick up and say, this is it, then you can start the conversation with them, to open things up, rather than them having to sort of find the words. For a lot of families, it might not be an issue, but for some, you know, explaining what the problem is, could be" Participant 3, GG&C

"I think you could probably maybe get a bit more buy in from parents in terms of it just being a general conversation. They might see a bit more from the cards that they've maybe not really thought about it" Participant 1, GG&C

Use of the cards and discussion of barriers also led to a discussion of other issues the parent or family may be having beyond toothbrushing.

"That could open the door to, a mum might sort of disclose something that's maybe on her mind heavily, that's sort of preventing her from, not just the toothbrushing, but it could be other things that she's struggling with, because of the preoccupation with another issue. So it might open the door to certain things – good or bad, I don't know. Probably good because, you know, even if it's just to get something off your chest for two minutes to somebody, you know." Participant 3, GG&C

The use of the cards may also be of benefit for use with parents where English is not their first language or are not fluent in English.

"I think she would really benefit and really enjoy that, and especially the fact that she could see the pictures. She does have English, but it's not as fluent as you would maybe…I mean, she can understand, you don't need an interpreter, but I think things like that, and you know, like demonstrating kind of structure and routine and, you know, she would really thrive in that kind of…with that input." Participant 1, GG&C

"And certainly, for parents where language might be an issue, if we've not got this text translated, if we have a visual picture of a realistic, you know, sort of scene in the life of a parent, then they'll be able to look at the picture and say, yes that's what's happening" Participant 3, GG&C

5.5.3 CFIR Domain - Inner setting

The inner setting refers to the setting in which the intervention will be implemented and current practices and procedures within it.

5.5.3.1 Theme: Current approach taken by DHSWs

Each DHSW currently has their own approach to tackling the dental health issues experienced by the families they visit. Most provide information about the importance of diet and toothbrushing and several DHSWs carry out a toothbrushing demonstration, often with the aid of a model. They also provide advice about diet and weaning.

"So when I'm in home visits, I would always talk about toothbrushing and always just explain to them about the dry brushing and pea sized amount of toothpaste. I would usually have a wee set of teeth that I bring and do a demonstration as well for the parents with the teeth" Participant 9, A&A

"My main thing is about trying to educate them about not aiming for sugar […] and then the toothbrushing side of it, I'll go into that and encourage them what best toothpaste to use and what size of toothbrush and that" Participant 6, Highland

Follow up contact with families is variable among DHSWs with some following up with families a few months after the initial visit to check if the family has registered their child with a dentist.

"We normally follow back up, so we go out...we would normally go out between 12 and 26 weeks for the first appointment, and then we'd follow back up after the 13 month...the one year, so between 13 and 15 months, to make sure they're registered and that they've followed it through." Participant 1, GG&C

For some, follow ups were more common previously but they stopped as they felt it was too much contact for the family. The lack of follow up visits means that DHSWs are unaware if the advice they give to families is being followed or is beneficial to them.

"We don't know [if advice is working] because we don't follow them. Yes, we do catch up. When Childsmile first started, we were supposed to meet them every three months. So say I met a baby at six-to-eight-week stage, I would follow that baby until they were three every six months and it was the point where it

didn't work because it was repetitive and we were kind of sort of like hounding the family" Participant 6, Highland

"I don't really have any feedback on it. Well, the only feedback, I would say, is if they don't come back, then I'm assuming that it has worked" Participant 1, GG&C

It was felt that having a way of following up with families to check how they have been managing with advice would be an improvement to DHSW's current practice.

"I suppose that's maybe another area that we could maybe keep on top of, to find out what actually happens in terms of closing the loop, like did it make a difference, was it effective?" Participant 1, GG&C

"I just feel there's definitely a need, somehow, for a follow-up of some kind of for all the families, even if it's a phone call, you know. Something for all of the families that we've visited, you know, a wee popup that might come up on our system to say, you visited this child a year ago, you know, they're due their follow-up phone call, or something like that" Participant 3, GG&C

The variation in whether a follow up visit or phone call with a family takes place may come down to the individual DHSW and their interest in the family. Some feel that delivering the required advice at the initial visit is sufficient and that is all that is required to be done and it would take too much time to carry out follow up visits on top of this.

"I personally do keep in touch with a lot of my families but some other dental health support workers do not. They'll go out and do a home visit and that's it, shut down, they've done what they need to do and they move on. And I'm quite the opposite. I like to know that, I care about the kids like I really do […] I can see other people going 'not happening'. That's being honest. Me, I wouldn't at all but I go see other people saying no I'm not doing it because we've got enough to do without chasing them up to see what they're achieving." Participant 9, A&A

Follow up is an important feature of the original Uitblinkers tool and is also incorporated into the new tool being designed for the Scottish context. Additionally, follow up is also a key component of motivational interviewing, elements of which the new intervention being developed is based upon. Therefore, careful consideration of how the follow up feature of the new intervention can be incorporated into DHSWs' current and future practice, is required.

5.5.3.2 Theme: Sources of referral

Families can be referred to DHSWs from different sources, most commonly health visitors but also from dentists or family nurses.

"I get referrals […] mostly from the health visitors and we do get referrals from a dentist if they think a family, you know, like scenario of toothbrushing or their hygiene is not as good in that respect […] We get a lot of family nurse partnership" Participant 6, Highland

DHSWs are not usually provided with much information on a family regarding oral health concerns from the referral from the health visitor.

"Normally what you do is you would get your referral in and the health visitor will write a wee bit at the bottom, so it'll maybe say, premature, born at 34 plus weeks, or on the child protection register, or had a chat with you about this one, and that's really all you get, or routine Child Smile, just things like that, there's no…other than me reading the postcode" Participant 1, GG&C

Many DHSWs only visit a family when the child is very young, often around three months old and therefore toothbrushing has not yet started. This would therefore mean that the use of the toothbrushing intervention would not be suitable on these particular visits, for these families at that time. They may only revisit the family at a later stage if the family has another baby and then there may be an opportunity to ask about the older child. In some areas, a child may be seen when they are slightly older if they have recently moved to the area. In addition, in certain areas in Glasgow, all babies receive a DHSW home visit unless the parent chooses to opt out.

"The visits that we do, the baby's only three months. To ask what's going well, like toothbrushing, it's a bit…you can't really ask that. We do visit the family again maybe with another baby and maybe we could say that with the older child" Participant 2 GG&C

"When we go to visit the babies, a lot of them don't have any teeth in yet. So, it's all kind of theoretical, if you know what I mean?" Participant 3, GG&C

5.5.4 CFIR Domain - Process: Implementation

5.5.4.1 Practicality in home setting: time and space

The space it may require while visiting a family's home, to use the cards, for example laying them out, didn't appear to be a concern for most DHSWs. This, however, could vary between different homes with the ability to display the cards being more practical in some home than others.

"Obviously in terms of space in a home visit, it changes up, like if the family have got a dog or it's a really messy house or it's chaotic or, you know, there's lots of things going on, then you've maybe not got access to be able…like this, to be able to lay things out, and I think holding them as like a pack might not be as effective." Participant 1, GG&C

"I think maybe probably space in terms of the home visit, what's going on, obviously in a surgery it's much easier to lay things out and get that kind of engagement and cooperation, but I think I would manage, I would find a space. I would just sit on the floor, I'm quite open to just making myself at home and, you know, taking it as I go, it's…I think sometimes, you know, like people don't always have couches, and sometimes you've got to sit on the floor anyway." Participant 1, GG&C

To increase the practicality of using and transporting the set of cards, it was thought it would be beneficial to have means of keeping the cards together and also for them to be laminated to be able to keep them clean after home visits.

"I think there needs to be an option of clipping them in, so that they don't get lost, or whatever, and laminated even, so that they're kept in good nick, if you

know what I mean. Because it's so easy, if you're taking these out two, three, four times a day, eventually, especially if there's toddlers in the house, they come over and grab it or whatever" Participant 3, GG&C

DHSWs are able to control and manage their own diaries so the additional time it may require to carry out the intervention was not something the DHSW thought would cause difficulties.

"I think time's okay, because we manage our own diary" Participant 1, GG&C

"If you know that you're going with these then and maybe take a bit longer you would, you know, leave that time for that family, you know, because we manage our own diaries" Participant 2, GG&C

5.5.4.2 Training

Some DHSWs have previously had training in motivational interviewing and the behaviour change process.

Currently, DHSWs are also able to choose which training course they are interested in and wish to attend.

"It's really just as and when you book them on, depending on what you want to do and how often [...] so you get, you know, pick and choose what you want to do." Participant 1, GG&C

In terms of the type of training which may be useful before carrying out the new intervention, the incorporation of roleplay was suggested as a potentially helpful method.

"I think it's a good way to learn, you know, like…I mean, just having feedback [...] I think that would be beneficial, and just to familiarise yourself with the cards and, you know, the options and the background to become a bit more kind of fluent, if you like." Participant 1, GG&C

While many DHSWs may currently already use or be aware of some of the techniques from the new intervention, it was felt that having scenario based

training would still be beneficial for raising awareness of how it may be used in different situations.

"Someone comes out and talks to us about it and maybe do scenarios. You know, you're the parent. You're, you know, and…because usually that's how we did most of our training because we were going to do one to one talks, you know, so, yes, a one-off training because it's things mostly that we already know but maybe how to, you know, adapt it" Participant 2, GG&C

5.5.5 CFIR Domain - Characteristics of individuals: DHSWs

All the DHSWs who participated were experienced at carrying out home visits and felt confident in using the new resources and intervention style and techniques.

"I'd feel quite confident, yeah, I think it's…yeah, I think that would be fine, I would be quite happy to follow up with a phone call or provide…pull them out at a visit and talk to them and kind of cover the strategies and support parents." Participant 1, GG&C

"I think, this is something new for us and I think it is good […] I think this would help us a lot. It will help us to help the families" Participant 2, GG&C

DHSWs also felt they would be able to use their own judgement to gauge when and for which families it would be suitable to use the new tool. Past experiences with a family or if the family were referred due to having certain issues, may also influence a DHSW's decision on whether to use the intervention or not.

"So probably maybe ones that have got older siblings that have had problems in the past or that…parents that have been brought to me due to, you know, they're struggling or routines or different things that you would…I think…I don't really know how you would go about that […] I'd probably decide while I was there on a visit, you know" Participant 1, GG&C

5.6 Designing the tool

This section will describe the process whereby the design for the cards was developed and details how and why changes were made to card illustrations. In addition, there is a detailed description of the process in how the cards have been designed to be used by DHSWs with families.

5.6.1 DHSW involvement in design

DHSWs were involved in the design of the new tool, based on elements from User Involvement. User involvement in research involves the close collaboration between those who make use of a particular service or process and researchers during different stages of the research process. It is being increasingly used within health and social care research (Russell et al., 2020).

A group of four DHSWs, including one who had participated in the interviews were involved in the design process. Communication took place via email and online Microsoft Teams meetings.

5.6.2 Illustrations

A graphic designer was contacted and provided with a brief for the card outline. A realistic illustration style was selected and ideas for an image which would represent each barrier was provided for the illustrator. Additionally, an illustration was required for the front page of the tool.

Initial sketches were sent by the graphic designer via email. These were shown to DHSWs who were asked to provide their feedback on these and if they felt any modifications were necessary. An example of some adaptations requested to the illustrations was with regard to barrier 9: "I'm so busy and it's difficult to find time for toothbrushing". Figure 5-1 shows the original sketch for this barrier which was presented to the DHSWs alongside the final image for this barrier.
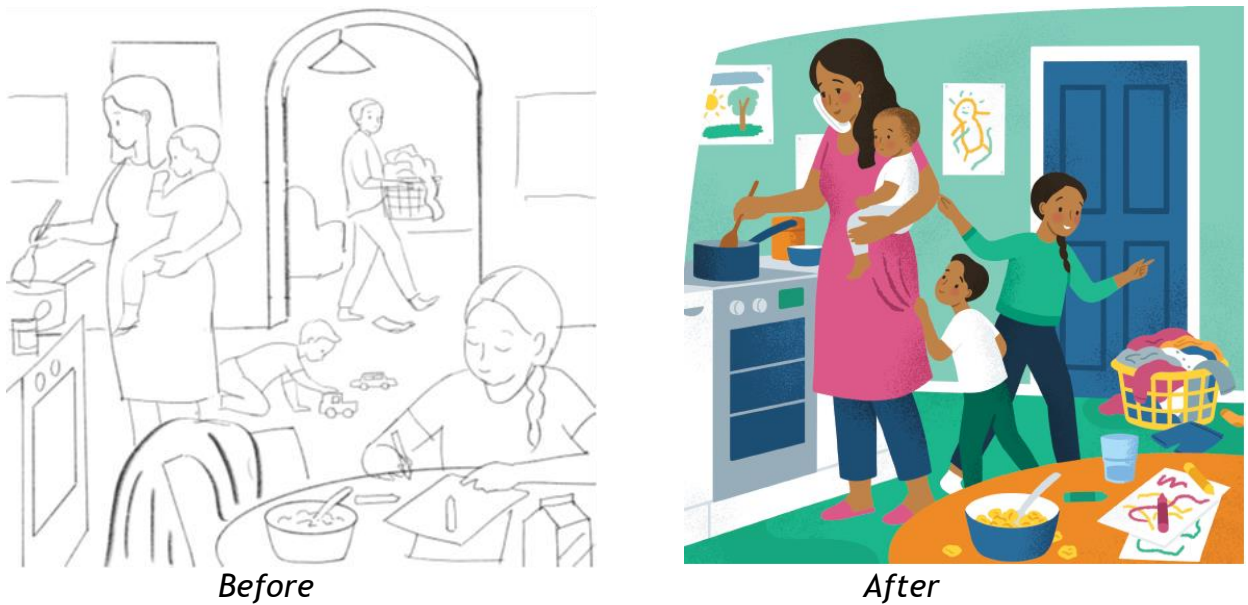
Before   *After*

Figure 5-1: Before and after images for barrier 9

The feedback was that this card needed to be changed in order to depict a scene which represented a busier household with one DSHW suggesting it needed to be "more chaotic". Based on feedback, this card was therefore modified to remove the 'helper' with the washing basket and depict the children seeking the parent's attention.

A further draft illustration that DHSWs felt required to be altered was the one depicting barrier 1: "My child refuses to let me brush their teeth". The initial draft for this card alongside the final image is shown in Figure 5-2.

Before　　　　　　　　　　　　　　　*After*

Figure 5-2: Before and after images for barrier 1

It was felt that the child represented in this card should be much younger, to depict a parent struggling to brush a baby's teeth. This was felt to be important as the tool is designed to help parents of very young children and DHSWs encountered many parents who had difficulties with brushing very young children's teeth due to child refusal. The draft illustration for barrier card 2, "My child appears upset when I'm trying to get them to brush" (Figure 5-3) was also changed based on DHSW feedback. It was requested that the running water from the tap be removed, and this was thought to be important as DHSWs recommend to parents that toothpaste should be spat out following brushing and

not rinsed away. In addition, a dry toothbrushing model is recommended so it was felt depicting a tap with running water may be misleading.
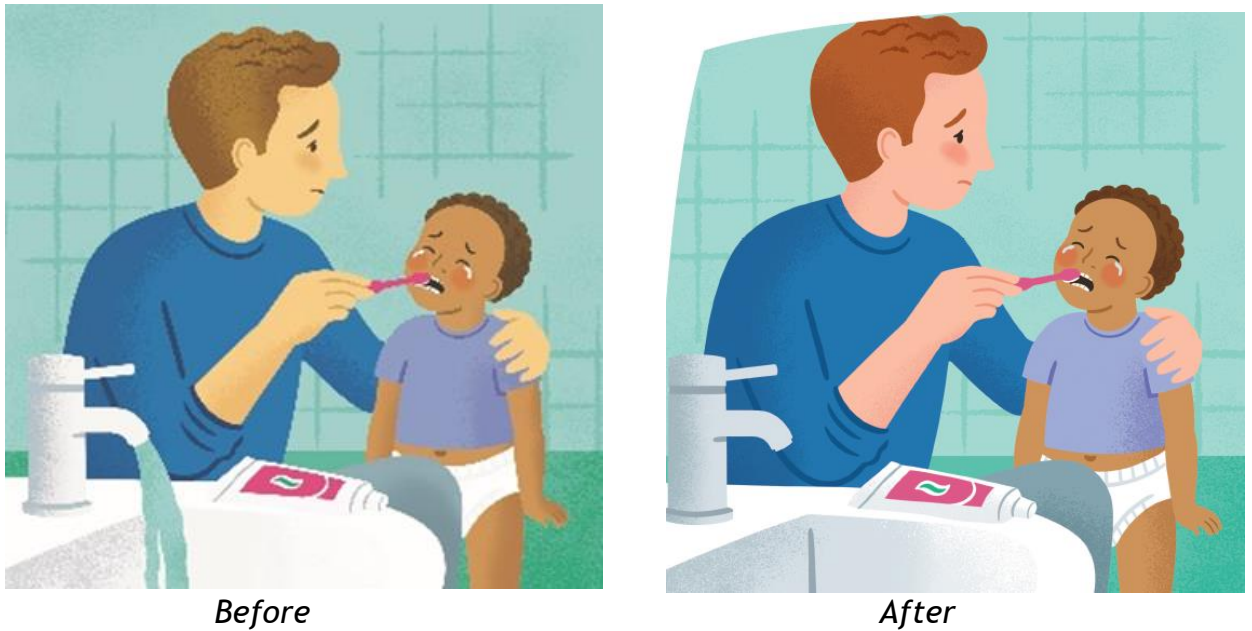
Before　　　　　　　　　　　　　　　　　*After*

Figure 5-3: Before and after images for barrier 2

Changes were also suggested for the original draft of barrier 4 "I can't really see the point in forcing my child to brush". It was suggested that the child be more "animated" and also include a toothbrush and toothpaste on the floor to make it clearer that there has been a struggle over toothbrushing which the parent has given up on and is walking away from. Figure 5-4 shows the illustrations for barrier 4.

Before   *After*

Figure 5-4: Before and after images for barrier 4

Minor alterations were recommended by DHSWs for barrier 6 "I am stressed". (Figure 5-5) It was suggested that the illustrations for the washing basket and the laptop be changed and instead include the examples of a ringing or vibrating phone and repairs required in the household. It was felt that this would better depict the variety of stresses a parent may be under and hint at potential time restraints or financial concerns that may be contributing to feelings of stress.
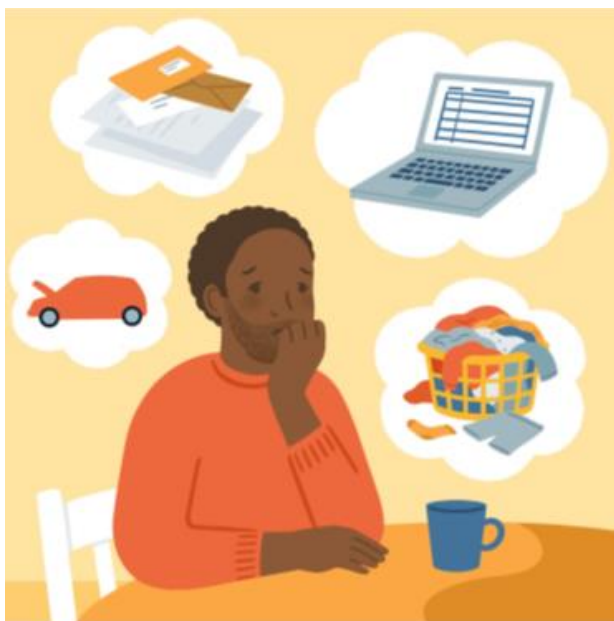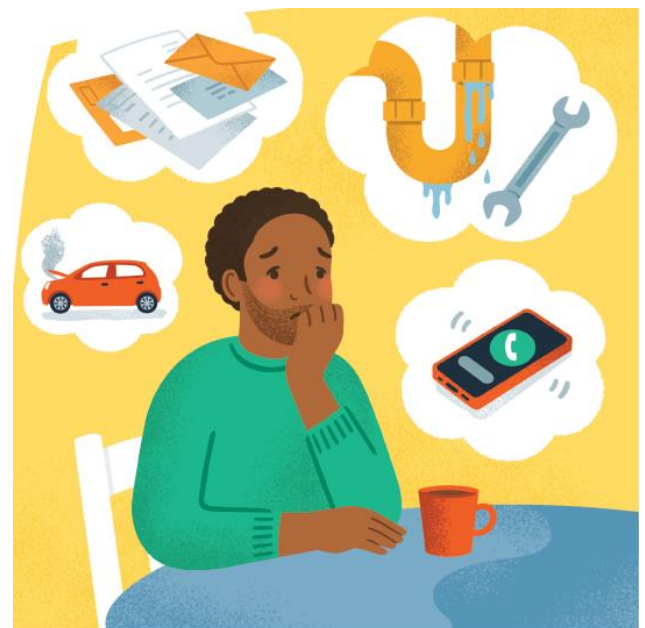
Before   *After*

Figure 5-5: Before and after images for barrier 6

The illustration for barrier 7 "We don't have the same routine or people in the house every day" also required minor changes based on discussion with DHSWs. It was felt that the events depicted on the calendar should be altered in order to represent a family in which there was more than one carer for the child and additionally that the child may live between different households (Figure 5-6). It was thought that this would more accurately represent the barrier statements.

Before

After

Figure 5-6: Before and after images for barrier 7

The draft illustration for barrier card 8 "I don't really feel support from other people" also required changes. The image sketch was modified to take place outwith the home setting. DHSWs gave feedback that they thought the illustration should include the presence of more sweets and sugar to make this barrier card clearer (Figure 5-7).

Before   *After*

Figure 5-7: Before and after images for barrier 8

DHSWs also felt that the illustration for barrier 10 "The information I get doesn't seem to be for people like me" should be changed. They suggested that it should include an interpreter struggling to bridge between the information giver and receiver (Figure 5-8).

Before   *After*

Figure 5-8: Before and after images for barrier 10

The draft illustration for barrier 11 "We often don't have things like toothbrushes or toothpaste" was felt to be too similar to the illustration for barrier 6. It was therefore changed to depict an empty toothpaste tube and toothbrush with splayed bristles which needs replaced (Figure 5-9).
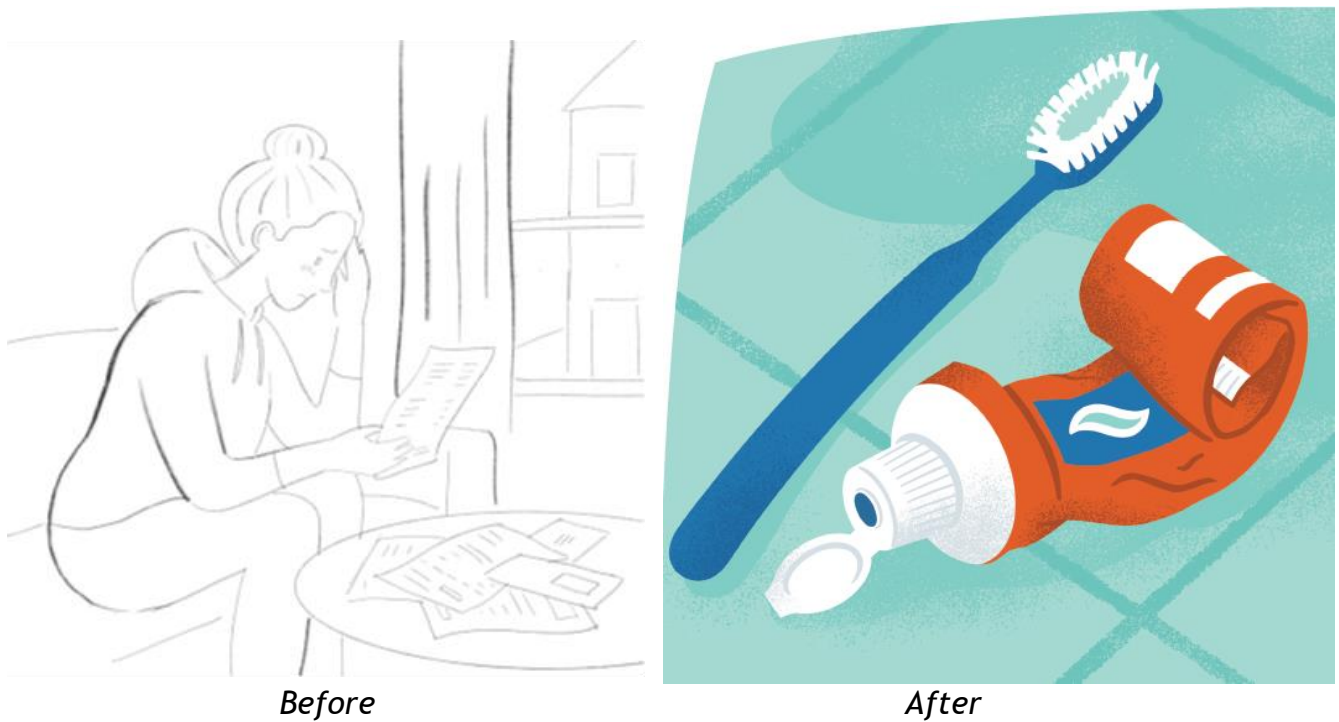
Before *After*

Figure 5-9: Before and after images for barrier 11

DHSWs were happy with the draft sketches for the remaining barriers and felt they did not require any changes.

The user input of DHSWs was continued throughout the design process, with updated sketches being sent to them for validation.

5.6.3 Wording and strategies

It was required that the wording for the set of barriers generated from the Delphi study be changed. This was in order that the barrier was clear enough to be understood without an additional description on the front of the card and also to be in language that a parent could identify with.

The research team developed a statement to depict each barrier. These were then presented to the DHSW group to seek their opinion. Their feedback was that these statements were clear and represented the barrier and DHSWs thought they would be understood by parents.

DHSWs provided suggestions for tips to be given to parents for each barrier based on their own knowledge and experiences.

A set of strategies were created for each barrier. The strategies used were based on those utilised in the Uitblinkers intervention, which were previously validated by the modified Delphi process: stimulus control, operant conditioning and goal-setting. In addition, techniques for each barrier were selected based on the use of matrices developed by Cane et al (Cane et al., 2015) and Michie et al (Michie et al., 2008). These matrices map domains from the Theoretical Domains Framework (TDF) to appropriate behaviour change techniques (BCT) from the BCT taxonomy (Michie et al., 2013). Table 5-2 outlines the results of this process. It was found that there were overlaps between barriers, TDF domains and BCTs therefore some BCTs may be relevant to more than one barrier. The process of barrier strategy selection was carried out alongside the PhD supervisor who is a Psychologist. In addition, where relevant, dental advice was given such as in relation to barrier 2 "My child appears upset when I'm trying to brush" which encourages the DHSW to first rule out dental issues such a pain or gum bleeding and refer to a dentist if required. Practical tips recommended by the DHSWs were also incorporated into the strategies. A definition of the BCTs (as described in the BCT taxonomy (Michie et al, 2013)) used as part of the barrier strategies is detailed in Appendix 11. These strategies are displayed on the back of each corresponding barrier card.

Table 5-2 Mapping of barriers to TDF and BCTs

Barrier	Barrier as written on card	TDF domain	BCT
Difficult child behaviour	My child refuses to let me brush their teeth	Behavioural regulation; Skills	Operant conditioning, Self-monitoring of behaviour; Graded tasks; Behavioural rehearsal/practice, Habit formation; Rewards- incentives
Child appears upset/child tired	My child appears upset when I'm trying to get them to brush	Behavioural regulation; Environmental context and resources	Operant conditioning, Self-monitoring of behaviour; Graded tasks; Behavioural rehearsal/practice; Habit formation; Rewards- incentives; Restructuring the social environment; Environmental changes (e.g. objects to facilitate behaviour); Role play; Avoidance/changing exposure to cues for the behaviour
Parent/carer capability	I often think I am not brushing my child's teeth in the right way	Skills; Beliefs about capabilities	Behavioural rehearsal/practice; Graded tasks; Habit formation; Goal/target specified: behaviour or outcome; Self-monitoring; Demonstration of the behaviour by others; Verbal persuasion to boost self-efficacy

Barrier	Barrier as written on card	TDF Domain	BCT
Parent/carer attitudes or motivation	I can't really see the point in forcing my child to brush	Motivation and goals; Beliefs about consequences	Emotional consequences; Comparative imaging of future outcome; Self-monitoring; Information regarding behaviours- outcome; Persuasive communication; Goal/target specified: behaviour or outcome; Behavioural rehearsal/practice; Graded tasks; Habit formation
Parent/carer knowledge	I don't really know what I'm supposed to do or where to start	Knowledge	Health consequences; Feedback on behaviour; Instruction on how to perform the behaviour; Demonstration of the behaviour by others; Habit formation; Goal-setting
Parent/carer self-care	I am stressed	Emotion	Social support (emotional); Coping skills; Emotional consequences; Reduce negative emotions; Habit formation; Goal setting; Problem-solving
Structures and routines	We don't have the same routine or people in the house every day	Environmental context and resources	Stimulus control, Restructuring the social environment; Discrimitive (learned) cue; Prompts/cues; Environmental changes (e.g. objects to facilitate behaviour); Habit formation; Problem-solving
Social setting and influences	I don't really feel support from other people	Social influences	Social support (emotional); Social support (practical); Social comparison; Social support or encouragement; Information about others' approval; Restructuring of social environment; Modelling/demonstration of behaviour

Barrier	Barrier as written on card	TDF Domain	BCT
Time constraints	I'm so busy and it's difficult to find time for toothbrushing	Environmental context and resources; Memory, attention and decision processes	Stimulus control, Restructuring the social environment; Discrimitive (learned) cue; Prompts/cues; Environmental changes (e.g. objects to facilitate behaviour); Habit formation; Planning, implementation; Self-monitoring; Goal setting
Cultural barriers	The information I get doesn't seem to be for people like me	Beliefs about consequences; Environmental context and resources	Information about health consequences; Instruction on how to perform the behaviour; Demonstration of the behaviour; Adding objects to the environment; Social comparison; Role modelling; Goal setting
Family resources	We often don't have things like toothbrushes and toothpaste	Environmental context and resources	Environmental changes (e.g. objects to facilitate behaviour); Social support (emotional); Social support (practical)

5.6.4 The STAR tool

The new tool was named the "STAR" tool. This name incorporates the stages involved in the use of the STAR tool process:

S: Support. The parent/carer is asked what is going well with child toothbrushing or things that have worked before and why.

T: Talk through the barriers. The parent/carer chooses from a list of common barriers which represents difficulties that they may be having in supporting child toothbrushing.

A: Apply. DHSWs and the parent/carer go through the potential tips that could help.

R: Recap. DHSWs and the parent/carer arrange to follow up and see how things are going.

The following sections will describe each stage in detail.

5.6.4.1 Support

The STAR tool follows a motivational interviewing model which allows parents to choose their own barriers to address and to identify solutions with support from the DHSW. Similar to the Uitblinkers technique, the aim is to create a positive care relationship between the DHSW and parent, while toothbrushing guidance is provided. This is achieved by making parents feel competent, by creating a connection and by respecting parents' autonomy (Ryan and Deci, 2002).

In order to accomplish this, the DHSW will begin the conversation by firstly asking about what is going well with toothbrushing and giving praise to the parent based on their response. This ensures that the conversation does not start negatively with what could be improved. After this, the DHSW can then ask about any issues the parent may be having with child toothbrushing. The DHSW is encouraged to use an empathetic and parent-centred communication style.

Parent autonomy is achieved by allowing them to be involved in the process of generating solutions to toothbrushing barriers by asking for their ideas and for examples of things which have worked in the past for them. The DHSW and parent can then work together to find a strategy which is suitable for the family.

5.6.4.2 Talk through the barriers

The parent is then encouraged to explore their own barriers by giving examples of difficult situations. The DHSW will then show the parent a set of barrier cards. The STAR tool is designed such that all eleven barrier cards are displayed and parents choose from the set. Each card depicts a home toothbrushing barrier which may relate with child, parent or family circumstances. The parent is then asked to select a barrier which most applies to them.

With judgement, and when DHSWs get to know families, or have had previous conversations, it may be that a particular selection of barriers are presented that are likely to represent known issues.

5.6.4.3 Apply

Based on the barrier selected, an appropriate strategy is explored with the parent. The back of each cards describes possible strategies for the specific barrier, which the DHSW can use as a guide. As previously mentioned, it is important that parents are involved in the process of both choosing barriers they can identify with and creating realistic solutions. In addition, DHSWs can also incorporate tips or techniques from their past experience.

Behaviour change techniques incorporated into the strategies for many of the barriers, also utilised by the Uitblinkers intervention and validated by the modified Delphi process, are stimulus control and operant conditioning. These concepts were previously described in Chapter 1 (see Section 1.8)

If parents choose more than one barrier, the DHSW is encouraged to reassure them that these can be addressed one by one or at a future visit. Again, understanding and statements of empathy should be shown throughout the process.

5.6.4.4 Recap

The process is concluded by the DHSW ending the conversation by summarising what has been discussed and creating a plan of action with the parent. This action plan should be practical and also contain a time frame for follow up. A key part of sustaining behaviour change is to set realistic, simple tasks suitable for a particular person's context and circumstances (Bailey, 2019). It is also important that the plan can be adaptable and to accept and plan for a situation where something does not work immediately.

For some families, depending on the barrier and circumstances it may be more suitable to attempt just some strategies and suggestions initially before moving on to the addition of further tips.

The DHSW should arrange a follow up consultation with the family to check how they are managing, and they can decide if a further visit is required to modify some of the suggested changes or repeat the process with any further barriers. The follow up can be carried out via a further home visit or by telephone.

Figure 5-10 shows the front of barrier card 1, "My child refuses to let me brush their teeth" and Figure 5-11 shows the back of this card with associated suggested strategies.

The full prototype STAR tool created during the design process is appended in Appendix 12.

Figure 5-11: Front of barrier card 1

Figure 5-10: Back of barrier card 1

5.7 Summary

The overall feedback from DHSWs on the premise of the new home toothbrushing tool was positive. The DHSWs interviewed were experienced in carrying out home visits with many having been in the role for over 10 years. Home visits are provided to families from a range of different backgrounds and varying socioeconomic circumstances. Each DHSW had their own approach to home visits and following Childsmile guidance on delivering oral health support and helping families register their child with a dentist. It was thought, however, that it would be beneficial to have new resources to use on home visits as it was mentioned that it had been some time since they had had new materials.

The time that it would take to carry out the new intervention wasn't a concern for any of the DHSWs as stated they are able to manage their own diaries and therefore allocate extra time when required. In addition, in terms of space required to use the cards, most DHSWs stated that this either wouldn't cause a problem or they could adapt if required by, for example, not bringing out all the cards at once.

DHSWs validated the set of barriers generated from the Delphi by agreeing that these were all common issues that each of them had encountered during their experiences with families on home visits. While most DHSWs felt that the list of barriers encompassed all the barriers they had come across, some DHSWs felt that an additional barrier would be those difficulties encountered by parents of children with additional support needs, such as autism. At the moment, the tool is intended to be used for the general population, so a decision was made to not include these additional barriers. However, further work may look at the appropriateness of adaptation of the tool for use with children or adults with additional support needs. Despite the tool not being specifically designed for use with parents of children with additional support needs, it may still be possible for DHSWs to use the tool with these families if both DHSWs and parents felt comfortable doing so.

All DHSWs agreed that the current size of the Uitblinkers cards would be appropriate for them to include in their home visit kits and so it was decided that the cards for the new tool would remain A5 size. With regards to the design

and the images on the cards, there was a variety of opinions. Many DHSWs stated that the Uitblinkers illustrations were not to their preference and did not make clear enough what barrier the card was representing. There may have been some cultural differences regarding the Uitblinkers cards, with some cards representing Dutch expressions which are not used in Scotland. It was therefore decided that new illustrations would be required. This was also necessary as the barriers for the new tool varied from those from the Uitblinkers tool. There were mixed views on preferences over the card featuring illustrations or photographs to depict the barrier. In order to try to create a balance and take both of these opinions into consideration, the research team decided that it would be most appropriate to feature illustrations which were more realistic than the Uitblinkers illustrations, particularly when depicting people and families.

There were some areas mentioned by DHSWs which would need to be taken into consideration, that may present barriers to effective implementation of the STAR tool.

Many DHSWs pointed out that they often visit a family when the child is less than six months old, often before they have teeth and toothbrushing has commenced. Some DHSWs stated that the toothbrushing advice they currently deliver is therefore "theoretical" as the parents do not yet have a need to use the advice or tips given to them. A crucial component of the new intervention is that the conversation is initiated and driven by parents identifying a toothbrushing barrier which they are experiencing and working with the DHSW support worker to find an appropriate solution to address that barrier. It would therefore mean that for many home visits, it would not be appropriate or indeed relevant to use the new resources as the parents are yet to encounter any toothbrushing difficulties. Consequently, there may then be a need for DHSWs to contact these families at a later stage, when they have begun the toothbrushing process, to find out how they are managing and assess at this stage if a further visit to use the intervention is required or would be beneficial. It is recommended that toothbrushing is started as soon as the first tooth erupts in the mouth (NHS, 2022b) and the first deciduous tooth erupts, on average, between the ages of 5 to 7 months (NHS, 2022a) so DHSWs may need to contact parents after the child has reached this age.

A further issue which was raised during the interviews was regarding follow up visits. Many DHSWs at the moment only carry out a single visit with a family. Most do not routinely carry out a follow up unless there was a particular concern raised during the visit. A key stage in the motivational interviewing process and therefore of the intervention is that an action plan is created and there is follow up to monitor progress. This is crucial to assess if the family has been able to put the strategies given to them into action and there are any further changes or additional strategies required. In addition, some families may have more than one barrier or concern which may not have been able to be addressed in one visit. It is possible for follow up to take place in person or during a telephone consultation if this is more appropriate or convenient. For some DHSWs, the extra time this may require may present a barrier to effective implementation.

DHSWs all mentioned that they would use their own judgement when determining whether they thought it would be suitable to use the new tool on a particular family. This may be the case especially when they have not met the family before and if they may not have many details on the family prior to the home visit. It may be that the resources and intervention are not appropriate for a family's needs or circumstances and training should make clear that its use should be targeted towards those families who would benefit from its use at that particular time.

The following chapter describes the procedure of testing out the protype STAR tool and associated process in a simulated setting with DHSWs and parents.

Chapter 6   Simulation testing of tool to assess feasibility and acceptability

6.1 Objectives and research questions

The objectives addressed by this study were:

1. Recruit parents and DHSWs to participate in a workshop to test the feasibility and acceptability of the new intervention.
2. Develop training for DHSWs on the use of the new intervention.
3. Deliver workshop wherein DHSWs can test out the new intervention with parents in a simulated setting.
4. Gain insight and feedback on the use of the new intervention from DHSWs and parents.
5. Follow up with parents via telephone interviews six weeks following the workshop, to see if they report any short-term benefits.

The research questions addressed by the study were:

Research questions associated with these objectives are:
- Is the intervention feasible and acceptable to DHSWs and parents when carried out in a simulated setting?
- Are there any short-term benefits reported by families following use of the intervention in a simulated setting?

6.2 Background

6.2.1 Simulation in research

Simulated practice is increasingly used in healthcare learning. Simulation is a situation in which the conditions have been artificially set up to represent real life scenarios, often used for educational purposes. Simulation is an effective strategy within healthcare teaching (Issenberg et al., 2005). Simulation often

involves health care staff training with part-task trainers (medical devices used to facilitate practice of specific clinical skills) or full body manikins (So et al., 2019). Standardised patients are also commonly used as part of simulation in medical and healthcare education. Standardised patients are actors who are skilled in playing the role realistically and consistently (Hardee and Kasper, 2005). The incorporation of standardised patients allows students or learners to practice or test out skills and abilities in a safe environment (Crow, 2012, Jack et al., 2014).

Another type of actor commonly used in healthcare education is the 'care actor'. Care actors are commonly used during scenarios involving more experienced clinicians (Hardee and Kasper, 2005). They usually work alongside the clinician to work together towards a learning goal or skill the clinician wishes to work on. The care actor is given direction regarding the clinical setting, overall mood and level of difficulty and works with the clinician to create a relevant clinical scenario. While standardised patients usually follow a set script rigidly, care actors can work flexibly and are skilled at improvisation. Additionally, with training involving actors, there is the opportunity to pause, go back or restart the scenario.

When simulation is used as a research methodology, the term 'translational simulation' is used. This refers to simulation in healthcare which is concerned specifically with improving patient care and healthcare systems (Brazil, 2017). This type of simulation is focused more on the purpose of the research and its outcome than the location, content or means of the simulation. It can therefore align with the quality improvements goals of a healthcare institution, while at the same time incorporate any educational activities which focus on patient outcomes or practice behaviour (Brazil, 2017). Translational simulation sits within a category of simulation activities known as transformative simulation. Transformative simulation is defined by the Association for Simulated Practice in Healthcare (ASPiH) as "A tool to transform health & care through collective understanding, insight and learning." (ASPiH, 2023) It is not designed around pre-determined learning outcomes but instead is concerned with understanding, investigating and improving healthcare processes.

While simulation practice is often used for education and training purposes, it is also used for the purpose of understanding and improving, and additionally testing and analysing health and care systems (Weldon et al., 2023, Nickson et al., 2021).

6.3 Methods

6.3.1 Simulation workshop

A simulation workshop took place over two days. On the first day, DHSWs were provided with an introduction to and training on the use of the STAR tool including details on motivational interviewing and behaviour change techniques. DHSWs were then given the opportunity to informally practise the use of the STAR conversation in pairs with an actor to familiarise themselves with the resources and conversation style. Training vignettes were developed for use with the DHSWs and the actors (See Appendix 13).

The training consisted of a morning session using a Microsoft PowerPoint presentation delivered by the PhD student with facilitation provided from their supervisor and a researcher from ACTA who developed the Uitblinkers tool. DHSWs were first given background information on the reasons why the STAR tool is being introduced and how it has been adapted from the Uitblinkers tool. The researcher from ACTA then provided the DHSWs with an in depth explanation of the Uitblinkers process and the theories it is based on.

Currently, all DHSWs in Scotland receive training on motivational interviewing, and behaviour change techniques as part of their standard training in line with their role (NHS Education for Scotland, 2023). Consequently, it was only necessary for the STAR tool training to include refresher information on motivational interviewing and behaviour change techniques. A more detailed explanation of some of the behaviour change techniques included in the STAR tool, including operant conditioning and stimulus control, was provided alongside details of the barrier cards for which these techniques are particularly relevant. Additionally, each of the four stages of the STAR tool process was explained to DHSWs. The training was designed to be interactive with DHSWs being given the

opportunity to ask questions and being encouraged to have discussions amongst themselves.

Following this training session, DHSWs tried out the use of the STAR tool with an actor. Two actors took part in this part of the session, with each having been given a role to play as a parent of a young child to work through a scenario with the DHSW. The DHSWs were separated into pairs and each given the opportunity to individually go through the scenario with the actor and test out the use of the STAR tool and also observe their colleague and provide feedback. This part of the session was designed to be informal and DHSWs were able to stop during the scenario to ask questions about anything they were unsure of or to ask for feedback. Figure 6-1 demonstrates a photograph taken during this actor try out session.

Figure 6-1: DHSWs being facilitated to test out the use of the STAR tool with an actor

On the second day of training, DHSWs tested out the use of the STAR tool. DHSWs carried out a conversation with a parent or simulated parent following the STAR tool process using the barrier cards to facilitate the discussion. This interaction was video recorded, with researchers observing from a separate room. Each DHSW carried out this process twice with a different parent or simulated parent. In one room, a DHSW and parent carried out the conversation using the STAR tool, with a camera recording via a private password protected Zoom meeting. In a separate room, a researcher was linked in to the same Zoom meeting, with camera and microphone switched off and was able to watch the interaction live. Figure 6-2 indicates a photograph of a DHSW and a simulated parent going through the STAR tool process.

Figure 6-2: DHSW and simulated parent using STAR tool during simulation workshop

Following this process, DHSWs and parents took part in semi-structured 'exit' interviews.

6.3.2 Participants and recruitment

Dental Health Support Workers who carry out home visits were eligible to take part. All DHSWs who participated worked within the Greater Glasgow and Clyde health board area. DHSWs who had previously taken part in earlier research regarding the STAR tool were invited to take part via an invitation email. Six invitations were sent to DHSWs. A snowball approach was also used as those

DHSWs invited to take part were asked to suggest colleagues who may also be interested in participating.

For the recruitment of parent participants, DHSWs were asked to approach parents with a child aged 0-3 years who were part of their case load who they thought might be interested in taking part. If parents agreed to take part, they gave permission for their contact details to be passed on to the researchers who contacted them with further details. DHSWs were asked to recruit two parents to participate each.

DHSWs and parents were provided with information sheets in advance of the workshop and given the opportunity to ask questions. Written consent was gained from all participants.

6.4 Analysis

6.4.1 Function Resonance Analysis Method: mapping tool in use

There was a need to use a method to analyse a trial of the STAR tool and focus on the process, as opposed to user reactions which are assessed separately using qualitative exit interviews (section 6.4.2). The Functional Resonance Analysis Method (FRAM) is a method which analyses how activities occur either retrospectively or prospectively (Hollnagel, 2012). FRAM can be used to map a process and allows for non-sequential or non-linear steps and aims to explore how a process works in practice (Hollnagel, 2011). The main application of FRAM has been in safety systems, however its core principle is to describe non-linearity and complexity and to "explore participants' accounts of their working realities" (Sujan et al., 2023). It works by mapping out how these activities take place in order and generates a visual representation or model of how a particuar process occurs. It can be used to model complex organisational systems. It was derived from the Resilient Health Care Theory (Braithwaite et al., 2015, Cook, 2006) which focuses on the role of adaptation in how success can be achieved in complex environments (Anderson et al., 2016). The use of the FRAM method is increasing within various healthcare systems (Patriarca et al., 2020, McGill et al., 2021). FRAM has previously been used to model processes as part of quality improvement within the Chilsmile programme (Ross et al., 2018). FRAM involves

the demonstration of how a process is carried out through multiple functions and activities. A function hexagon is used as the basic unit of anaylyis.

There are six aspects by which functions can be specified:

1. Inputs (I): Aspects which start and are processed in the function
2. Preconditions (P): Conditions which exist for the function to start
3. Resources (R): Items which are used during the process
4. Time (T): Temporal constraints on the function
5. Control (C): The ways in which the function is monitored
6. Outputs (O): The outcome of the function

A key initial stage in developing a FRAM model is the identification and description of the functions which are essential in the process. It is important to consider if there is variability in these functions and look at how this variability may impact on the process. The determination of how functions link to each other and how they vary is important in identifying any areas where a system or process could be improved or recognising which areas are important for a successful outcome. The FRAM aimed to look at the order of the activities and how questions and prompts drive other, further questions or activities. Therefore, for the purposes of this analysis, only Inputs and Outputs were used.

A FRAM model was built by analysing the video recordings of the DHSW and parent interactions. A set of broad functions was identified which were linked to other more specific functions which had aspects in common. The first stage in this process was familiarisation with the data by watching each video recording of the DHSW and parent interaction and then creating a code for each key function. This was then sense checked and discussed with a supervisory team which included experienced users of the FRAM methodology. Following this, individual models were developed for each DHSW's interaction. These were then compared and synthesised into a general model.

The dedicated FRAM Software (FRAM Model Visualizer v0.4.1) was used to build the model. Colour coding was used to code each function with the stage of the STAR tool process it was associated with:

S: Support parents (Green)

T: Talk through the barriers (Blue)

A: Apply the tips (Pink)

R: Recap/review (Orange)

6.4.2 Exit interviews: acceptability and feasibility

'Exit interviews' is the term most often used to describe interviews which are carried out after an intervention has taken place to gain insight into patients' experiences. Exit interviews are often used following clinical trials, providing qualitative data which can improve the interpretability of quantitative trial results as the interviews often explore the same outcomes as those measures by clinical trial endpoints (Matza et al., 2022).

Semi-structured qualitative 'exit' interviews were carried out following the conversation between DHSWs and parents (and/or simulated parents). A separate topic guide was used for the DHSW and parent interviews.

All interviews were audio recorded and transcribed for analysis. Coding took place using QSR International NVivo 12. The data were analysed using framework analysis, guided by a framework adapted from the Consolidated Framework for Implementation Research (CFIR), based on that used in the analysis of the interviews in Chapter 5. The framework analysis approach to qualitative research utilises both inductive and deductive methods. It is developed to be a thorough and valid process which can produce results which can be clearly interpreted and easily implemented (Ritchie and Spencer, 1994).

The CFIR (see section 3.1.4) comprises 39 constructs which are organised in to 5 domains and is commonly used within implementation science. It provides a guide for evaluating potential barriers and facilitators to allow for the adaptation of implementation strategies and modifications to the new intervention being implemented (Damschroder et al., 2009).

The interview guide for DHSWs and parent exit interviews is appended in Appendix 14.

6.5 Results

Four DHSWs took part in the simulation workshop along with two parent participants, with an additional two actors (simulated parents) participating on the second day also due to short notice unavailability of parent participants.

6.5.1 FRAM models of STAR process conversations

5 FRAM models were generated following analysis of the video footage of DHSWs using the STAR tool. One FRAM model was developed for each of the 4 DHSWs (each DHSW having completed the process twice) and these were combined to make a single generalised FRAM of the STAR tool process in action.

A key to the STAR stages is shown in Figure 6-3.

Figure 6-4 shows the final combined FRAM model. This shows that there were 29 key functions associated with the use of the STAR tool process. Each DHSW carried out all four stages of the STAR process. While there are four steps to be carried out to complete the STAR tool process, the FRAM demonstrates how these may be carried out in different ways in practice.
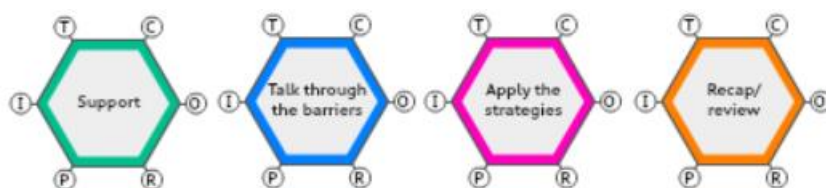
Figure 6-3: Colour-coded key to 4 STAR stages
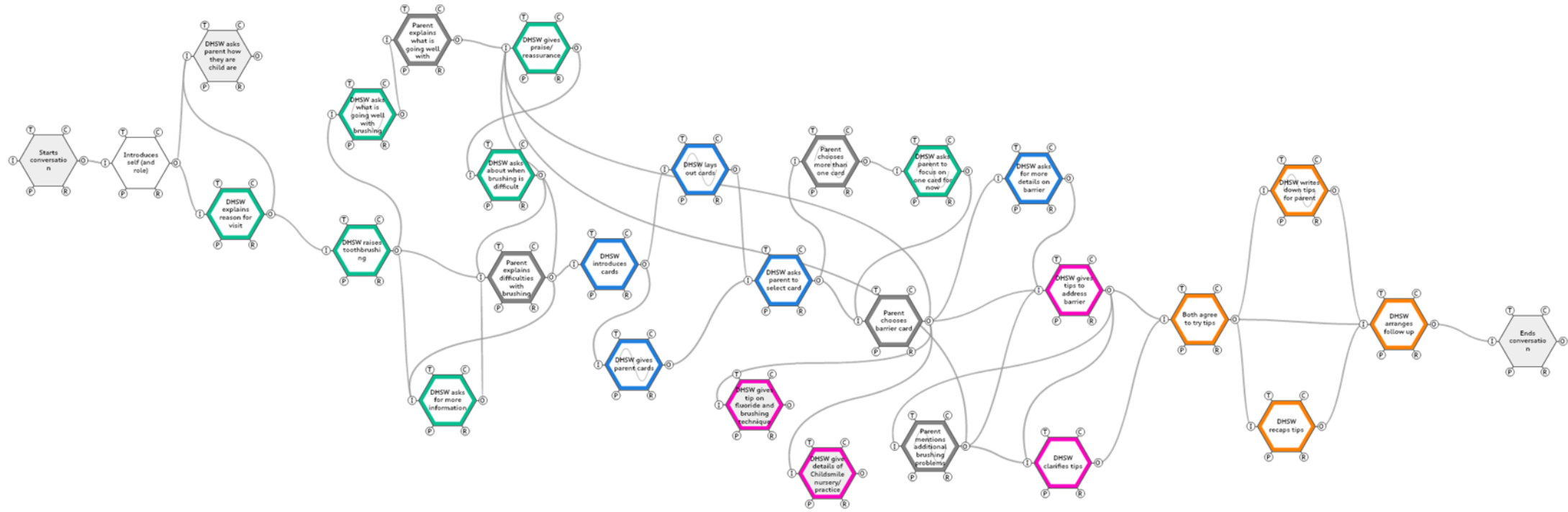
Figure 6-4: FRAM model of all DHSWs combined

For example, DHSW 1 starts the process by asking the parent about toothbrushing and what is going well and allows the parent to explain before asking about times when they are having difficulties with brushing (Figure 6-5)
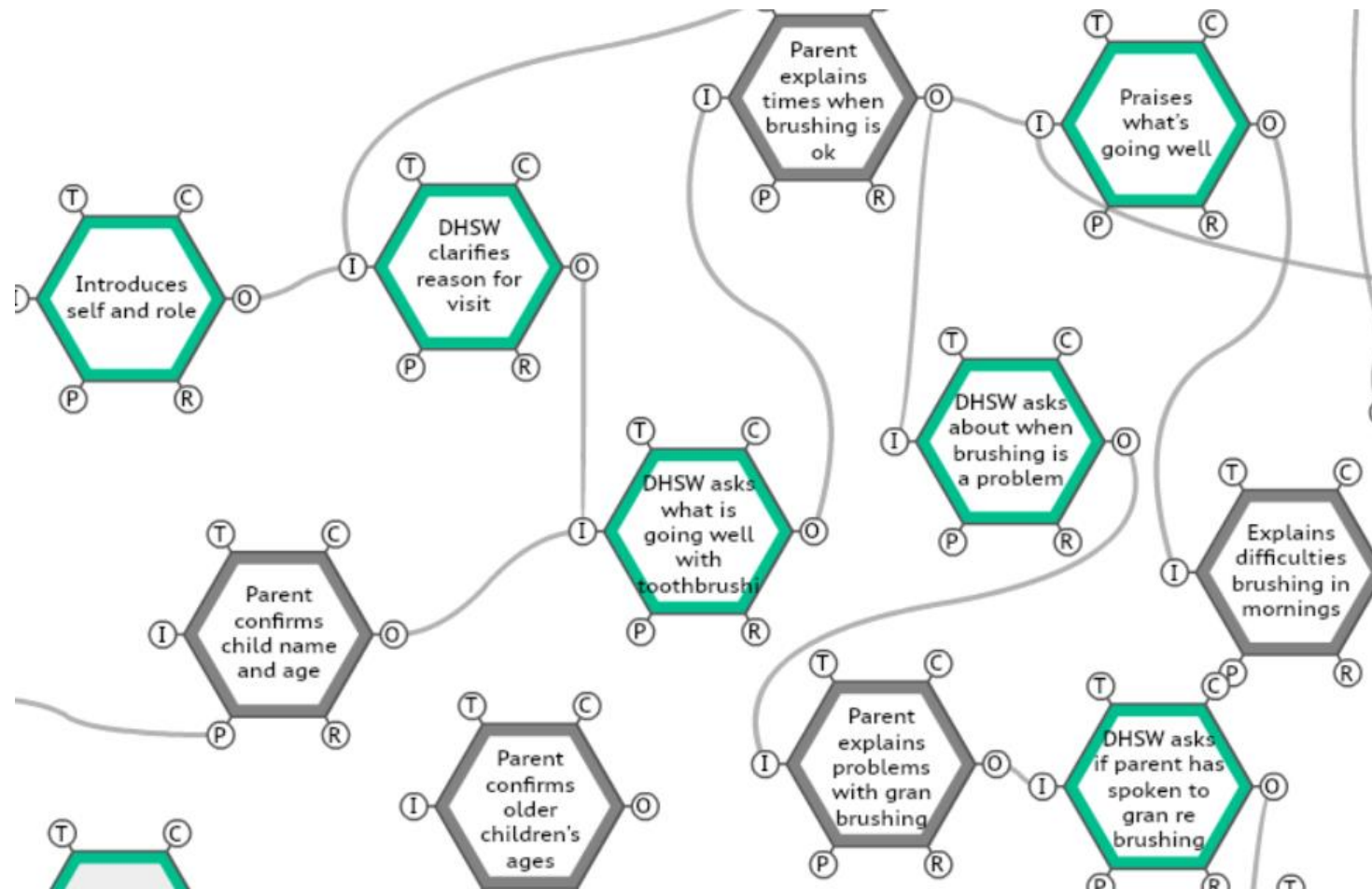

Figure 6-5: DHSW 1 introducing topic of toothbrushing

In contrast, DHSW 2 asks more generally and the family and context of the visit: *"The health visitor has let me know that you want to speak to somebody regarding dental health in some sort of way" DHSW 2.* The parent then introduces the topic of toothbrushing (Figure 6-6). It can be seen in this instantiation that the parent response initiates the DHSW asking for more information which elicits the topic of toothbrushing problems.
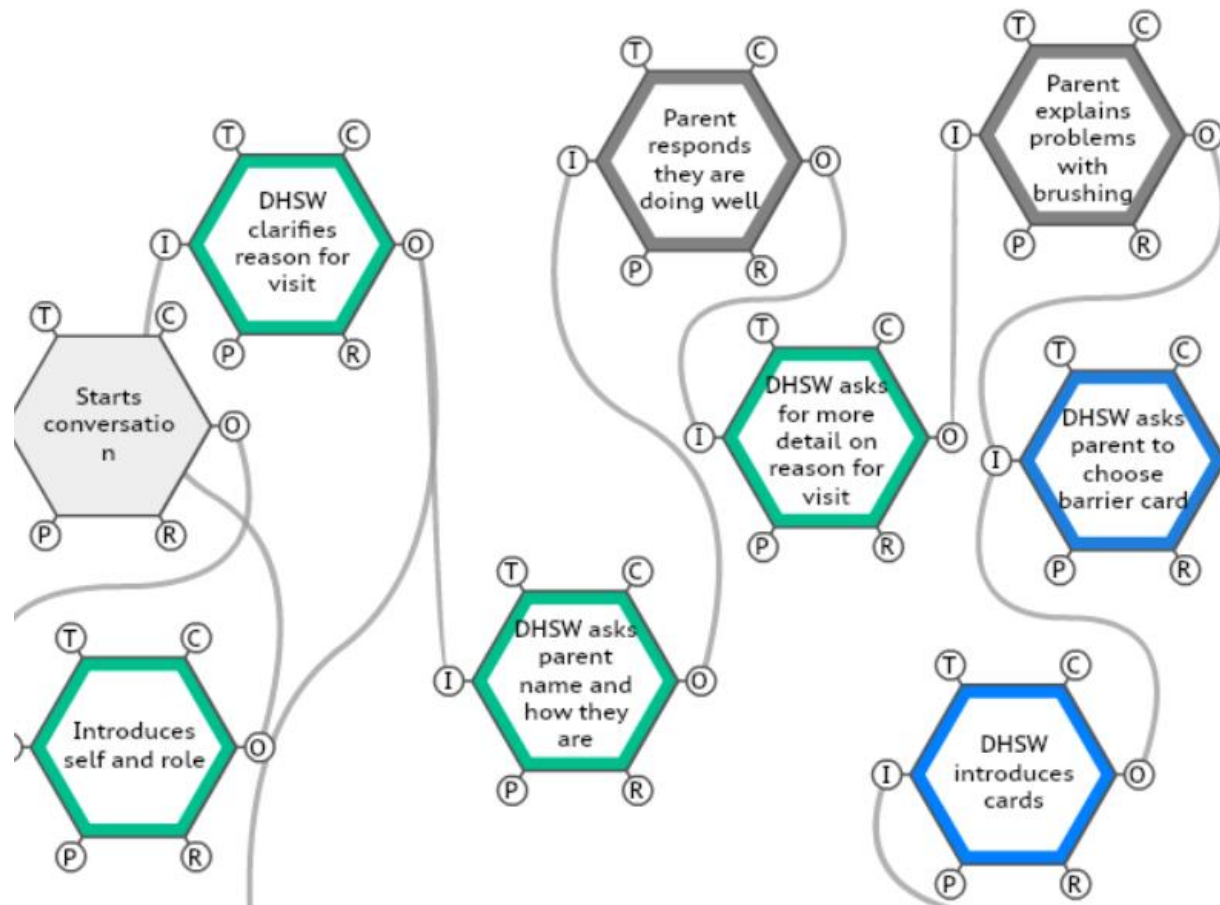
Figure 6-6: DHSW general question about oral health visit

All DHSWs asked parents to select a barrier card with which they most identify. However, there was variation in how they presented the cards to the parents. DHSW 4 handed the cards to the parent to look through themselves before asking them to select a card (Figure 6-7).
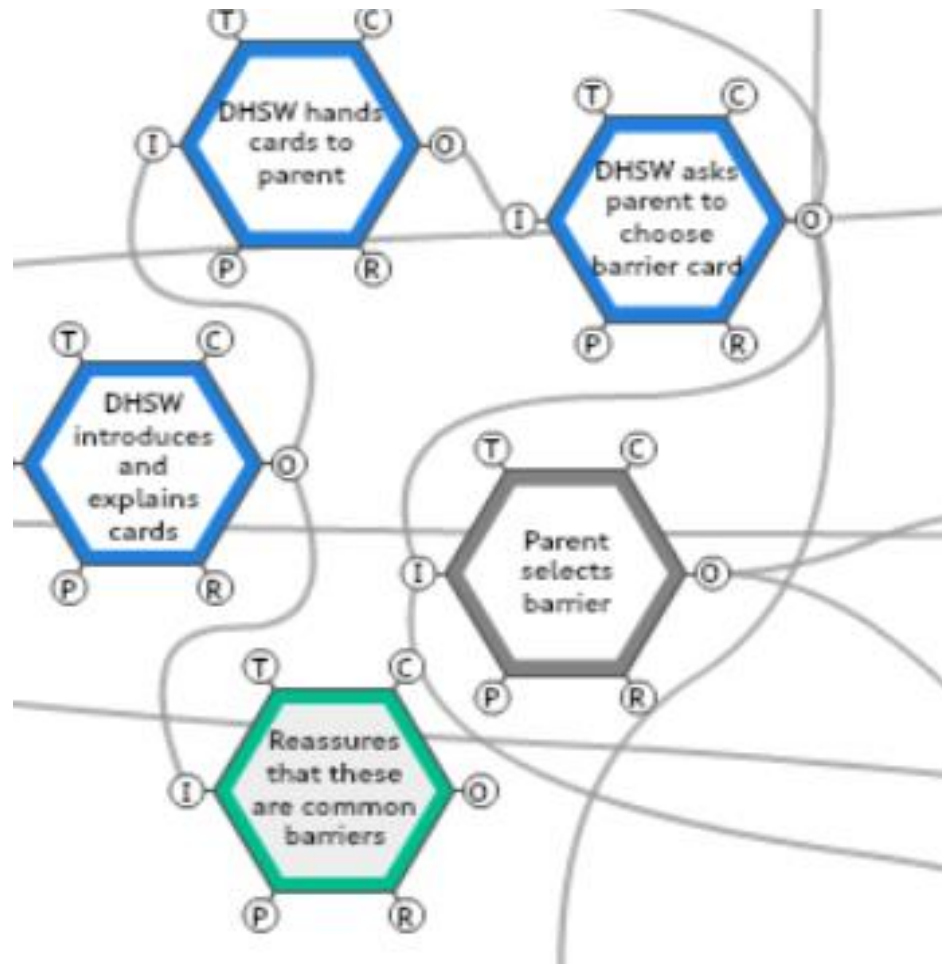
Figure 6-7: DHSW 4 method of introducing barrier cards

In contrast, DHSW 1 talked the parent through each barrier card and then requested the parent to choose a barrier they identify with (Figure 6-8).

Figure 6-8: DHSW 1 method of introducing barrier cards

DHSW 3 presented the cards to the parent by laying the cards out on a table at the beginning of the conversation but introduced the cards at a later stage in the conversation after finding out more information from the parent (Figure 6-9).
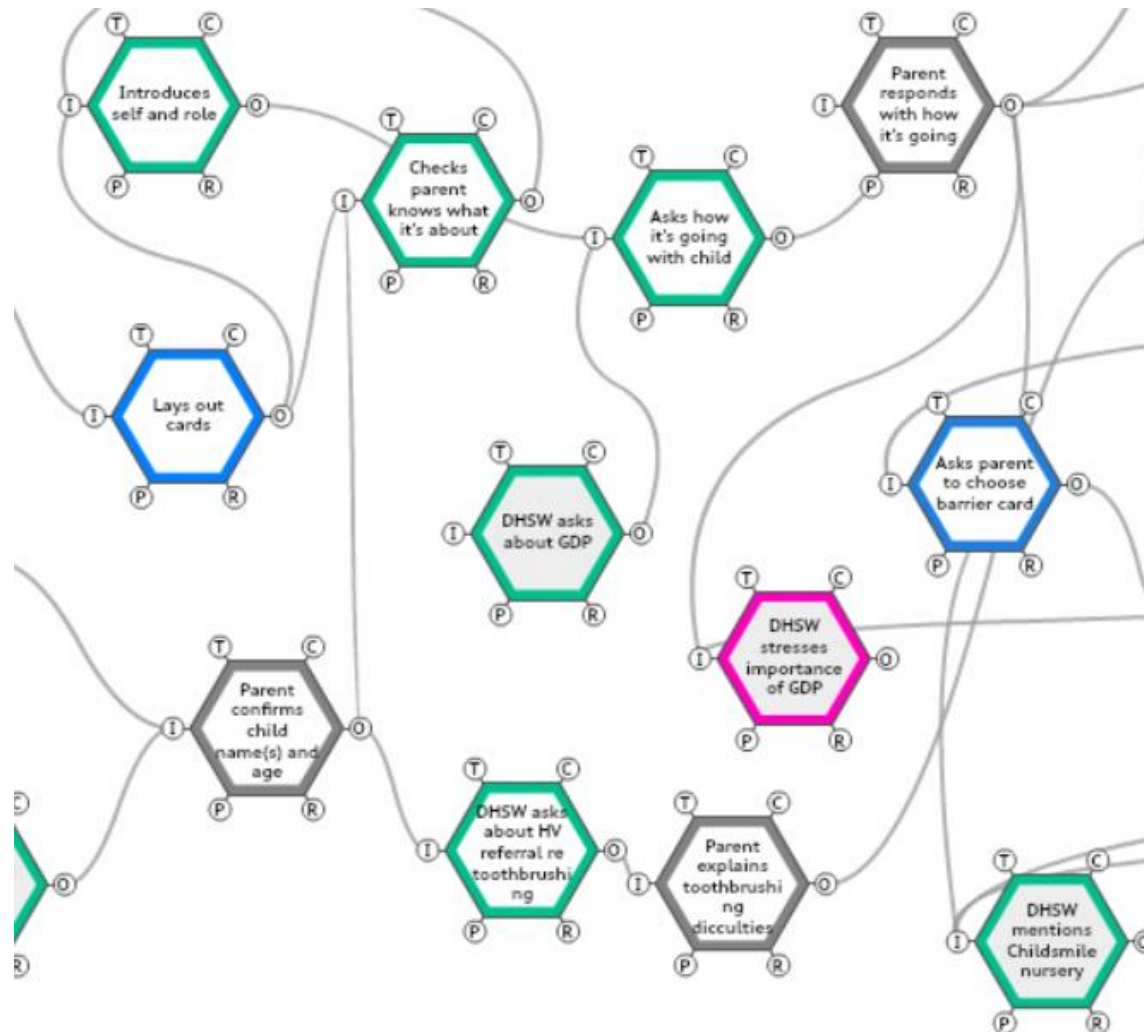
Figure 6-9: DHSW 3 method of introducing barrier cards

All DHSWs offered tips and strategies based on the barrier that the parent chose. DHSW 3 gave tips on role play and role modelling, routine and toothbrushing technique immediately after the parent selected a card and responded to parent concerns about trying out these new strategies (Figure 6-10).
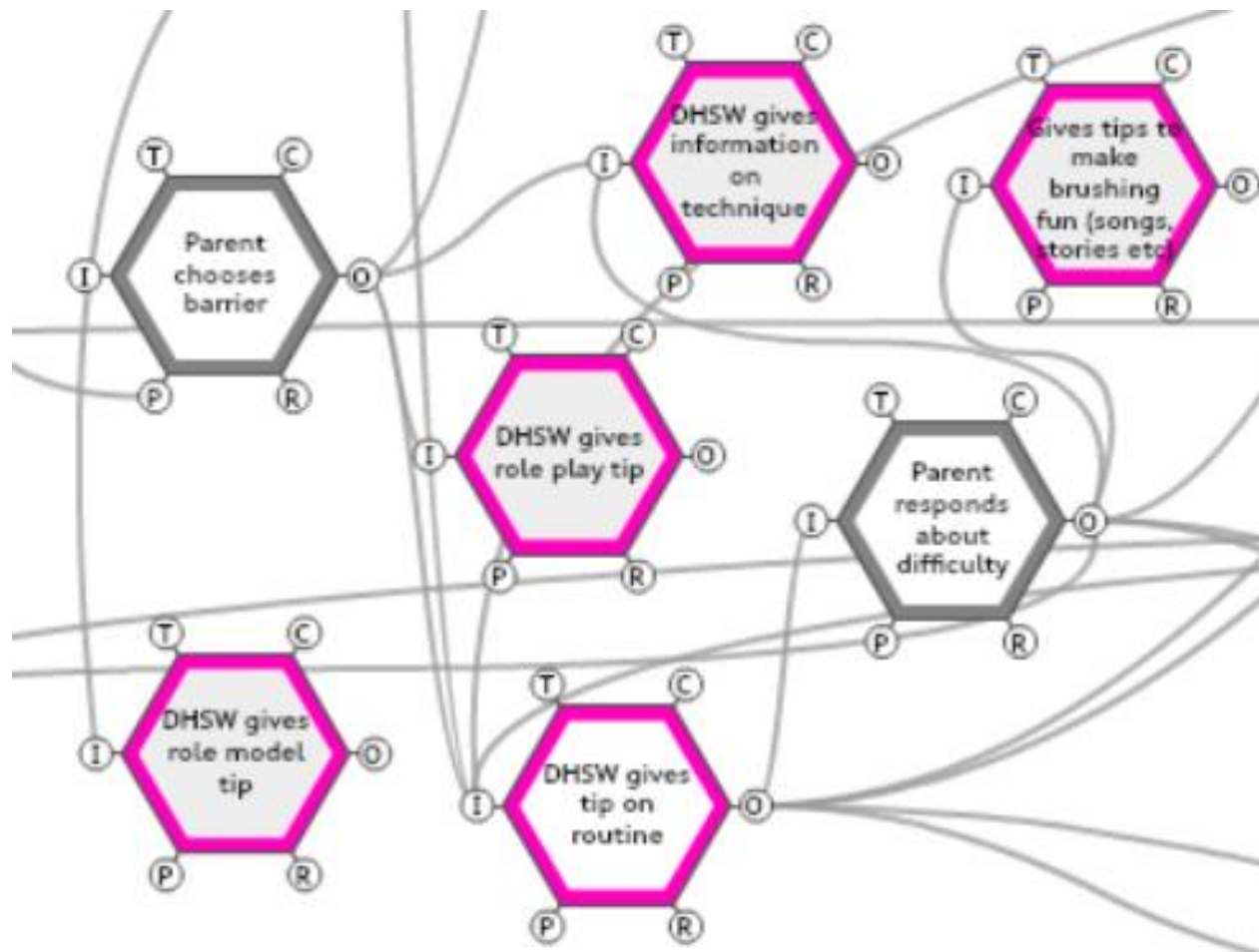
Figure 6-10: DHSW 3 giving out multiple tips based on parent's chosen barrier

The DHSWs all closed the conversation by checking that the parents were happy with and understood the advice given before arranging to follow up with the parent to see how they have managed using the new strategies. In addition, DHSW 4 wrote down the tips for the parent and two other DHSWs offered to write down the tips as a reminder (Figure 6-11).
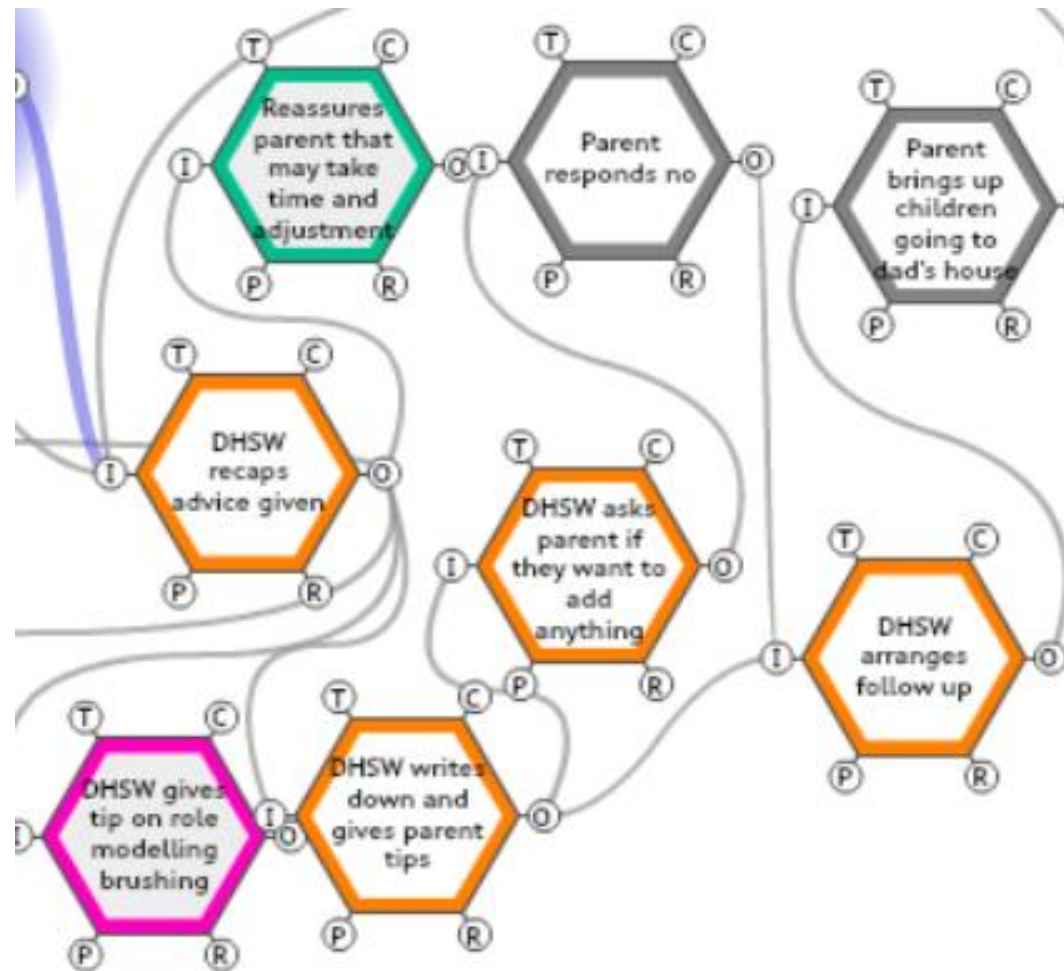

Figure 6-11: DHSW 4 recaps and writes down tips for parent

It can also be seen in the individual DHSWs' FRAM models, that the STAR stages are not necessarily carried out in a linear order and in isolation. DHSWs offered support to the parents throughout the conversation process and also recommended tips at more than one stage during the course of the conversation.

In addition, DHSWs also flexibly incorporated advice regarding fluoride and brushing technique and details of the Childsmile toothbrushing programme, which is information they routinely supply parents with during home visits currently.

6.5.2 Exit interviews following workshop

Each DHSW took part in a semi-structured interview following their interaction with a parent or simulated parent using the STAR tool process. In addition, two parents also completed an interview immediately after their conversation with the DHSW. Overall, both DHSWs and parents gave positive feedback following their participation in the STAR tool process and felt it would be beneficial to use in the home setting. DHSWs also provided details of the context in which they normally provide support to parents during home visits.

6.5.2.1 CFIR Domain – Intervention characteristics: STAR tool revisited

DHSWs again provided feedback and insight into their thoughts on the STAR tool and its design and format overall including how it fits in with their current practice.

6.5.2.1.1 STAR tool general model

DHSWs felt that the STAR tool provided a strong foundation for them to provide advice to parents. They also thought that the STAR tool provides parents with an opportunity to address their own problems.

"We always had advice to give them but this toothbrushing tool is more structured and I think we can learn a lot from it" DHSW 1

"The parents make their own decisions, but we're just giving them the tools to help them to come to a conclusion" DHSW 1

DHSWs also explained that they felt like this process was similar to some of their current practice and they view the STAR tool as an addition to something which they already do during home visits with families and a means to open a conversation with parents regarding toothbrushing barriers.

"This is the way I see it – we are doing this, because we do have families that are finding difficulties with brushing their children's teeth. So I see this as a tool for us, something that we're already doing" DHSW 1

"A lot of it actually folds into what we do anyway. It kind of all fits together" DHSW2

"What I found with the cards is, you know, we cover most of the topics that are on the cards, like, you know, but that just makes it easier for parents to identify with, you know. Which makes our job easier as well, like, you know, if you can pinpoint what the problem or problems are" DHSW 3

It was also thought that the STAR was appropriate and suitable for use during home visits and some DHSWs have experience using similar approaches.

"To me this is, this is for the homes. This is ideal for it. I can't say any more than that, that's spot on for the homes" DHSW 2

"It is something I use. Because I used to do smoking cessation groups and that was the…you know, that was the training we had, the motivational interview. You know, where you have to encourage the patient to talk […] So, it worked well; it works well in a home setting as well, like, you know. Because people want to talk about their problems, they want to talk…you know, it just needs you to say…you know, to try and, sort of, bring it out, by having that discussion with them" DHSW 3

DHSWs stated they would use their own judgement to decide whether it would be suitable or useful to use the STAR tool with certain families, particularly if they don't know them well yet.

"If it's a family I know then I think you, kind of, gauge if there are going to be problems. You get a feel for what their, sort of, life routine is, you know, whether it's chaotic or whether it's organised or, you know, somewhere in between the two, like, you know. So you, kind of, get an idea, so…I mean, it's one of those things I would keep in my work bag, you know, and take with me […] maybe if I'm going for the first time and I don't know the family at all, you know, I would need to ask the questions and see, and then use it" DHSW 3

"It's probably something I would just be taking with me to every visit and I would be having it there in my bag. And in the course of chatting about the baby, if there were older children there and it came up, I would be happy to say oh, I'm really glad you asked me that because I've got this great new resource, very new, and it's specifically for what you've just mentioned" DHSW 4

After an initial visit to a new baby where toothbrushing has not yet started, DHSWs feel that a further visit would be required to follow up on how parent is getting on with toothbrushing, although this is not always currently implemented.

"There was a big gap there for parents in terms of right okay, I'll have a visit from a dental health support worker, I've been to the dentist and now I'm brushing my child's teeth and now I'm experiencing some problems think this […] It might very well be that maybe six months or a year down the line another visit might need to be implemented just to say how are things going with the toothbrushing?" DHSW 4

"with Childsmile, we don't really have follow ups, unless the parent needs help going to the dentist […] but with this you definitely would need a follow up; it might be more than one follow up […] it depends" DHSW 3

While not routine, DHSWs will occasionally contact parents via phone to check how they are getting on. However, it was thought that they are more likely to do a follow up phone call after having used the STAR tool.

"Sometimes we do phone them to see how they got on and we say to the parent, you can give us a phone to see how you got on. But think, this, it's more, aye, we will phone you back" DHSW 1

6.5.2.1.2 Views on use of pictorial barrier cards

DHSWs thought the cards could be used to offer a prompt for parents and provide them with a means to address issues that they perhaps wouldn't otherwise be able to voice or think of at that moment.

"Maybe sometimes they think they've got one difficulty but when they're looking at the cards they'll realise, oh, you know what, no, it's not just that, there's something else. There's another thing that maybe I'm finding hard when it's toothbrushing" DHSW 1

"I loved the idea of the cards because lots of families, they don't know how to express themselves […] There're certain things that even us, will not know how to express it" DHSW 2

Additionally, the use of barriers may help normalise having difficulties with toothbrushing. By presenting a set of potential barriers to parents, it allows them to realise that they are not the only one having these difficulties.

"It think it's good for us and especially for the parents to see…and when they see that there's been these cards done, they realise […] it's not just me. […] There must be other parents that are like me" DHSW 1

"When they see the cards, they know, oh this must be happening to other people. And that can put a parent's mind at ease" DHSW 2

The cards may also be useful when there are language barriers or limitations present. Having pictures representing each barrier means that parents are more likely to understand even if they speak a different language.

"I like the pictures because you can see…even if there's a language barrier, the pictures are quite good, you know" DHSW 1

"That really for my area, pointing to pictures because these pictures are very expressive if that's the right word, that I can, I mean, I know I could read it but I would, kind of, go like that. And they'll say, I, no, I can see in that picture" DHSW 2

DHSWs currently use pictures and other visual aids to parents during home visits so parents are accustomed to these during home visits.

"There's a lot of pictures and I like pictures and I find that the parents do […] so they're quite used to us showing them, you know, things like that" DHSW 1

The cards were also described as being easy to understand and visually appealing.

"They're certainly colourful, they're quite exciting to look at. […] the images themselves are not too wordy, they've got a basic statement about what the picture is trying to portray. So yeah, I do think they're quite good. I think most of them are quite easy to understand what's going on" DHSW 4

"It's so colourful, it's so…'cause it's not a pleasant subject for people, is it really? You know, brushing their kids' teeth and having massive problems with it, it's not a nice thing, nobody loves to go through it. But to look at something that's quite cheerful it's like saying hey, don't worry, it's not as bad as what you think" DHSW 4

DHSWs appreciated that the cards depicted both parents as being responsible for looking after a child's toothbrushing as that is representative of what they see during their visits.

"I really like that there's mums and dads in this […] it really shows that equality there that both parents could be struggling with the toothbrushing, it's not just mummy that does it" DHSW 4

6.5.2.1.3 General design/format of cards

The size of the cards themselves was also a key consideration and it is important that any resources the DHSW brings on a home visit don't take up an excessive amount of space as many family homes may have limited room.

"You're sitting with your bag behind your legs, like that, and, you know, anything you're wanting out has to be compact, you know, and together" DHSW 3

In addition, DHSWs were mindful of COVID-19 and therefore felt it would be necessary that cards could be wiped clean after use.

"The practicality side of it, the less people, especially now with Covid, as well, that touch it, the better. Because if they come out, before I went into the house, I'd be cleaning them and then after I came out, that would be getting cleaned again" DHSW 2

In terms of the physical format or display of the cards, some DHSWs suggested that it may be useful to display the cards in a flipchart as an alternative to the cards being bound with a single ring clip. This would still allow parents to view the picture on the front while the DHSW reads the tips on the back. DHSWs explained how they currently use a similar flipchart format to portray other oral health messages during home visits.

6.5.2.1.4 DHSW thoughts on tips on the back of the cards

While the DHSWs were experienced and had their own way of delivering advice to parents, they felt having the tips on the backs of the cards were useful to provide a guide for them to use for each barrier.

"I actually really like the points being on the card […] because if I was going out to a family and I was going to specifically talk about what's your toothbrushing

issue and I was going to use the cards, I feel comfortable having that there as a guide" DHSW 4

On the backs of the cards, along with the tips, there are also short stand out prompts for DHSWs which can be useful for DHSWs to quickly glance at when speaking with a parent rather than reading through all the tips.

"I really like the stars here, the flash points […] because you can read through all that at some point but when you're in a conversation you don't want to lose eye contact with that person […] having the wee flash points down there that you can very quickly glance at is an added little bonus" DHSW 4

DHSWs thought that they be able to learn and remember the tips and, over time, after using the cards, they may no longer have to refer to the tips on the back of each card.

"Like by the time…once we start using them, we won't need to look at that […] there are 11 different barriers but in time we would […] and we already know […] the tips to give them but this is just showing us maybe in a more structured way to help the parent and to support the parent and praise them" DHSW 1

6.5.2.1.5 Leaving reminders at the end of visit

It was felt that it would be useful to leave behind a way of reminding parents of messages discussed during the home visit as there is often a lot of information given.

"If there were cards that the dental health support worker could write wee tips […] then just lines and we can write tips that we told them to do […] it would be good for the parents because then even if they forgot they can go back to it" DHSW 1

"I do that because I do realise when we speak to families we are sharing a lot of information. They're sharing a lot with us, we're sharing a lot with them. When we go away, if there's nothing recorded it's quite hard to remember everything and to think…and to then incorporate that into another reason why you're not

doing the toothbrushing properly, 'cause I can't remember anything that we spoke about […] So they've got something tangible to show for their efforts really, for that day" DHSW 4

6.5.2.2 CFIR Domain – Outer setting: Wider context

6.5.2.2.1 Organisational structure

DHSWs often receive referrals via the health visitor pathway and referrals can be received regarding both young babies and older children, where the families may require additional support regarding oral health care.

Health visitors will therefore offer parents the option of receiving support from a DHSW at new baby visits.

"Every time the health visitor goes out to see a new baby they speak to the parent about their own health and they ask the parent do you want someone to contact you a wee bit further down the line, the baby's a wee bit older, to chat to you about dental health […] In our team there's probably about a 90 per cent of families that accept that, that say they want that" DHSW 4

DHSWs also receive referrals from health visitors about older children if they have concerns regarding oral health.

"When we visit, the health visitor can tell us about children…not just a Childsmile consultation, it could be for older children that may be transferred in […] the health visitor's got pathways" DHSW 1

Consideration was given to how families could be re-referred to DHSWs if they are having problems with toothbrushing following the initial visit by the DHSW at 3-5 months.

"[the health visitor's] out intermittently as you know, probably. So it might be that once we've done our visit maybe the health visitor, she does a year visit. So it might be at that year visit that she would then maybe ask, how's things going with the toothbrushing? […] I don't know if there's anything in the health

visitor pathway where they actually ask how are things going with the toothbrushing?" DHSW 4

If DHSWs are part of the health visiting team, they thought that approval would first be required from health visiting team leads before introduction of new resources.

"We are Childsmile but now we're under the health visiting team […] so we get our tasks from the health visitors' referrals. So something like this, then you would need to go through, like, the team leads and…well, I think the area…you know, you would need to go through that […] Childsmile gives our money but once it goes to the health visiting team, then, you know, like our wages, then it's up to them what we do" DHSW 1

DHSWs are part of a large team of health visitors and therefore families which they manage can be spread across a large area.

"It ended up that there are now two dental health support workers on our health visiting team, which can be quite confusing at times. But it is a big health visiting team, there are over 20 health visitors on that team […]it is a big area to cover, it's a lot of health visitors to cover" DHSW 3

For some issues raised during the course of the conversation using the STAR tool, there may be a requirement for a DHSW to refer the family back to the health visitor or onto other services. These issues raised may include those that DHSWs would not currently discuss with parents at the moment.

"If there's a problem you might need an outside agency involved to help or pass them on to that agency […] we don't normally discuss anything to do with, like, money, finances, but if I go into a house and the family, a parent does say anything like, they've got a problem with breastfeeding or they've got problems with money, all these kinds of things. I'll say, I'll let your health visitor know today. There're certain things on these cards that I normally would not approach" DHSW 2

Issues regarding staff shortages were also raised. One DHSW described struggling to carry out home visits as she was covering another DHSW's area after they left. This meant that she was usually only able to support families over the phone rather than carry out home visits.

"I was covering [area of Glasgow] for the first year, myself. Which, when you're making phone calls or texting or whatever, then it's not too bad, but I was struggling 'cause I only work three days […] I was struggling with it so I had to ask [other DHSWs] to help me […] I did say there is no way that I can do visits. You know, I only do if it's absolutely necessary, if the health visitor asks for a face-to-face visit, and if there are any other issues I'll go out and do a visit. But otherwise, everything…all other contact at this moment in time is by phone" DHSW 3

6.5.2.2.2   Impact of COVID-19 pandemic

The pandemic has changed the model of delivery that DHSWs provide, from previously carrying out all home visits to a family to now increasingly carrying out phone calls and only visiting if a family requires more intensive support. This new model may present an opportunity to allow DHSWs to spend more time on home visits to carry out the STAR process due to phone calls being less time consuming than visits.

"We always did home visits before the pandemic if a family wanted a home visit, but during the pandemic obviously the health visiting team and myself, we weren't visiting families at home, it was all done over the 'phone. Now it's a kind of mixed model, working I do phone calls and home visits. So going forward, I don't know how that's going to look. I know that our line manager has said that they're looking to stick with that mixed model of phone calls, maybe to parents that have already got children, have already had the information previously. And home visits would be for first-time parents or families that have additional needs, maybe perhaps social work interventions or that type of thing" DHSW 4

"I think the pandemic has possibly opened the way for more time to be created for this […]the parents that might want a bit more help with some of the issues on these cards, we will have the time, I believe, to go and do that" DHSW 4

6.5.2.3 CFIR Domain - Outer setting: Families seen during home visits

As discussed in previous DHSWs interviews (see section 5.5.1) DHSWs again described the families they usually visit during home visits, including different factors that can impact on the level or type of support they provide to the families.

6.5.2.3.1 Social aspects

DHSWs discussed the social isolation experienced by some parents or carers of young children and explained that not all parents have a social network that can provide support if they are having difficulties with toothbrushing.

"But not everyone has that group of friends that have got young children. Especially if they came from abroad and they don't have friends or family here" DHSW 1

As previously discussed in Chapter 5, DHSWs visit families from varied social backgrounds and from a range of socioeconomic circumstances and pointed out that there may be difficulties with toothbrushing regardless of these circumstances.

"You visit different families from every, you know, walk of life and you get used to that" DHSW 1

"I think [The STAR tool]'s suitable for all families, you know. If there's a problem with toothbrushing, it doesn't matter which family it is, they do have a problem" DHSW 1

In addition, some families requiring support from DHSWs may have issues with poverty or addiction.

"There is a high level of poverty and addictions in those areas […] it can be quite challenging at times, you know, going in. Especially if it's a family where there are addictions" DHSW 3

6.5.2.3.2 Parent/carer engagement with DHSWs

DHSWs expressed that they can experience difficulties providing support to parents during home visits due to varying levels or lack of engagement from parents or carers. With some families, they may experience a lack of interaction, however other parents/carers may show higher levels of engagement by, for example, asking questions.

"There's always the hard to reach, you know, and sometimes you've just got to put your hands up and say, I don't know what else to do for you, you know. And sometimes people…you walk away, and people have got a middle parting because everything's just been whoosh, you know" DHSW 3

"I could be in a family when I'm doing Childsmile for about maybe between half an hour and 45 minutes, it depends […] 'cause you'll get a parent that asks a lot of questions and you'll get parents that, you know, just sit there and just listen" DHSW 1

For some families, caring for a child's oral health, including toothbrushing, may not be a priority, particularly in households where there are other issues involved.

"Toothbrushing and child healthcare is not a priority. Even generally, childcare is not a priority, you know, and that can be really difficult" DHSW 3

6.5.2.3.3 Cultural background

DHSWs often visit families who speak a different language which can present barriers and can often be an issue even if an interpreter is present as the DHSWs message to the parent can sometimes be lost in translation.

"A lot of times in the area that I'm in, it could be the same with other areas, there is that language barrier. See, even with an interpreter, sometimes the interpreter will say, I don't how, really to word that in your language. Or sometimes the parent will say something but they're not really sure how to say it in our language […] even although there's an interpreter or whatever, there's still language barriers" DHSW 2

In addition, many families may have moved recently to Glasgow from other countries and may have a different cultural background, which some DHSWs find challenging.

"Recently there's been a high influx of transfers in; families coming in from India and Arabic countries are there, you know. And that can be quite difficult; it's different cultures" DHSW 3

6.5.2.3.4 Family group

While visiting families with a young baby for whom toothbrushing is not yet required, DHSWs will often give advice to parents regarding older siblings, particularly if parents express concerns about brushing for these children.

"These babies have siblings that are older, and we do have families that would say to us, oh see my older child, they'll not let me brush their teeth" DHSW 1

"There could be some older children in the house that have got teeth that the mum might want to chat about the toothbrushing with" DHSW 4

There can also be a variety of living arrangement for children from families visited by DHSWs and children may live between different households and with different family members in the house.

"I've been to a few families where I've taken…I've been, you know…to get them to go to the dental practice […] there's one time I went in, and I chapped the door, and this wee girl was staying with her boyfriend's parents. And it was the granny answered the door and she said, she's still in her bed" DHSW 3

6.5.2.4 CFIR Domain – Inner setting: Home visits/setting

DHSWs provide context regarding their normal practice during home visits and the format of these visits.

6.5.2.4.1 Initial visit

As previously discussed in Chapter 5, DHSWs usually first visit a family when the child is very young, often around 3-5 months old so parents haven't started toothbrushing yet. DHSWs will often still try to give parents advice regarding toothbrushing, in preparation for commencing once the child's teeth have erupted. This is relevant to the STAR tool as parents are required to select a toothbrushing barrier to explain a difficulty they are currently having with toothbrushing. DHSWs would therefore be unable to use the STAR tool during these first visits when the child is very young.

"So we do visit newborn babies. Well they're about three months old" DHSW 1

"Most of the time when I'm visiting, because the children are still so young – they're mostly under six months – the children don't have any teeth yet […] mainly it's babies so it's like preparatory advice, as it were" DHSW 4

There may often not be a lot of free space to lay out any resources a DHSW may want to use during home visits, so it is important that the new tool will not require a lot of space to be used.

"You won't have […] usually the coffee table's got things on it" DHSW 1

"When [other DHSW] was spreading them out on the table, I thought, I kept thinking, maybe not ideal for most of the homes I would go to. But I would go over them page by page with them" DHSW 2

When considering the length of time it may require to have a supportive conversation using the STAR tool, DHSWs gave details of how long they usually spend with families during home visits. DHSWs spend a varying amount of time in

a home during a visit depending on the needs of the family and can be flexible with this if needed.

"Some houses you can be in for an hour and you're still saying just the same amount as what you were saying to some other house that you were in. It depends on the family" DHSW 2

6.5.2.4.2   Other interventions delivered during home visits

DHSWs provide families with a wide range of advice, not only relating to toothbrushing but also with regards to teething and weaning. They give advice regarding recommended best practice for toothbrushing and can carry out a toothbrushing demonstration on a model. They also provide advice on diet and help families register with a dental practice. In addition, they give families a toothbrushing pack including a toothbrush and toothpaste, and an appropriate drinking cup.

"We then discuss the use of non-medicated and medicated teething remedies […] we are going through the dry toothbrushing, just explaining to parents how much toothpaste to put on the brush, when's the best times of day to do the toothbrushing – morning and night – we're talking about using the correct fluoride in the toothpaste and we give the wee dental pack [..]
Registering and attending, we sort of stress both of them. It's great to register a baby with the dentist, even better if you take them along […]if the baby's already weaning or the mum is looking for that advice, I would definitely cover that at home" DHSW 4

DHSWs currently use pictures and other visual aids to parents during home visits so parents are accustomed to these during home visits.

"There's a lot of pictures and I like pictures and I find that the parents do […] so they're quite used to us showing them, you know, things like that" DHSW 1

6.5.2.5 CFIR Domain – Process: Planning and implementation

6.5.2.5.1 Training

DHSWs described the format of training which they think might be useful when considering future training on the use of the STAR tool. DHSWs like the idea of role-play and this is something they are familiar with from other training they have previously completed.

"With the mock-ups as well […] [other DHSW] and I are the same, we enjoy…what's the word? Role play […] We've done role play a few times and…so, you know some people are really awkward about it, they don't like doing it, but I like getting into the…you know, into character" DHSW 3

DHSWs thought that use of video-based examples may be useful to use in training on use of STAR tool, as an alternative to role play.

"I think there should be […] maybe video examples for you goes on the training to see. 'Cause, like, sometimes not everyone likes to […] do a mock […] role play type" DHSW 1

"Useful, to put a wee bit of role play on a video and let people see, for example, best practice and utterly terrible practice. Do you know what I mean? And have like wee group discussions about what we've just seen […] that kind of gives people a clearer idea of the best way to approach this with your families" DHSW 4

DHSW training needs may vary depending on level of experience and what previous training they have received as this may vary between DHSWs.

"To be honest with you, the training that they get now is not the training we did […] they covered all bases with us. 'Cause we did six weeks training; intensive, you know, every day for six weeks. […] we covered everything – child protection, you know, absolutely everything that you can think of. Poverty, you know, all this sort of thing. But obviously it's more focused now and I think that would be…that would be what you would need to do, is to be…you know, to give

us a wider picture and then focus in on the cards and such-like. You know, the tool" DHSW 3

DHSWs explained their thoughts experiences on using actors to receive training on the STAR tool. Although it felt a bit unfamiliar to DHSWs, it can be beneficial to try out the use of the STAR tool initially with an actor to allow DHSWs to practise and prepare.

"I still liked the ideas of starting with the actors to, for preparation, if that's the right word. Although it was strange, I still preferred it that way. Because it prepared me, it let me get to read them and look at them a few times, myself. Get a wee bit of, familiar with that, as well, before I was with a family […] although I felt a bit funny, you know, I still liked that. It gave me that wee opportunity to practise a bit with it" DHSW 2

"I was so glad we'd had that session, like, you know. Because it can be quite awkward when you're introducing something; when you're going into somebody's home, like, you know, and you're trying to introduce something new to them. But yeah, that was very beneficial" DHSW 3

6.5.2.5.2 DHSW skills

DHSWs explained that they are experienced at delivering advice and have their own way to deliver all necessary advice to parents.

"The more you do it, the more it will come naturally to you […] when I'm out doing the Childsmile talk, I feel like I've pressed a button and it all flows out […] I've got it in a way that I don't miss anything" DHSW 1

"It's like my normal spiel, as I say. I know it like the back of my hand" DHSW 2

"you've got set pieces of information that you're going to impart, you've got set things you're going to chat about but it's not scripted because you don't know at any minute what that parent is going to come out with really" DHSW 4

DHSWs often visit family homes where there is a lot going on and there may be multiple issues which they need to identify as families may not always express these to DHSWs.

"You go into a house, and you can see it's chaotic. So, you know there's stress, you know there could be other things, but families are not always good at telling you that. You use your eyes and your ears lots of times. You're a detective going into a house, I can assure you. It's like trying to draw blood out a stone" DHSW 2

Some other DHSWs may not be receptive to the introduction of a new intervention and it was explained that it may feel to some that it seems like they are being given more work to do.

"I can tell you some of the other workers would go, 'ppfh', another job on top of what we've got. I'm being honest, you know, like because even when we were told about this, you know they weren't, like, keen" DHSW1

"I could probably say quite safely 95 per cent of dental support workers will be absolutely ecstatic about having something like this to work with. There might be the odd one or two that are not, but once they see how well it works […] they'll come onboard with it […] it's easy to get comfortable with what you've been using for so many years and then something new comes along and you think, what do I need that for? I'm getting along pretty well without. There might be a wee element of that in some people" DHSW 4

It was felt that workers other than DHSWs could be trained in the use of the STAR tool due to ease of use which could be useful if DHSWs are unavailable.

"We have support workers that do help parents with potty training, bed wetting, sleep. So, like, I don't think you need to be a dental health support worker if you have this tool […] if maybe there was a shortage of dental health support workers because […] they're off sick or something, I think it's easy to pick up this. You know, anyone could really pick it up" DHSW 1

DHSWs explained that they would feel more comfortable carrying the process out in the home setting (as opposed to the simulation) as it would be more realistic and familiar to what they would normally do. They also felt more comfortable with the family compared with the actor expressing that it felt more natural to them. When a DHSW visits a family, they normally have some background information and an idea of some of the issues they may be having and they therefore reported that it felt slightly 'awkward' starting the conversation in the simulated environment without this information.

DHSWs took between 20-30 minutes to carry out the STAR tool intervention with parents and actors. All DHSWs expressed that this length of time wouldn't present an issue and they could fit it in to their current home visit routine.

6.5.2.6 Parent views on STAR tool

Parents liked the cards and felt that they reflected issues that were realistic to their own experiences. Similar to the DHSWs, parents also thought that having a set of barriers presented to them, allowed them to realise that these are common issues often faced by other parents also.

"I really like the cards and sort of how they put on a piece of paper with something that just sort of clear and concise and it's written, sort of all the issues that I faced" Parent 1

"The pictures were very very relatable to the moments I've had especially at the point where she wasn't letting me go near her mouth. And that scene of the mum sitting with the frowny face and the child just sort of refusing, that's pretty much exactly what I went through. So that was really relatable, that was quite good" Parent 1

"I guess it makes you think that they're quite common problems. So problems that you are having you then think well a lot of people must be having them if they've got cards for them so that was good. And like certainly some that I could identify with" Parent 2

The parents also stated that they were willing to try the tips given to them by the DHSWs and thought they would be beneficial to them and their families.

"Yeah absolutely, definitely. I mean I was kind of looking in to the whole situation myself as well with the whole stress aspect […] You know so it's things like that, you know I think that would definitely help, yeah" Parent 1

"Yes, I think we'll try. We'll definitely try letting him do my teeth and see […] this is maybe another way of managing it" Parent 2

The parents felt the cards were easy to understand and read and felt it didn't take them too long to go through each card.

"The wording it was you know, really good, easy to read, sort of short and snappy […] bright coloured pictures and short snappy words which helped a lot. I wasn't reading loads or spending loads of time on one card before moving on to the next. So it was laid out, you could just see 'oh yeah xyz was what I faced' Yeah" Parent 1

6.5.3 Six week follow up with parents

Follow up interviews with parent participants were undertaken six weeks following the workshop via telephone. Parents gave their experiences of using the strategies discussed with them by DHSWs during their use of the STAR tool process.

Parents expressed that they found the strategies useful and had been able to incorporate the strategies received during the workshop into their routines make beneficial changes to the toothbrushing process.

"So we'd spoken about, you know, picking our battles and try to just focus on the moment and not worrying too much about other things that are not present. And I think I've been trying to focus on that and that's helped a lot. And you know, something like that can actually help so much in terms of doing, you know, things like brushing the kids' teeth. And if I'm having a stressful day or night and it's time to brush their teeth, well, it's about parking the other

thoughts and just focusing on what's in front of you right now. So that, that's been quite helpful." Parent 1

"We play this game, again it's having the time to play this game, that we brush, if I brush her teeth then she ends up with princess teeth, which she loves because she's obsessed with princesses just now [...] So I'll say to her, well you have a shot at it first and then when I do it, they turn into princess teeth. So she's been doing that and she's letting me do it which is the main thing. Yeah so definitely, it definitely has been having a direct impact in getting her to actually brush her teeth and let me do it and do it right." Parent 1

"I think in particular the one about trying to get him to brush my teeth and then brushing his afterwards was quite a good idea. Because he still likes to brush his own and then what we'll tend to do afterwards is then me will go in and kind of brush them properly. I think he does it at the front ok, or he sucks it mainly, but I let him do that and then he's kind of quite happy for me to take over and then do them. So I think that's probably the most helpful tip I got." Parent 2

Parents were also able to apply strategies regarding routine and stress management to other areas regarding their child's wellbeing, such as diet and nutrition.

"If you look at sort of the whole picture, it impacts every little aspect doesn't it? So, previously if I was stressed out about something, I would just give them a quick option to eat, which usually is something unhealthy. But now, you know, it's about being prepared. And for example, this morning, I've just done the school run and I know in the car, [child name] who was with me that day, she's obviously not at school yet. In the car, she always wants a wee something, so it's about being organised and prepared and I've had time to make her up a wee healthy snack box and cut her up some, I think apples and grapes she's got today. So the fact that I've been in a wee bit more control and that's allowed me then to prepare something, I've had the time to prepare something healthy." Parent 1

It was felt that the cards were a useful tool and would have most benefit when used at the early stages when commencing toothbrushing when a child is very young.

"I think the cards were good, I think it would have been good to have been given them like right at the beginning. Like right when they were really small and were just starting with brushing." Parent 2

Additionally, as mentioned previously by parents, the cards allow parents to realise that these are common issues, and they are not the only ones experiencing them. This experience of relating to other parents was something that was felt to have been missed out on during the lockdown period as a result of the Covid-19 pandemic.

"And also, it was quite good to see sort of possible problems then you'd maybe feel like right I'm not the only one. Whereas I think, partly with lockdown as well, you didn't really discuss with other people so you didn't really know like, so are all children terrible at getting their teeth done or is it just mine? So that would have been quite helpful." Parent 2

6.5.4 Changes to STAR tool

Following the feedback from the results of the simulation, minor changes were made to some of the illustrations and some wording of the text.

There was some feedback from DHSWs regarding some barrier card illustrations not being obvious enough about what they were trying to portray. The illustrations were therefore altered to make clearer based on this feedback. The barrier cards which were changed were Barrier 3 "I often think I am not brushing my child's teeth in the right way" and Barrier 10 "The information I get doesn't seem to be for people like me".

For barrier 3, feedback from DHSWs received during the exit interviews was that they thought the illustration could be clearer in its demonstration of the fact that the parent was confused or worried that they were not brushing their child's teeth in the correct way. DHSWs gave the suggestion of adding question

marks to the illustration as a way to make the card more obvious and the card was subsequently updated to reflect DHSW feedback (Figure 6-12).
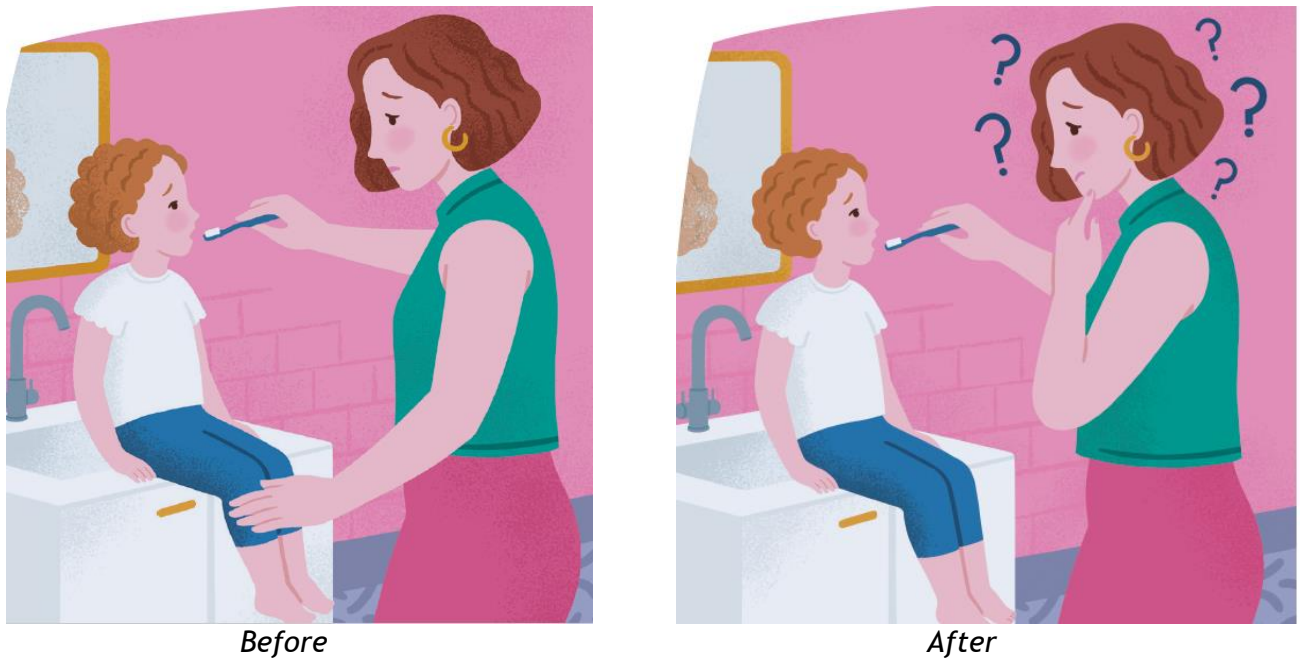

Before   *After*

Figure 6-12: Before and after illustrations for barrier card 3

Feedback was also received from DHSWs regarding changes which should be made to barrier card 10, "The information I get doesn't seem to be for people like me". It was felt that the inclusion of an interpreter to the conversation between the DHSW and parent was more likely to act as a facilitator to aiding communication rather than demonstrating a barrier. It was therefore felt that it would make more sense to exclude the interpreter from the illustration, to demonstrate a parent struggling to communicate with a DHSW. In addition, the illustration was updated to include the DHSW wearing their standard uniform to make clearer the roles of the people in the illustration. Figure 6-13 demonstrates the illustration for barrier card 10 before the simulation workshop and the updated card following feedback.
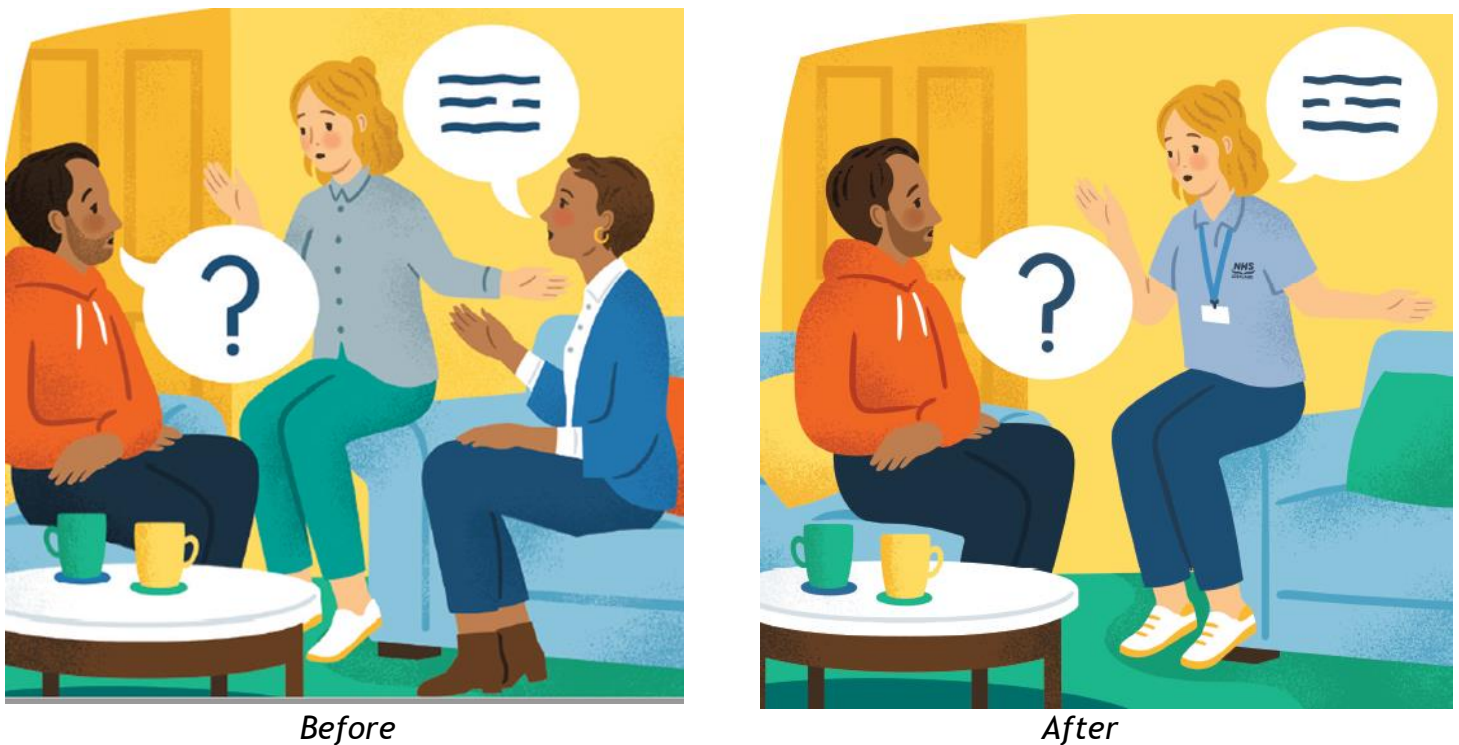
Before   *After*

Figure 6-13: Before and after illustrations for barrier card 10

6.6 Summary

The aim of this study was to test the feasibility and acceptability of the STAR tool intervention. This was achieved by simulating the interaction between DHSWs and parents in a controlled environment. Research activities carried out in a simulated environment is increasingly used in healthcare, particularly for educational purposes and increasingly as translational simulations as described previously. This allows processes to be tested and also the exploration and rehearsal of tools and interventions before they are put into use. Within this environment, DHSWs were able to try out the use of the STAR tool with parents and it was possible for researchers to observe this interaction and subsequently analyse the data. Each DHSW completed all stages of the STAR process during the course of their conversation and were able to give tailored toothbrushing support to parents based on this discussion and the card chosen by the parent. All DHSWs who took part had a number of years of experience working with parents and carrying out home visits to provide oral health support. The analysis was able to show how DHSWs were able to use the tool flexibly and use in a way which fit with their communication style. They were able to adapt to the circumstances of each parent and keep a conversation flowing while remaining

true to the design and intent of the process. In addition, DHSWs delivered their usual oral health support which they give during home visits, including information on the Childsmile nursery toothbrushing programme and registering with a dentist.

The use of FRAM as a means of analysis of processes is becoming more commonly used, however it has rarely been used to analyse a conversation-based activity. To our knowledge, this is the first use for modelling the complexity of a conversational intervention. It allowed for the mapping of how the STAR tool is used in reality as opposed to only in theory and the variability in how different DHSWs may choose to carry out the process.

The FRAM analysis of the DHSW and parent interaction was used to aid in the development of a training package to introduce the STAR tool intervention to other DHSWs. By reviewing the FRAM model, it was possible to see areas where DHSWs were more comfortable and those in which they were more unsure. Future training in the use of the STAR tool will therefore be more focused on areas in which they struggled slightly more with or appeared less comfortable with.

Both DHSWs and parents responded positively to the use of the STAR tool. DHSWs felt that it was a useful tool and would be feasible to use in the home setting with parents.

The feedback received from DHSWs and parents during the exit interviews was also used to make minor adjustments to the STAR tool design including alterations to some illustrations and slight changes in the wording of the text.

Chapter 7   Discussion

The oral health of children in Scotland, particularly with regards to dental caries, continues to be a public health issue. While there have been improvements observed in the overall levels of decay in children in Scotland, inequalities have persisted with children living in the most socioeconomically deprived areas having higher levels of caries experience than those living in the least socioeconomically deprived areas.

The Childsmile programme was introduced to tackle the growing issue of poor child oral health in Scotland. Additionally, the programme aims to reduce inequalities in both child oral health and access to dental services. One component of the Childsmile programme is the universal supervised toothbrushing programme available to all children attending nurseries in Scotland. As previously outlined in Chapter 1, this toothbrushing programme has been found to be effective at reducing dental caries in children, with the highest level of impact seen in children living in the most deprived areas (Kidd et al., 2020). However, there are many children who experience tooth decay before they reach nursery age (approximately 2-3 years old) (McMahon et al., 2011) and therefore receive the benefit of the toothbrushing programme. Consequently, there is a need for additional interventions that reach children at an earlier age.

Dental Health Support Workers work within the Childsmile programme and can provide support, including regarding toothbrushing, to families who require additional input in the home setting. DHSWs have previously been found to be effective at linking families with primary dental care services, with those children first attending the dentist earlier than those who hadn't received DHSW input (Hodgins et al., 2018). In Childsmile data linkage outcome evaluation, DHSWs were shown to not be as targeted to the most vulnerable children as envisaged when the DHSW role was first conceived (Kidd et al., 2020). However, the DHSW role could still be further optimised such that DHSWs can provide more targeted and tailored interventions to families who require additional input. In addition, it is important that these interventions are carried out at a young age to ensure that preventive behaviours embed in the early years to reduce the chances of dental caries occurring.

The Uitblinkers intervention is a Dutch behaviour change intervention for parents to promote twice daily toothbrushing in children aged 2-10 years (de Jong-Lenters et al., 2019). It is delivered within the Netherlands by dental care professionals, such as dental therapists, in the practice setting and identifies and addresses parental barriers to toothbrushing by using principles from social learning theory (Bandura, 1977). Uitblinkers demonstrated some benefit to children attending dental practice in the Netherlands. The target group of Uitblinkers are the parents/carers children already attending dental practice, therefore it is likely that this groups is already somewhat more motivated and able to change behaviour. In Scotland, universal supervised toothbrushing is happening in nursery schools, but pre-nursery, in families where children are not yet attending dental practice, only DHSWs can effect any change. DHSWs are effective at linking families with dental practice, however there is scope to further enhance their role and provide support to DHSWs to provide more targeted and tailored interventions to families requiring additional input. The Uitblinkers intervention, was considered as a potentially useful addition to the current support and interventions provided by DHSWs during home visits. In order to fit the Scottish context, the Uitblinkers intervention required adaptation to be delivered by DHSWs in the home setting to families with young children (age 0-3 years) who require additional support.

The aim of this research was to adapt the Uitblinkers intervention with the goal of optimising family toothbrushing behaviours for families who require additional support in Scotland and who may not yet be attending general dental practice. A pragmatic approach was taken in the research, through the three main studies. The first study identified the most important barriers which should be addressed by the new adapted intervention and the most appropriate behaviour strategies and approaches which could be used to address the barriers. The second study gained insight from DHSWs working across Scotland into their current role delivering home visits, feedback on the new intervention and how this would fit in with their current practice. The third study explored how the new intervention could be delivered by DHSWs in a simulated setting and gained feedback from both DHSWs and parents on how useful and acceptable they found the intervention. There were potential barriers to full scale roll out which were identified during the process which may require additional considerations. These

include for DHSWs who only visit a family once, DHSWs who only carry out home visits when the child is very young and before toothbrushing has started, children with additional support needs and families in which English is not their first language.

This chapter will provide an outline and discussion of the results of the research, the strengths and limitations and finally conclusions will be drawn and recommendations for next stages will be set out.

7.1 Main findings

7.1.1 Study 1: Identifying barriers to parental supervised toothbrushing and strategies to address them for adapted tool

The Uitblinkers intervention is targeted towards parents/carers of children attending dental practice in the Netherlands. It was required that Uitblinkers be modified to be suitable for the context of being delivered by DHSWs during home visits to families who would benefit from extra input. This required expanding and prioritising the set of parental home toothbrushing barriers to be addressed by the new intervention and considering the appropriateness of the strategies and overall approach to address these barriers.

Expert opinion was gained via a modified Delphi process and resulted in a set of 11 barriers to parental home toothbrushing being validated as being of highest priority to include in new intervention. The expert panel prioritised and validated the barriers list presented to them indicating a robust list as they opted not to exclude any of the barriers presented to them in the initial two rounds. In addition, expert opinion confirmed the suitability of the overall approach and the psychological strategies to tackle the barriers.

The Delphi process has previously been used successfully to prioritise key areas which should be focused on within child interventions. For example, Perry and colleagues (2021) used the Delphi method to gain consensus from stakeholders on the areas they thought were most important to be targeted by school-based

ADHD (attention deficit/hyperactivity disorder) interventions (Perry et al., 2021). One hundred and fourteen stakeholders across four groups rated the level of priority of 52 outcomes which should be targeted by school-based interventions. The initial list of outcomes had been gathered from a literature search and included both outcomes which had previously been included in existing interventions and those which were unstudied. This process resulted in the stakeholders reaching consensus regarding seven of the outcomes, which they regarded as being most important to be targeted by interventions.

The 11 barriers which were prioritised for inclusion in the STAR intervention were:

- Difficult child behaviour
- Structures and routines
- Parent/carer capability
- Social setting and influences
- Parent/carer attitudes or motivation
- Time constraints
- Parent/carer self-care
- Cultural barriers
- Child appears upset/child tired
- Family resources
- Parent/carer knowledge and complicated advice

This appears to be the first time that parental home toothbrushing barriers have been prioritised for inclusion in new intervention. Aliakbari et al (2021) conducted a systematic review to investigate the barriers (and facilitators) to toothbrushing behaviours in the home by parents of young children (Aliakbari et al., 2021b, Aliakbari et al., 2020). All of the barriers included in the list generated by the Delphi study were reported in the results of the systematic review. The systematic review found that the most common barriers, presented by TDF domain, were knowledge (e.g. knowledge around toothbrushing), environmental context and resources (e.g. busy schedules and competing demands), and behavioural regulation (e.g. child's behaviour). This would appear to align with the findings of the Delphi study, in which 'Difficult child behaviour' and 'Structures and routines' were rated as being of the highest priority to be included in the new intervention. However, "Parent/carer

knowledge" was not rated highly by the expert panel as being a priority for inclusion, with just 62% of respondents agreeing it is a priority. Despite this, there was a lack of consensus that this barrier should be excluded (25% agreement on exclusion) from the intervention and subsequently it was combined with another barrier and included in the intervention. It should be noted, however, that in the previously referenced systematic review (Aliakbari et al., 2021b, Aliakbari et al., 2021a), when only papers of the highest quality were taken in to consideration, knowledge no longer appeared as a barrier (or facilitator). As previously mentioned, interventions which focus solely on providing knowledge are not effective at bringing about behaviour change (Kay and Locker, 1996, Schou and Wight, 1994, Qadri et al., 2018). It has been found that parental home toothbrushing barriers often relate more to the setting and context in which toothbrushing is to be carried out rather than simply requiring knowledge of what to do (Marshman et al., 2016).

Busy routines and varying structures of how day to day life plays out for families was prioritised as a crucial barrier for inclusion in the new intervention. This is a barrier which was commonly reported by parents as making toothbrushing for their child difficult (Duijster et al., 2015, Marshman et al., 2016, Amin and Harrison, 2009, Mofidi et al., 2009, Virgo-Milton et al., 2016, van Nes et al., 2018). Similarly highly rated during the Delphi process as being a significant barrier was related to difficulties with child behaviour such as child refusal to allow brushing to take place. This is frequently outlined by parents as resulting in issues with child toothbrushing (van Nes et al., 2018, Duijster et al., 2015, Marshman et al., 2016, Elison et al., 2014).

Eleven barriers were prioritised as being of highest importance to be included in the new intervention. These barriers span the range of categories as being child-related, parent/carer related or family environment related barriers. This demonstrates the scope of barriers which families may come across when carrying out toothbrushing for a young child. It is therefore important that those delivering child oral health care interventions work in tandem with parents, allowing parents to uncover the specific barriers they face and work together to find appropriate strategies and solutions. DHSWs will deliver the new intervention, the STAR tool, to parents in the home setting. By allowing parents

to be involved in the process and select from a range of barriers, DHSWs will be in a position to deliver tailored support to the families, relevant to their situation and circumstances.

The Uitblinkers intervention has a set of nine barrier cards, later reduced to seven cards. The Delphi process resulted in 11 barriers being brought forward for inclusion in the STAR tool. All barriers from the Uitblinkers intervention are included in the STAR tool barriers although some barriers are combined in the STAR tool which are standalone in the Uitblinkers intervention. For example, Uitblinkers has separate barriers for toothbrushing being difficult as a result of being busy in both the morning and evening, whereas this is covered under the same barrier ('Time constraints') in the STAR tool. Additional STAR tool barriers which are not covered by the Uitblinkers intervention include 'Social setting and influences', 'Parent/carer capability', 'Parent/carer attitudes or motivation', 'Cultural barriers', 'Family resources' and 'Parent/carer knowledge and complicated advice'.

The inclusion of additional barriers in the STAR tool compared to the Uitblinkers intervention is as a result of the STAR tool being targeted towards a different population. Uitblinkers is delivered by dental care professionals to parents of children attending dental practice whereas the STAR tool is targeted to families with young children who require additional support with caring for their child's oral health and may not yet be attending dental practice. Parents who are already bringing their child to a dentist, may be more motivated and further along in the process of caring for their child's oral health. Parents who are more highly motivated to brush their child's teeth, may then go on to actually carry out the behaviour (Marshman et al., 2016, Trubey et al., 2014, Adiatman et al., 2017, Hamilton et al., 2018). The STAR tool uses principles from motivational interviewing to facilitate the process of DHSWs providing tailored toothbrushing support to parents/carers of young children. The process of motivational interviewing is an approach which is already familiar to DHSWs as teaching on this approach is currently delivered to DHSWs during their standard training.

7.1.2 Study 2: Development of the tool alongside DHSWs

The second study of this research involved undertaking semi-structured interviews with DHSWs who carry out home visits in Scotland as part of their regular role. DHSWs explained the current context in which they deliver support to families in the home setting. DHSWs felt the STAR tool would be a useful addition to their current practice, benefiting both themselves and the families they visit. It was felt that the use of the STAR tool would provide DHSWs with a structured approach to provide support and provide parents with a means to voice specific toothbrushing concerns. DHSWs also provided feedback on the format of the new tool including insight into the physical format the barrier cards should take and what they should look like.

All DHSWs who took part in this part of the study were experienced, having worked in the role for several years. They are confident and comfortable with delivering oral health support to families with young children during home visits. While each DHSW had their own way of delivering this support, they were supported by the current Childsmile resources and leaflets on child oral health which they referred to as the 'big yellow book'. DHSWs play a unique role in that they are health support workers in Scotland, dedicated to delivering oral health support in the community, including visits to families' homes.

The DHSW role exist only in Scotland however, and in other areas of the United Kingdom there are differences in how child oral health support is delivered in the home setting. Eskyte et al (2021) undertook qualitative interviews and focus groups with health visitors (n=18) who delivered home visits to parents of young children aged 9-12 months (Eskyte et al., 2021). The health visitors worked in a deprived, urban area in England. Researchers asked the health visitors about factors which impact on their ability to deliver oral health support to parents during their home visits. It was found that, due to the range of topics regarding child development required to be covered during the visit, there was often limited time to discuss topics in depth and oral health was often not a priority for discussion. In addition, health visitors reported having limited or, in some cases, no oral health resources such as leaflets that they were able to provide to parents. This was reported to be due to differences in organisational structure

and finance cuts. All health visitors who participated in the interviews had some gaps in their knowledge regarding child oral health and many did not feel confident about delivering oral health advice and support to parents. While all health visitors receive some level of oral health training, it was reported that this was a one-off, with health visitors being required to seek out extra training if they wanted to update or further their skills and knowledge. The findings of this research were included in the development process of the HABIT intervention (Eskyte et al., 2018), which is discussed later in this chapter.

The Consolidated Framework for Implementation Research (CFIR) (see section 3.1.4) was used to aid the analysis process with findings being presented under the CFIR constructs of 'Outer setting', 'Intervention characteristics', 'Inner setting', 'Process' and 'Characteristics of individuals'. The results of the interviews aided with the development of the intervention resources, leading to a prototype STAR tool which was used in the next phase of research. It has been suggested that qualitative research can allow developers of an intervention to identify factors which may have an impact on the intervention outcome, allowing them to subsequently tailor the intervention which may then lead to the intervention being more likely to be accepted and effective (O'Brien et al., 2016).

Qualitative research methods involving healthcare workers are commonly used to assist in the development of new interventions to target a range of health outcomes, as outlined in a rapid overview of reviews on the co-design process within healthcare (Slattery et al., 2020). For example, O'Malley et al (2020) conducted focus groups with a range of healthcare professionals involved in the oral care of stroke survivors living in the community (O'Malley et al., 2020). They outlined the current issues they see when delivering care and suggested factors which they think could lead to improvements in oral health. The results of this qualitative research were used in the process of developing an intervention to support stroke survivors with their oral care after they transition from hospital care to living at home (Lievesley et al., 2022). Qualitative interviews with healthcare professionals were also undertaken in the development of an intervention to support family members and friends when sharing news of lung cancer diagnosis (Ewing et al., 2016). Healthcare professionals including

respiratory physicians and consultants and nurse specialists took part in focus groups and individual interviews. They discussed their experiences in diagnosis giving, experiences in supporting patients with sharing bad news, and suggested potential approaches for supporting patients in sharing bad news with others. The results of this qualitative research then fed into a further workshop with healthcare professionals which led to the development of a supportive framework to guide patients and professionals in the sharing of bad news regarding lung cancer diagnosis (Ewing et al., 2016).

Another example of an intervention which has been developed to improve young children's toothbrushing in the home setting in the United Kingdom is HABIT (Health visitors delivering Advice in Britain on Infant Toothbrushing) (Eskyte et al., 2018). HABIT is an intervention delivered by health visitors working in a deprived city in England which aims to improve parental supervised toothbrushing in infancy. The intervention involves the delivery of training to health visitors and provision of oral health resources to parents. The one-day training for health visitors includes topics such as general oral health messages as well as knowledge regarding toothbrushing and diet. The training also includes details on how health visitors can use the HABIT resources to bring about discussions regarding behaviour change with parents. The HABIT resources have been designed to support parents in commencing and maintaining preventative oral health behaviours for their child. The resources include short video vignettes, simple advice sheets and the provision of a toothbrush and toothpaste. An early phase feasibility study of the HABIT intervention was carried out by Giles and colleagues in Bradford, United Kingdom (Giles et al., 2022). The researchers recruited health visitors trained in HABIT (n=11) and parents (n=35) of young children (age 9-12 months) receiving their universal health visitor check up appointments. The outcome measures were self-reported toothbrushing behaviours, dietary habits and three different objective measures of toothbrushing recorded at baseline, two weeks and three months following the intervention delivery. The measures of toothbrushing were a dental examination, plaque scores and duration of toothbrushing during a video recording of the toothbrushing process between parent and child. With regards to self-reported toothbrushing behaviours, there was an improvement in toothbrushing compliance, increasing from 30% (n=27; 95% Confidence Interval

(CI) 0.13-0.47) at baseline to 70% (n=24; 95% CI 0.53-0.89) 2 weeks, and 68% (n=25; 95% CI 0.50-0.86) 3 months following the delivery of the HABIT intervention. These results were found to be statistically significant. There were also improvements seen in plaque levels with plaque scores decreasing from 42% (n=25; 95% CI 0.23-0.61) at baseline to 20% (n=21; 95% CI 0.03-0.37) at two week follow up and to 19% (n=21; 95% CI 0.02-0.36) at three month follow up. These decreases in plaque scored were statistically significant. There were also increases seen in toothbrushing duration following the HABIT intervention, with the duration increasing from an average of 36 seconds (n=18, Standard Deviation (SD) =23.9) at baseline to 47 seconds (n=19, SD=23.6) at the final follow-up visit. The authors concluded that the intervention was feasible and increases in ideal toothbrushing behaviours could potentially lead to improvements in caries levels (Giles et al., 2022).

7.1.3 Study 3: Simulation testing of the tool to assess feasibility and acceptability

The third study was simulation testing of the STAR tool in action between DHSWs and parents. A FRAM analysis was conducted on the DHSW and parent interaction using the STAR tool. This highlighted the process through which each DHSW used the STAR tool and the variability between each DHSW. The DHSWs each used the tool in varying ways but all were able to complete each stage of the STAR tool to provide support to parents, demonstrating the flexibility of the STAR tool. In addition, DHSWs were able to incorporate their standard Childsmile guidance alongside STAR, suggesting that it was possible for the STAR tool to fit in with their current means of delivering support. FRAM analysis showed that the tool was able to be used flexibly by DHSWs to deliver tailored toothbrushing support to parents. Findings from qualitative interviews with DHSWs also found that DHSWs thought the tool would be beneficial and would fit in with their current practice and felt it would be feasible to undertake during home visits. DHSWs felt that the training provided was valuable and sufficient for them to feel comfortable to carry out the STAR tool process with parents. The cards were stated to be a useful way to identify barriers with parents and DHSWs felt that the barriers aligned with those that they come across commonly when delivering home visits with families. While DHSWs felt that some of the strategies were similar to those that they provide parents with currently, they liked that the

STAR tool provided a structured way to introduce the topic and deliver these techniques. This structured approach could be a useful and beneficial feature particularly to less experienced staff members. The need for resources that provide a structured approach within an intervention has been highlighted in previous studies. In a study undertaken by Bhatti and colleagues (2022), qualitative interviews were completed with health visitors who had carried out the HABIT intervention in England (Bhatti et al., 2022). They found that health visitors carrying out the intervention would prefer that the oral health resources they were provided with as part of the intervention, provided more of a guide as to how they should give out the information to parents, offering more structure to the conversation.

This appears to be the first time the FRAM process has been used to analyse a conversational based health improvement intervention. The FRAM methodology allowed for the identification of areas where DHSWs vary in their use of the STAR tool and how they were able to incorporate the use of STAR alongside the provision of usual Childsmile support. Additionally, analysis of the FRAM model allowed for the highlighting of any areas which required focus when conducting further training in the use of the STAR tool. While it has not been used often within dental research, FRAM, however, is increasingly commonly utilised within other healthcare contexts (McGill et al., 2022). An example of FRAM being used within a dental context was in a study by Ross et al (2018). The researchers used FRAM to assess the system within which fluoride varnish is applied to children within dental practice settings in Scotland (Ross et al., 2018). Data which were fed into the FRAM model included that gathered from a survey of practitioners, interviews with key informants such as dentists and dental nurses, and information gathered from a workshop with stakeholders such as dentists, Childsmile programme managers, dental public health specialists and NHS clinical directors. Assessment of the FRAM model allowed researchers to understand the variable functions which impact on fluoride varnish application and highlight these areas as being required to be targeted for improvement. FRAM was also used in a study to investigate risk management within paediatric homecare in Ireland (Hoy et al., 2023). Qualitative interviews were carried out with nurses working within the field of paediatric healthcare and gathered data regarding incident reporting and risk assessment. The key functions of these

areas were then mapped onto a FRAM model which outlined how the risk management process was conducted during actual practice. Analysis of the FRAM model then led to the refinement of the risk management process and subsequent changes to policy and training to enhance the paediatric homecare system (Hoy et al., 2023).

In addition, interviews undertaken with parents following the STAR tool simulation workshop, showed that the tool would be a helpful way for parents to discuss toothbrushing barriers and provide useful, relevant strategies to overcome toothbrushing difficulties. The cards provided an easy way to bring up and provide a prompt for discussing certain barriers families were facing. The fact that these barrier cards existed, made parents recognise that these are barriers faced by other parents also and therefore it was not unusual for them to be struggling with toothbrushing for their child. While the conversation took place in a simulated environment, parents felt that if the STAR tool was used during a home visit, it would be helpful and they wouldn't mind the time it would take to carry out. Moreover, after follow up 6 weeks after the workshop, it was found that parents had been able to use the techniques given to them to make beneficial changes to their toothbrushing routines. The importance of providing support that is personalised to families was also highlighted by parents interviewed by Bhatti et al (2022) following their participation in the HABIT intervention.

The findings and feedback following the simulation workshop also reflect the findings of an early feasibility study of the Uitblinkers intervention (de Jong-Lenters et al., 2020), from which the STAR tool was adapted. Fifteen dental therapists from 12 dental practices took part in the study via focus groups, telephone interviews and structured questionnaires. In addition, telephone interviews were conducted with four parents. Similar to feedback from DHSWs, the dental therapists were generally very positive about the Uitblinkers approach and conversation style and found that it allowed them to deliver more tailored advice based on the barriers. In addition, the therapists also found the cards a useful means to identify barriers. Like parents who used the STAR tool, the parents who took part in the Uitblinkers study also were able to identify with and recognise many of the barrier cards presented to them. Parents also

appreciated the time taken by the therapist to carry out the approach and didn't mind the extra time taken.

7.2 Strengths and limitations of this research

7.2.1 Covid-19 Pandemic

The Covid-19 pandemic had a major impact on the PhD project. The PhD started in December 2019 with full lockdown being in place in early March 2020. This necessitated home/remote working for extended periods.

The pandemic resulted in disruption to many aspects of the Childsmile programme, including DHSW home visits which were terminated for several months with many DHSWs were also redeployed to other roles to assist with the NHS pandemic response. As a result, accessing and recruiting DHSWs in the first two years of the project was challenging and any research conducted with them had to be done online via MS Teams and robust co-design and co-production with DHSWs was not possible. This meant that planned face to face interviews or focus groups at the early stages had to move online. The Delphi process potentially could have been done in person but was fully conducted online. We originally planned to recruit parents/carers into a more prominent co-design role but this was not possible as DHSWs could not recruit on our behalf during this time.

7.2.2 Strengths

The STAR tool is a theory-based intervention. Evidence has suggested that interventions informed by theory lead to more successful outcomes (Michie and Prestwich, 2010). The use of theory allows for better understanding of situations and processes as they provide possible reasonings for why and in what context certain behaviours take place (Heath et al., 2015). In addition, the use of behaviour change theory in the development of interventions can offer a way to allow for the recognition of why an intervention is effective or not (National Institute for Health and Care Excellence, 2014a).

STAR was adapted from a previously existing intervention, Uitblinkers, in which feasibility and acceptability had already been tested. This therefore meant that

we were able to have the benefit of and input from expert group advisors from the team who had developed the Uitblinkers intervention. Uitblinkers was further along in the process meaning it was possible to advance much quicker and get to the roll out stage more rapidly than if starting from scratch.

There have been other examples of interventions which have successfully been adapted and translated from one context to another such as Healthy Habits Happy Homes (4H). 4H is a pre-school childhood obesity prevention intervention, delivered in the home setting. It was originally designed and carried out in Canada, where it was found to have an improvement in diet and weight outcomes (Haines et al., 2018). In addition, the motivational interviewing approach was shown to be feasible and acceptable for families involved (O'Kane et al., 2019). Gillespie and colleagues (2020) undertook a study to investigate the feasibility of the adaptation of the 4H intervention for use in a deprived area in Scotland. They used the RE-AIM framework as an evaluation tool and found that the intervention was able to reach the intended target population, with inclusive recruitment methods, effective communication approaches and positive links with the community all being identified as facilitators. There was also demonstrated to be high fidelity to the original intervention's motivational interviewing methodology. The authors concluded that it was feasible to translate the 4H intervention to a new setting and context (Gillespie et al., 2020).

The project was embedded within the Childsmile programme and therefore had support from staff, resources and rapid feedback on feasibility prior to conducting research. For example, early feedback was gathered on the feasibility of adapting the Uitblinkers for use in the Scottish context by Childsmile regional researchers and members of the Childsmile Evaluation Research Team (CERT) (see Section 1.8.1).

A further strength was the input from an advisory group made up of DHSWs and dental public health academics with experience of working in the area of child home toothbrushing. This guided the research by allowing for important insight in the early stages of the project into the key elements to incorporate to the intervention such as barriers and associated strategies.

There was input from individuals with a range of expertise involved in the development of the STAR tool. For the modified Delphi process, the survey respondents were from a variety of backgrounds including those working in academia who had published widely in this topic, and those working in the home setting as DHSWs providing a broad range of insights and opinions. The modified Delphi process allowed participants to express their views anonymously and openly and minimised the influence of individuals with more assertive personalities or participant status on the group result (Jones and Hunter, 1995). The use of both a modified Delphi process and qualitative interviews allowed for data triangulation, strengthening the level and depth of consensus gained.

The inclusion of end users (DHSWs and parents) is a critical element of research co-design which can enhance health research processes and outcomes (Slattery et al., 2020). The continued involvement of DHSWs was a key element throughout the design and development process of the home-based toothbrushing tool. Additionally, parents were involved in the testing process, giving insight into both their experience in going through the STAR process with DHSWs, and also feedback on the design and format of the resources.

7.2.3 Limitations

The initial literature search, which formed one basis for identification of toothbrushing barriers for the first round was not a formal systematic review. It is therefore possible that some potential barriers reported in the literature were missed. However, it was felt that the nature of the data being collected for the purposes of the Delphi process didn't lend itself to a systematic review. Recent systematic reviews were used, however, to aid the search strategy process. In addition, searching of reference lists of key papers was undertaken to find additional barrier papers. Also, prior to the commencement of the Delphi, a toothbrushing advisory group, many of whom authored recent systematic reviews in the area of parental home toothbrushing, assessed the initial barrier list for completeness and Delphi expert panellists were asked to provide any additional barriers they thought were missing from the list presented in Round 1.

With regards to the set of eleven barriers generated following the modified Delphi process, some DHSWs mentioned that there may be further barriers for

families with children with additional educational support needs. At the moment, the tool is intended to be used for the general population, so a decision was made to not include these additional barriers. However, further work may look at the appropriateness of adaptation of the tool for use with children or adults with additional support needs. In addition, the STAR tool is currently in the English language only. DHSWs reported during the qualitative interviews that they visit many families for whom English is not their first language and they sometimes come across language barriers, although they may have an interpreter present if required. In Scotland, it is common for English to not be the first language spoken at home for many school pupils (4-18 years). It was estimated in 2022 that 17,723 students in Scotland spoke Polish as their main language at home, which was the highest of any non-English language in 2022. In addition, Urdu was the main language spoken at home of a further 7,163 pupils (Scottish Government, 2023). Therefore, it may be beneficial for the STAR cards to be translated into other languages in the future if required. The current model of DHSWs practice varies across Scotland and many only visit families one and only when the child is very young, before any teeth have erupted and therefore before toothbrushing has commenced. The STAR tool is designed to be used to identify and address current toothbrushing barriers and requires a follow up visit (or phone call). This therefore means its use would likely not be possible for DHSWs who follow the model of single visits and for visits to families where toothbrushing has not yet started.

A further limitation of the research project was the limited parental involvement. The earlier and more in-depth involvement of parents was not possible due to the impact of Covid-19 on the project. However, Childsmile regional researchers carried out focus groups with parents prior to the commencement of this project, where they collected data regarding parents' views on the Uitblinkers cards and toothbrushing barriers. It was therefore felt that it was not necessary to gather this data again in the early stages of the project. In addition, the COVID-19 pandemic and subsequent lockdowns began just three months following the start of this PhD project. The ongoing restrictions for the following two years limited opportunities for contact with parents, particularly as many aspects of the Childsmile programme, including DHSWs home visits, were temporarily suspended during this period. In addition,

many DHSWs and other members of the Childsmile team were redeployed to assist with the NHS pandemic effort. There was, however, parental input and involvement in the simulation workshop, following which changes were made to the cards following feedback. In addition, the current evaluation process following the roll out of the STAR tool will have parental involvement throughout. In order to increase the numbers of parent participants, an alternative approach could have been to ask DHSWs to recruit a larger number of parents to take part. A further approach would have been to repeat the simulation workshop in other health board areas. In addition, offering an incentive to participants taking part in interviews or the simulation workshop may have resulted in a higher uptake or may have made short notice cancellations less likely.

As previously stated, parents were involved in the simulation workshop (see Chapter 6). However, two parents who had been due to take part were unable to participate at short notice. This therefore meant that two DHSWs did not have the opportunity to use the STAR tool with parents and instead went through the process with simulated parents (actors) only. There has previously been discussion over the extent to which simulation reflects real life scenarios (Stokoe, 2013, White and Casey, 2016, de la Croix and Skelton, 2013) with the suggestion that learners may act differently, which could have an impact on the learning process (Stokoe, 2013). However, there have been studies which show that there is no difference in the learning process when simulated patients or real patients are used. For example, a Portuguese study by Carvalho et al (2014) assessed the application of communication skills following a training programme of healthcare professionals, during interviews with standardised versus real patients. They found that there were improvements in communication skills across all groups and that there were no statistically significant differences between the skills demonstrated in the interviews with standardised and real patients. The authors suggested that this indicates that skills can be transferred between simulated settings to real life practice (Carvalho et al., 2014). A second study, carried out in Australia, considered the self-reported communication skills, knowledge and confidence in a group of undergraduate speech pathology students (Quail et al., 2016). The students were randomly allocated to take part in a conversation with either an actor playing a patient (simulated patient), a

virtual patient (computer simulation) or a real patient in a nursing home. Students in all three groups reported an increase in communications skills, knowledge and confidence, with no significant differences seen between the groups. This therefore indicates that interaction with simulated patients may be as effective as that with real patients.

A further potential limitation was that some of the qualitative interviews with DHSWs had to be carried out online using Microsoft Teams. This was due to local travel restrictions and individual health board policies at the time, in place as a result of the COVID-19 pandemic. It was therefore only possible to carry out the interviews within NHS Greater Glasgow and Clyde in person. It was felt however, that sufficient and similar depth of conversation was gained between both interview types. Thunberg and Arnell (2022) carried out a review into the use of digital interviews within the fields of social work, sociology and adjacent disciplines (Thunberg and Arnell, 2022). Part of this review considered digital interviews in comparison to in person research. Overall, they felt that it was possible for data collected from digital interviews to be of similar quality to that collected from in person interviews. One study included in the review stated that while it took time for a relationship to be established between researcher and participants during online interviews, once the participant had 'settled in', there was found to be no differences between interview types (McCarrick et al., 2016). It was also argued by some researchers that online interviews may be preferable in some ways, as participants may feel more at ease due to the flexible setting and not having to meet with an unfamiliar person, and this may lead to them feeling more comfortable speaking about their experiences (AlKhateeb, 2018, Sipes et al., 2022, Weller, 2017). Online interviews also have the advantage of opening up participation to those living in more remote areas (Thunberg and Arnell, 2022). Additionally, Davies et al, 2020 conducted a scoping review of the collection of accounts of health and illness, comparing face to face with online collection methods (Davies et al., 2020). Eleven studies were included in the review, consisting of 565 participants in total, 43% of whom participated online. Talk-based platforms such as Skype were included as well as text-based, such as online discussion forums. The researchers found that in general, the responses provided by online participants were shorter and more direct although often lacking in contextual detail. It was also found that it was

more difficult to build relationships using online methods. It was however possible to reach a wider range of participants using an online approach.

7.3 Roll out of STAR tool within the Childsmile programme across Scotland

Following the feasibility and acceptability testing (based on this PhD), the Childsmile programme made a decision to roll the tool out across health boards in Scotland with an embedded evaluation. The following section is a description of future roll out and evaluation. The PhD student was part of the team and has developed and is delivering the training for the STAR tool.

Currently, the STAR tool is in the process of being rolled out across all 14 NHS health boards in Scotland for DHSWs to use during their home visits to targeted families who require additional toothbrushing support. As part of this process, a training package has been designed to deliver training to all DHSWs across Scotland in the use of the STAR tool. The training was based on and adapted from the training provided to DHSWs during the simulation workshop. Feedback from DHSWs during the qualitative interviews indicated that they thought scenario-based training and the use of a video outlining the STAR tool process would be beneficial. As a result, a video was created illustrating the use of the STAR tool in action using actors which has been used as part of the training package.

The outcome and process evaluations of the STAR tool has been designed by members of the University of Glasgow Childsmile Central Evaluation Research Team (CERT). As part of the process evaluation, it is planned that DHSWs will take part in a survey regarding their experiences using the STAR tool and how often and in which situations they choose to use the tool. In addition, a series of focus groups will take place with DHSWs to gain more in-depth insight into their experiences using the tool and also the training process. It is anticipated that they will also provide feedback on how it impacts on their usual practice, benefits they have found in using the tool or any challenges they have faced. Qualitative interviews will also take place with parents and carers with whom

DHSWs have used the STAR tool. They will be asked to provide details as to the acceptability of the STAR tool to them, alongside any factors which may influence how they respond to the use of the STAR tool. Additionally, focus groups will take place with DHSW managers to gain an insight into how the STAR tool fits in with the DHSW programme, as well as any challenges or potential opportunities they have come across regarding the tool.

For the outcome evaluation, the primary outcome which is to be measured is the caries experience at 5 years old of the child whose parent or carer went through the STAR tool process with a DHSW. The secondary outcome which will be recorded is the frequency at which toothbrushing occurs with a measurement taken at both baseline and follow up. Primary and secondary outcomes will be measured using data input by DHSWs regarding their use of the STAR tool on the Health Informatics Centre (HIC) system, alongside data linked from the National Dental Inspection Programme (NDIP).

It is intended that the STAR tool will be rolled out in a lagged fashion. The tool will be introduced in 'clusters' gradually, with data collection taking place throughout the roll out process. For the STAR tool, the clusters will be groups of health boards, with each cluster having similar population numbers. NHS Greater Glasgow and Clyde will be separated across two different clusters due to its large population. There will be four clusters of health boards, with the STAR tool being rolled out across these at three monthly intervals.

7.4 Conclusions

This thesis described the process of the development of a new theory-based toolkit, the STAR tool, which will be implemented to optimise home toothbrushing in the early years in Scotland, within the Childsmile programme. STAR was developed to assist DHSWs deliver tailored toothbrushing support to parents of young children.

DHSWs are well placed to provide home based oral health support to families who require additional input in the home setting although it was previously identified that there is a need for support provided by DHSWs to be more

targeted and tailored towards those families most in need of additional support. An existing practice-based behaviour change intervention called Uitblinkers aimed to support parents with home toothbrushing. This intervention was adapted for use in the Scottish context of use by DHSWs during home visits with families who require additional toothbrushing support for their young child.

A wide range of barriers to parental home toothbrushing for young children were identified. A modified Delphi process led to the prioritisation of a succinct and robust set of barriers to be addressed by STAR. In addition, this process led to the validation of appropriate strategies to address these barriers.

These barriers and strategies were further validated by DHSWs during semi-structured qualitative interviews. DHSWs were positive about the introduction of the STAR tool to their current practice, feeling that it would be a useful and beneficial addition for both themselves and the families they visit. It was however noted that DHSWs often visit a family only once, often when the child is very young and before toothbrushing has commenced. Additionally, on many occasions, DHSWs will only carry out one home visit or contact for a family, while an integral aspect of the STAR tool is follow-up to see how the family is managing with the strategies given to them. In collaboration with DHSWs, a prototype tool was designed to be tested in a simulated setting.

The STAR tool was tested in a simulated environment by DHSWs and parents. DHSWs completed each stage of the STAR tool process and delivered tailored support to parents based on their conversation and the card chosen. DHSWs were able to use the tool flexibly, incorporating their own communication style and also delivering the oral health support they provide currently during home visits. DHSWs felt comfortable using the STAR tool to deliver toothbrushing support. Parents found the use of STAR tool to be useful and would feel comfortable if this was delivered in a home environment. Follow up also found that parents were able to use the support provided to them to make beneficial changes to their toothbrushing routines in the weeks following the delivery of the STAR tool intervention. Minor adjustments were made to the STAR tool cards following the simulation workshop. It is now planned for the STAR tool to be rolled out across the fourteen NHS Scotland health boards for process and outcome evaluation.

7.5 Recommendations and future work

7.5.1 Recommendations

- Process evaluation of the STAR tool should take place in the form of surveys and qualitative interviews and focus groups with DHSWs, parents and DHSW managers to assess the feasibility and acceptability of the tool.

- Outcome evaluation of STAR is required to identify any short or long term impacts. The primary outcome which should be measured is impact on caries experience at 5 years old. Changes in toothbrushing frequency should be recorded as the secondary outcome.

- The outcome of the evaluation process should be assessed to understand if any further adaptations are required to the STAR tool resources or process to optimise its use and impact.

- Due to feedback from DHSWs that home visits are often carried out at a young age prior to the commencement of toothbrushing, a follow up contact should be undertaken once toothbrushing has started to assess if the STAR tool would be beneficial where there are toothbrushing concerns. This may require collaboration with other agencies, such as health visitors, to ensure families are being contacted at an appropriate stage in the child's development.

- It would be beneficial for DHSWs to more routinely undertake follow up contacts with families to assess their oral health following an initial visit, especially if this was carried out when the child was very young.

- While the STAR tool has been designed to be used for parents of children age 0-3 years, some of the techniques could be used during home visits for older children if judged by the DHSW to be beneficial.

7.5.2 Future work

- Assessment should be carried out on the need for the STAR tool to be translated into other languages as required.

- Adaptation of the STAR tool could be carried out for use in other contexts, for example, to provide toothbrushing support to parents or

carers to children or adults with additional special needs or language issues.

- Consideration needs to be given regarding the role of DHSWs as many only undertake one visit with a family and some often only see babies, which is contrary to the intended role of DHSWs outlined in the Childsmile logic model. It would therefore be beneficial for the Childsmile programme to revisit and appraise the DHSW model to better understand the current DHSW role.

- The STAR tool approach could also be used for other areas of child health behaviours other than home toothbrushing, such as nursery toothbrushing and diet and nutrition, and further work would be required to adapt the tool for other uses.

- Further research should be conducted to assess if the use of the STAR tool has an impact on toothbrushing within the wider family within the household such as older siblings and parents.

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Appendices

Appendix 1: NHS ethics committee favourable opinion letter

NHS ethics committee favourable opinion letter removed due to confidentiality issues.

Appendix 2: University of Glasgow Community Oral Health department's data security protocol

	Name	Signature
Authored by:	Mariel Goulart	
Reviewed by:	Andrea Sherriff and Alex McMahon	
Approved by:	David Conway	

1. SCOPE

The Community Oral Health Section (COHS) of the Dental School studies factors associated with oral health and oral health inequalities. This document covers the activities relating to the handling and processing of data by COHS.

2. RESPONSIBILITY

The named responsible individual is David Conway but all COHS staff and students affiliated with the section are responsible for data security. NHS Staff working within a University office without access to the University network must adhere to NHS Information Governance protocols.

3. FORMS AND LOGS REQUIRED

COH-LOG-001: COH Folders and Current Permissions Log
COH-FOR-001: Research Data Security and Confidentiality Agreement

4. SECTION REQUIREMENTS

This procedure is carried out within the COHS offices at Glasgow Dental Hospital & School or on University of Glasgow computers at other remote locations. Members of the COHS may be authorised to access a Safe Haven such as the Public Health Scotland (PHS) National Safe Haven or one the four regional NHS Local Safe Havens located in Aberdeen, Dundee, Edinburgh, and Glasgow.

4.1. Data Protection & Information Security Training

All COHS members must complete the University's online Data Protection and Information Security trainings (these trainings are mandatory for all University staff and PGR students). It can be found in the Moodle as Course: Introduction to the General Data Protection Regulation (gla.ac.uk). The course is a basic overview of the main provisions of the General Data Protection Regulation (GDPR) and data security individual responsibilities, which is very important for ensuring GDPR compliance.

After completion the certificate should be send by e-mail to the author of this protocol. This should be completed within the first month as a member of the COHS.

4.2. Storage of Data

1. Paper records must be stored in locked cabinets.
2. Computers must be locked when the user is not present [Ctrl, Alt, Del → Lock Workstation].
3. Databases and audio recordings need to be backed up and saved in the appropriate folder on the MVLPublic (J:) drive at:
   a. J:\MED\DentalSchool\DPHU.
   b. Access to each folder is on a 'need to use' basis and is controlled centrally by IT Services.
   c. Local management of the DPHU folder is undertaken by Research Secretary (in conjunction with IT services).
4. Duplicate copies of databases and audio recordings are to be avoided.
5. All audio-recordings must be deleted from recording devices once uploaded to the J Drive.
6. There is a general move towards using OneDrive / SharePoint for most data storage, however local SSD storage (e.g. J Drive) will still offer less risk in some cases.

4.3. Access to Data

1. Ensure that you have appropriate and secure storage for all your paper and electronic records.
2. Any mobile device – a laptop, tablet, memory stick, or mobile phone – that is used to access or store personal data must be secured/encrypted.
3. Do not share passwords with colleagues and ensure that access to data is limited to those with the authorisation to see it.
4. Do not share personal data with third parties unless you have an appropriate agreement in place to cover use of that data.
5. All personal data should be destroyed appropriately when no longer required.
   a. Paper records should be confidentially destroyed, i.e. shredded, and kept securely until they are uplifted for shredding.
   b. Electronic records should be appropriately deleted from databases, and "deleted" folders in email systems should be regularly purged.

4.3.1. Data stored at (J:\MED\DentalSchool\DPHU):

1. Each folder within J:\MED\DentalSchool\DPHU will be assigned to a named individual responsible (recorded on *COH-LOG-001*) for reviewing user access and data stored within.
2. Data within this folder must only be accessed by authorised named individuals in document *COH-LOG-001*. No unauthorised access is permitted.
3. All COHS staff and affiliated students with access to data will have to sign a confidentiality form *COH-FOR-001*.

4.3.2. Data stored in the cloud:

You should not store or sharing personal data in any cloud-based organisation (such as Google Drive, Dropbox, or iCloud) except Microsoft SharePoint storage, with OneDrive and Teams. OneDrive for Business via Office365 is only one cloud storage provider that has been approved for use by the University. All staff have access to this service via their University Office365 log-ins. Use Teams where access by another member of the University is required on an ongoing basis).

4.4. Transfer of data

1. Database creation, data extraction and data transfer must be kept to a minimum.
2. All transfers of confidential data, including those between named data users within the Community Oral Health Section (listed above), need to be approved by the Community Oral Health Section's Information/Data Custodian (David Conway).
3. Confidential data must only be transferred from the Community Oral Health Section following approval of the Information/Data Custodian.
4. Electronic data containing personal identifiers must only be sent via an approved Secure FTP provider or NHS official email.
5. Databases need to be password protected.
6. Passwords must be sent in a separate e-mail from a username / link to database.

4.5. Uses

1. Analyses of confidential data is to be done on the University J Drive or OneDrive/Teams only (excluding studies approved for analysis within a Safe Haven such as the PHS National Safe Haven or the NHS Greater Glasgow & Clyde Safe Haven).
2. Unless priorly approved, for evaluation and research purposes all data will be analysed pseudo-anonymously, i.e., name, address, date of birth, postcode and CHI will be removed.
3. Transfer procedures (above) need to be followed prior to release for analysis.
4. No publication will appear in any form in which an individual may be identified unless the written permission of that individual has been obtained.

4.6. Retention

1. In keeping with the Data Protection Act (2018) records will not be retained for longer than necessary.
2. Records required for current business: paper records are to be stored in locked cabinets in the Community Oral Health Section and electronic records on the University servers.
3. Records no longer required for current business use will be transferred to the University Records Centre for archiving.
4. Paper records that are not required to be retained, and where there is an electronic copy of the record fit for purpose, must be destroyed securely through the use of the confidential waste process.
5. In the case of Childsmile, confidential electronic records will be transferred to PHS for storage in the dental data warehouse.

5. AUDIT

Every year an internal audit of access to folders within the J:\MED\DentalSchool\DPHU drive will be undertaken by the named individual persons responsible for each folder. The process will be coordinated by the author of this protocol.

All unnecessary files (e.g., duplicate databases, database extractions and audio files no longer required) must be deleted. The named responsible for each folder will review user's access to the folders and request removals of users that no longer require it. Each member will be personally responsible for audit his/her own OneDrive and review access to the folders and remove users that no longer require it. Evidence of the undertaking of this task will be recorded in COH-LOG-001.

6. SAFE HAVENS

1. Access to the safe havens is for approved users only and unauthorised users must not access the system.
2. Appropriate information governance approvals (e.g. PBPP) must be granted.
3. Users of the PHS National Safe Haven are required to have 'eDRIS approved researcher status' which includes completing the Medical Research Centre (MRC) e-learning course "Research, GDPR and confidentiality" found at RSC LMS: All courses (byglearning.com). Users accessing one of the Local Safe Havens must ensure they have completed any equivalent pre-defined requirements.
4. No data or tables are to be removed in any form from the National Safe Haven system without approval from an eDRIS Research Coordinator (RC) or equivalent if using a Local Safe Haven. The RC or equivalent will run a disclosure control on tables to be released to ensure data confidentiality.
5. The Community Oral Health Section may also be asked to provide data to be used in a safe haven in which case, eDRIS rules must be followed.

Note: For further guidelines and assistance with the PHS National Safe Haven, please contact eDRIS at phs.edris@phs.scot or 0131 275 7333.
https://www.isdscotland.org/Products-and-Services/eDRIS/Use-of-the-National-Safe-Haven/

7. REMOTE WORKING

COHS staff working remotely (e.g. from home) are still required to follow the procedures of this DSP, the University of Glasgow's Information Security guidelines[1] and the eDRIS User Agreement[2]
[1]https://www.gla.ac.uk/myglasgow/it/informationsecurity/confidentialdata/
[2]https://www.isdscotland.org/Products-and-Services/eDRIS/_docs/eDRIS-User-Agreement-v16.pdf)

If you are using your own device (i.e., a non-University of Glasgow device) then you are responsible for ensuring it receives updates for the operating system and any software installed and that it has the most up to date antivirus and malware protection installed and is protected with a firewall. Further information security advice when using your own devices can be found at
https://www.gla.ac.uk/myglasgow/anywhere/informationsecurityadvice

8. PERSONAL DATA BREACHES

In accordance with the University of Glasgow guidelines, any personal data breach or suspected personal data breach, or an accident or misuse involving personal data must be immediately reported to the Information/Data Custodian and to the University's Data Protection Officer (0141 330 3111). **If you are involved in or discover the breach, report it immediately to the Information/Data Custodian** who will then notify the Data Protection Officer and forward all relevant information related to the breach.

9. VERSION HISTORY

Version	Change	Date of Issue
1.0	N/A – Initial	02-MAY-12
1.1	New Section added to include Safe Havens	01-JUN-19
2.1	• Transfer of DSP to new template. • Removed reference to NSS/ISD and updated to PHS (Public Health Scotland). • Electronic data containing personal identifiers must only be sent via an approved Secure FTP provider rather than both a Secure FTP and an nhs.net email account. • Update NHS Safe Haven section to include reference to National Records Scotland. • Added sections 'Data Protection & Information Security Training' 'Data Management Plan' & 'Remote Working'.	14-MAY-21

	• Reference to the new COH-LOG-001: COH Folders and Current Permissions Log and a named person responsible for monitoring access to and content of folders within the J:\MED\DentalSchool\DPHU drive.	
2.2	• Changes audit of JDrive from quarterly to yearly basis. • Add information about cloud storage of data.	08-FEV-23

APPENDIX 1 - WHAT IS CONFIDENTIAL INFORMATION?

1. The term "Confidential Information" applies to:
   a. data relating to identifiable individuals (students, patients, donors, NHS Scotland staff or practitioners):
      - in hand-written, typewritten, printed or machine-readable form on a document, microfiche, CD, magnetic medium (disk, tape, video, etc.) or computer screen
      - some business data, including that relating to financial information, details of projects, trade secrets, programming code copyright.

2. Individuals may be identified by:
   a. name
   b. unique reference number (e.g., CHI number, hospital case reference number/patient identifier, NHS number, Pupil ID, GMC number, etc.)
   c. address
   d. postcode
   e. in combination with other data sources

Appendix 3: Search strategy for literature search for modified Delphi

OVID (Embase/Medline)

1. Toothbrushing/ed, is, mt, nu, px, sn, td, ut [Education, Instrumentation, Methods, Nursing, Psychology, Statistics & Numerical Data, Trends, Utilization]

2. Toothbrush*.mp. [mp = title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier].

3. (brush* adj4 teeth).mp. [mp = title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier].

4. (brush* adj4 tooth).mp. [mp = title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier].

5. 1 or 2 or 3 or 4.

6. *Oral Health/ed, mt, sn, td [Education, Methods, Statistics & Numerical Data, Trends].

7. *Oral Hygiene/ed, mt, nu, px, sn, td, ut [Education, Methods, Nursing, Psychology, Statistics & Numerical Data, Trends, Utilization].

8. 5 or 6 or 7.

9. *Dental Care for Children/is, ma, mt, nu, og, px, st, sn, td, ut [Instrumentation, Manpower, Methods, Nursing, Organization & Administration, Psychology, Standards, Statistics & Numerical Data, Trends, Utilization].

10. Parent*.mp. [mp = title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier].

11. Carer*.mp. [mp = title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary

concept word, rare disease supplementary concept word, unique identifier].

12. *Parents/ed, px [Education, Psychology].

13. *maternal behavior/ or *parent-child relations/ or *parenting/ or *paternal behavior/

14. 9 or 10 or 11 or 12 or 13.

15. 8 and 14.

PubMed

(Toothbrushing OR toothbrush*)

(oral hygiene OR dental care)

Dental care for children

Parent*

Carer* OR caregiver*

Web of Science

1. TI=((tooth or teeth or dent* or oral) Near/2 (hygiene or brushing or clean* or cleans*)) OR AB= ((tooth or teeth or dent* or oral) Near/2 (hygiene or brushing or clean* or cleans*)

2. TI=(child* or dental care for children)

3. TI=(parent* or carer* or caregiver*)

4. 1 AND 2 AND 3 AND 4

Appendix 4: Toothbrushing barriers mapped to TDF domains

Barriers from Modified Delphi literature review

Paper	Description	Barriers to toothbrushing	Theoretical Domains Framework domains
Duijster et al (2015)	• Dutch study with Dutch parents of low and high socioeconomic status and parents from Turkish and Moroccan origin • 39 parents of 7 year old children • Focus groups	• External locus of control – parents did not believe oral hygiene efforts could prevent their child from getting tooth decay.	• Beliefs about capabilities
		• Difficult child behaviour and non-compliance e.g. resistant behaviour, tantrums, pain during teething, tiredness of child	• Emotion • Behavioural regulation

		Time constraints/busy schedules – especially in the mornings	Environmental context and resources
		Parental knowledge – some parents insecure about details of knowledge	Knowledge
		Complicated advice – some parents found difficult to adhere	Environmental context and resources
Elison, et al (2014)	• 16 first time mothers of children aged 24-30 months living in one of two areas of Greater Manchester with the worst rates of dmft in under 5s. • Recruited from local childcare services • Qualitative interviews at participants' home	• Perceived maternal self-efficacy for tooth-brushing – important to feel confident to establish a toothbrushing routine in order to do so	• Beliefs about capabilities
		• Stress related to difficulties experienced when trying to establish toothbrushing routine	• Emotion

		• Ability to remember to brush child's teeth – especially at night	• Memory, attention and decision processes
		Child behaviours: • Child wants to brush themselves, grabbing toothbrush • Child dislikes toothbrushing/taste resulting in non-compliance • Refusal to open mouth • Child sleeping - parent doesn't want to wake to brush	• Skills • Behavioural regulation
		• Lack of support from others • Lack of practical advice from healthcare professionals	• Social influences

		• Family history – parents own experience as a child – what is 'normal' to them	• Nature of the behaviours
Marshman et al (2016)	• 27 interviews with parents living in Bradford and Barnsley, mostly living in deprived areas • purposively sampled through a maximum variation approach to ensure inclusion of the following: parents (or caregivers with parental responsibility) living in deprived areas; of different sexes, ethnicities, and first languages; with children of varied ages and dental attendance patterns, with and without dental caries	• Knowledge – not aware of guidance to help brush until child is 7 years old	• Knowledge
		• Social influences e.g. grandparents letting children get away with not brushing	• Social influences

		• Mothers perceived (by both mothers and fathers) to have overall responsibility for child toothbrushing	• Social/professional role and identity
		• Manual skills – worried about hurting their child when brushing – especially when first starting as babies • Child behaviour regulation – lack of parenting skills to manage behaviour of unwilling child – often encountered challenging behaviour when child reaches 18-24 months – crying, keeping mouth closed, wanting to brush by themselves	• Skills

			Beliefs about capabilities in managing their children's behaviours – lack of control	Beliefs about capabilities
			Breaks in routine e.g. weekends, school holidays, sleepovers • Stressful environment/circumstances that make day to day life a struggle e.g. several young children to look after, unemployment, debt, drug use, single parenthood, and domestic abuse	Environmental context and resources
			Prioritising activities/toothbrushing taking place at busy times e.g. getting children to bed, eating breakfast, leaving for school	Behavioural regulation

Huebner et al (2010)	• 44 parents of infant/preschool children interviewed in rural southwest Washington State • Participants were clients of 1 of 3 early childhood education programs in the community that served low-income families with infants or preschoolers.	• Oral health beliefs – some false beliefs, worry about damaging teeth if brush too much	• Knowledge
		• Social norms – lack of social norm or other support for twice daily brushing • Emotional reactions – not wanting to upset child or, in turn, themselves	• Social influences • Emotion
		• Self-standards – feeling that brushing once a day is sufficient	• Beliefs about consequences
		• Self-efficacy – parents don't know how to overcome self-reported barriers	• Beliefs about capabilities
		• Skills – not making twice daily brushing a habit	• Skills

		• External constraints – struggles with fussy/moody child, lack of time in rushed schedule, particularly in the morning	• Environmental context and resources
(Finlayson et al., 2019b)	• 24 interviews with parents of children aged between 6 months – 4 years • Parents enrolled in the home visit component of the Early Head Start programme in LA	• Child resistance, stage of development – increasing sense of independence • Deviation from regular routine – child sickness, tiredness, not wanting to wake child to brush teeth	• Environmental context and resources
		• Different caregivers carrying out toothbrushing e.g. some fathers more relaxed about toothbrushing, less strict with the routine	• Social influences
		• Knowledge – many parents unsure when children should brush independently – answers ranged from 1 to 5 years of age	• Knowledge

		• Lack of effective solutions to overcome difficulties led to abandoning brushing and waiting until child is cooperative	• Skills
Trubey et al (2014)	• 15 parents of children aged 3-6 years, semi-structured interviews • Purposive sampling on the basis of child's involvement in a national, school-based toothbrushing scheme called Designed to Smile • Programme is run in nurseries and schools in areas of high soci-economic deprivation in Wales	• Disrupted routines – mornings often 'hectic' but more stable routine. Evening routine subject to change e.g. work schedules, after school clubs – toothbrushing could be a struggle and so, often missed	• Environmental context and resources
		• Knowledge/attitude - Some parents did not see importance of brushing in the evening if brushing in the morning anyway	• Knowledge

		• Toothbrushing norms – parents compared their habits to others.
		  - Parents who believed that very few other parents brushed twice per day, thought that the message about what you should do (twice daily brushing) was not credible.
		  - Some parents who brushed less frequently sceptical that others brushed more regularly.
			• Social influences

		• Some parents content with less frequent brushing because they believed other parents were acting similarly	• Motivation and goals

(Aljafari et al., 2014)	• 29 interviews with parents of children aged 3-10 years who have had teeth extracted under general anaesthetic	• Difficulties maintaining toothbrushing routine due to factors such as: - Time constraints - Number of children - Children's attitudes and brushing skills	• Environmental context and resources • Skills
		• Lack of practical toothbrushing advice	• Social influences
(Amin and Harrison, 2009)	• 26 interviews with 18 parents of children who had been referred to a specialty paediatric dental practice due to young age of child and extent of treatment needed • Children aged between 2.5 and 6 years old	• Resistance from child	• Skills
		• Stresses of daily life	• Environmental context and resources • Emotion

(Finlayson et al., 2019a)	• 6 focus groups and 1 interview with lower income Hispanic mothers of preschoolers aged 3-5 years (n=36 total participants) • Community health clinic on California-Mexico border	• Lack of time/oral health not a priority	• Environmental context and resources • Behavioural regulation
		• Uncooperative child	• Skills
(Lotto et al., 2020)	• Focus groups with parents of children who attended paediatric dental clinics • 17 participants with mean age of 34.9 years and income of US$ 591.17	• Busy lives/lack of time	• Environmental context and resources
(Naidu et al., 2012)	• 3 focus groups with 18 parents of children attending preschool	• Difficulties achieving night time brushing due to child falling asleep soon after last meal	• Nature of the behaviours
		• Lack of support	• Social influences
(Riedy et al., 2001)	• 7 community focus groups with 5 ethnic populations on the island of Saipan, self-governing US island in western Pacific Ocean	• Difficulty brushing a baby or young child's teeth – resistance from child	• Skills

	• 41 mothers and grandmothers of who had between 1 and 7 children/grandchildren, age range from 3 months to 20 years. Majority had 3 children under 4 years old. • Mix of working and non-working mothers and job types		
Virgo-Milton et al (2016)	• Semi-structured interviews with 32 mothers of young children age 6 months or older • Variety of demographic variables (socioeconomic, family size)	• Lack of time in busy schedules	• Environmental context and resources
		• Child uncooperative	• Skills • Behavioural regulation
Mofidi et al (2009)	• Focus groups with parents (n=22) and pregnant women (n=13) enrolled in the Early Head Start programme • Purposive sample to represent four major ethnic groups	• Lack of awareness of importance of deciduous teeth and caring for oral health of young children	• Knowledge • Beliefs about consequences
		• Busy routines and other priorities	• Environmental context and resources

		• Child uncooperative	• Skills • Behavioural regulation
		• Knowledge – unsure how to brush a young child's teeth	• Knowledge
(Prowse et al., 2014)	• Focus groups with parents/carers (n=40) of children <6 years old • Four different cultural groups living in Manitoba, Canada	• Child uncooperative	• Skills • Behavioural regulation
		• Lack of time due to parent tiredness	• Environmental context and resources • Memory, attention and decision processes
Van Nes et al (2018)	• Focus groups (n=16) and interviews (n=13) with mothers of Dutch-Moroccan preschool children in the Netherlands	• Difficulties supervising toothbrushing due to child resistance	• Skills • Behavioural regulation
		• Daily morning chaos and fatigue in the evening	• Environmental context and resources
(Weinstein et al., 1999)	• Interviews with Native American mothers (n=62) of children age 0-3 years in the USA	• Expectation that children should brush their own teeth from one year of age	• Knowledge • Beliefs about capabilities

		• Mulptiple children to care for	• Environmental context and resources
		• Difficulties with toothbrushing when child reached 2 years old	• Behavioural regulation
(Zeedyk et al., 2005)	• Observation of videotaped toothbrushing sessions with 18 families in the UK • Average age of child=2.5 years old	• Child cooperation/lack of concentration	• Skills • Behavioural regulation
		• Parents' lack of confidence	• Beliefs about capabilities

Uitblinkers Barriers

Barriers to toothbrushing	TDF
- Toothbrushing is challenging when my child has pain - Toothbrushing is challenging when my child is heavily resisting or crying - Toothbrushing is challenging when I am tired - Toothbrushing is challenging when I am stressed or pre-occupied - Toothbrushing challenging when it's too busy (in the evening) - Toothbrushing is challenging when it's too busy (in the morning) - Toothbrushing is challenging when my child wants to brush by his/herself - Toothbrushing is challenging when my child is too tired - Toothbrushing is challenging when I don't want to force my child against his/her will	- Knowledge - Skills - Beliefs about capabilities - Emotion - Memory, attention and decision processes - Environmental context and resources - Behavioural regulation

Barriers from dental team members workshop and Childsmile regional researchers work with DHSWs and parents

Barriers to toothbrushing	TDF
• Time pressures/working/busy • Multiple children to look after • Single parent • Poor co-operation from child/behaviour/attitude • Parent working patterns/shift work – tiredness • Child falling asleep before brushing • Parents don't brush their own teeth, don't encourage child • Lack of facilities – bathroom, toothpaste, toothbrush - Cost/financial issues • Cultural background/beliefs/Family norms • Parent willingness/motivation • Parents don't think important to brush • Social situation • Baby teeth a low priority • Different priorities - low on list of priorities • Separated families, shared responsibilities • Alcohol and drugs • Lack of knowledge/education • Parents too tired • Lack of skills/techniques • Psychosocial reasons – family breakdown/depression	• Knowledge • Skills • Environmental context and resources • Memory, attention and decision processes • Nature of the behaviours • Motivation and goals • Beliefs about consequences

Appendix 5: Modified Delphi invitation email, information sheet and privacy notice

Modified Delphi invitation email

Dear […]

I hope this finds you well and that you do not mind the contact email.
*I would like to invite you to be part of an **international expert panel** and to participate in a short 'modified Delphi' exercise on home toothbrushing barriers and matched interventions.*

Our research indicates you have conducted previous research in this area.
*The Delphi involves two 'rounds' with two parts each. We estimate **the total time commitment for all four rounds to be around 40 minutes.***

The aim of the research is to adapt an existing home-based intervention ('tool)' to improve supervised toothbrushing in young children (0-3 years old) in Scotland. The intervention is targeted at families referred to a Dental Health Support Worker service because they are thought to need additional support before attendance at General Dental Practice.
From existing literature and previous work with support workers and families, we have identified an initial set of barriers these families may face in adopting supervised toothbrushing for young children, and techniques employed to address these in one-to-one settings.

We now wish to 'weight' these barriers and techniques by priority for inclusion in the tool, hence the need for this expert consensus exercise, which we will be conducting through online survey.

We do hope this is something you'd consider taking part in, based on your knowledge and expertise. Alternatively, or in addition, if you are able to identify colleagues who you feel would be able and willing to contribute, we would be very grateful if you could provide us with contact details.

If you would like to participate and/or suggest someone else, please read the information sheet and privacy notice attached. The attached information sheet gives a little more information about what we are asking you to do, the tool, the setting for delivery, and the aims of the overall project, which is a funded PhD within the Childsmile research and evaluation programme.

The link to the first round for the online Delphi is below.

Please do not hesitate to contact us if you require further information. If we do not hear from you or receive your first expert ratings in two weeks we will send one reminder invitation, then after that we will not re-contact you.
Yours sincerely,

Emma Fletcher (BDS, MPH), PhD student, Glasgow Dental School, University of Glasgow

Modified Delphi participant information sheet

PARTICIPANT INFORMATION SHEET

INVITATION TO TAKE PART IN A RESEARCH PROJECT

Version 1.0, March 2021

Title of study: Optimising family toothbrushing behaviours in the home in the early years in Scotland: developing and evaluating a community based intervention

We would like to invite you to take part in a Delphi consensus study. The study relates to a research project that forms part of a PhD and sits within the Childsmile process evaluation. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. If you require further clarification or information please email e.fletcher.1@research.gla.ac.uk or alastair.ross@gla.ac.uk.

What is the purpose of this research?

Tooth decay is a common preventable disease which affects many young children and can result in pain and infection. Twice daily toothbrushing with fluoride toothpaste has been proven to reduce the risk of tooth decay. While the Childsmile nursery and school toothbrushing programmes have been responsible for improvements in children's oral health in Scotland, many children already have decay by the time they enter nursery school at 3 years of age. In these young children, twice daily toothbrushing should be carried out by parents/caregivers within the home setting. However, many parents and caregivers can face barriers which prevent them from effectively implementing toothbrushing for their child.

Further reduction in decay and narrowing of inequalities requires a more targeted approach based in the home setting at an earlier age than most children start nursery and for those children whose families are in need of additional support. A key component of the Childmsile programme is the role of Dental Health Support Workers (DHSWs) who, after referral by the Health Visiting team, support families to improve oral health behaviours, often via home visits.

The Academic Centre for Dentistry (ACTA) in Amsterdam developed a behaviour change tool (currently a short set of cards based on a motivational interviewing model) called the 'Uitblinkers' intervention.

The aim of this project is to test the feasibility and acceptability of implementing the Uitblinkers 'tool' for families supported via the DHSW programme. We aim to develop a home-based intervention to improve toothbrushing in young children (0-3 years old) in Scotland by working with parents to overcome barriers to effective toothbrushing. The intervention is targeted at families referred by health visitors to DHSWs because they are thought to need additional support before dental practice can take over.

The purpose of this Delphi study is to reach consensus on the most significant barriers to parental-supervised toothbrushing, techniques to overcome these and methods of delivery of the

intervention. We have chosen to use the recognised term 'parental-supervised toothbrushing' although in the target age range of 0-3 years, parents will likely need to brush their child's teeth for them.

Why have I been chosen?

As an expert in this field, we are keen to gain your views on prioritisation of the most common and significant barriers to toothbrushing and subsequent techniques to be incorporated into our intervention. The planned intervention is to be carried out in the home setting by Dental Health Support Workers and delivered to families in need of additional support with toothbrushing.

Do I have to take part?

No, it is up to you to decide whether or not to take part. If you do decide to take part, you will be asked to complete a consent form (attached to the Microsoft Forms survey). If you decide to take part, you are still free to withdraw at any time and without giving a reason.

What will be expected if you choose to take part?

This study will use the Delphi method, which is a way of combining the views of multiple experts to reach agreement on a subject. We are inviting you to participate as a Delphi panel member. This would involve completing two rounds made up of two parts each. The first round consists of prioritising toothbrushing barriers identified from literature using Microsoft Forms. We will also ask for any additional comments or suggestions which you think are important with regard to toothbrushing barriers. These results will be collated, and you will be asked to give brief feedback on these aggregated findings. The second round involves assessing techniques for parents/families to overcome barriers to toothbrushing and giving your opinions and feedback on the resources and methods of delivery for the intervention. Following this round, descriptive findings on the group consensus will be fed back to you for validation and comment. We anticipate that the total time commitment across all rounds will be around 40 minutes.

What will we do with the information we collect?

All data gathered will be treated as confidential and stored on a password-protected secure server in full compliance with the General Data Protection Regulation (2018). The obtained data will be stored, analysed and maintained in compliance with our Data Security Protocol.

Individual responses will be disidentified and disseminated material will include aggregate results only

What will happen to the results of the research project?

The results will aid with the development of a home-based intervention carried out by Dental Health Support Workers which will sit within the Childsmile programme.

What are the possible benefits of taking part?

The research aims to improve home toothbrushing behaviours in young children through the development of an intervention carried out by DHSWs in the home setting. Those taking part will get a chance to give their opinion and suggest ideas on the key areas which this intervention should target. We will use this information to help inform the development of an intervention which will

support families with young children to overcome barriers to toothbrushing and will facilitate its implementation and delivery.

What if I have any questions?

Please contact our research team with any questions or seek further information:

Emma Fletcher (BDS, MPH), PhD Student   e.fletcher.1@research.gla.ac.uk

Dr Al Ross (PhD; C.Psychol), Senior Lecturer   alastair.ross@gla.ac.uk

Thank you for your time and support.

Modified Delphi privacy notice

Privacy Notice for Home Toothbrushing Delphi Consensus Study

Version 1.0, March 2021

Your Personal Data

The University of Glasgow will be what's known as the 'Data Controller' of your personal data processed in relation to enhancing the Childsmile programme via development of an intervention to improve family toothbrushing behaviours in the home in young children. This privacy notice will explain how The University of Glasgow will process your personal data.

Why we need it

We are collecting basic personal data [Name, Professional role] in order to ascertain characteristics of experts in the field taking part in a Delphi study to inform the development of a tool to be used in the home by Dental Health Support Workers.

Legal basis for processing your data

We must have a legal basis for processing all personal data. In this instance, the legal basis is that you have consented to provide this for the above purpose.

What we do with it and who we share it with

All the personal data you submit is processed by staff at the University of Glasgow in the United Kingdom.

All online responses will be anonymised, and only aggregated data will be reported and stored on a password-protected secure server in full compliance with the General Data Protection Regulation (2018).

How long do we keep it for?

Your data will be retained by the University keeping with the Data Protection Act (1998)/ General Data Protection Regulations (GDPR 2018), records will not be retained for longer than necessary (10 years; https://www.gla.ac.uk/myglasgow/datamanagement/lookingafteryourdata/preservation/). After this time, data will be securely deleted.

What are your rights?*

You can request access to the information we process about you at any time. If at any point you believe that the information we process relating to you is incorrect, you can request to see this information and may in some instances request to have it restricted, corrected or, erased. You may also have the right to object to the processing of data and the right to data portability.

Participation is entirely on a voluntary basis and you will be free to withdraw at any time, without giving any reason, without your legal rights being affected. Where we have relied upon your consent to process your data, you also have the right to withdraw your consent at any time.

If you wish to exercise any of these rights, please submit your request via the webform or contact dp@gla.ac.uk.

*Please note that the ability to exercise these rights will vary and depend on the legal basis on which the processing is being carried out.

Appendix 6: Modified Delphi survey

Round 1

Priority setting for parental supervised home toothbrushing barriers

Thank you for taking part in this Delphi survey which is a component of a PhD project.

This first round should take no more than 10-15 minutes to complete.

The overarching aim is to adapt an existing parental supervised toothbrushing intervention called Uitblinkers (translation: "brilliant stars") which was originally developed by The Academic Centre for Dentistry Amsterdam, to be used by Dental Health Support Workers (DHSWs) within the Childsmile programme in Scotland.

DHSWs provide oral health support to targeted families in their home. At this stage we would like to gather your views on the main barriers to parental supervised toothbrushing for this target population, which will allow us to adapt the Ultblinkers intervention for DHSW delivered home based support within Scotland.

The target group is families with young children, age 0-3 years, who are in need of additional support and may not be attending dental practice.

Following a review of the literature, we have identified a number of barriers to parental supervised toothbrushing. It is necessary for delivery of the intervention to have a concise set of barriers therefore we require your expert judgement to identify and prioritise the most important barriers to be included in our intervention to support and improve home toothbrushing in young children. This will allow us to consider behaviour change techniques to overcome these barriers which will form the basis of the second round of this Delphi exercise.

The barriers are categorised as relating to child factors, parent factors and social/ family environment factors.

There are no right or wrong answers as we are interested in your opinions and judgement.

Thank you again for contributing and if you have any questions or encounter any problems with the survey, please contact Emma Fletcher: e.fletcher.1@research.gla.ac.uk or academic supervisor Al Ross: alastair.ross@glasgow.ac.uk

Section 1   ...

Consent

1. I confirm that I have read and understood the Participant Information Sheet, version 1.0, March 2021 (accessed here: tinyurl.com/4vbxmurf) and have had the opportunity to ask questions. *

○ Yes

○ No

2. I confirm that I have read and understood the Privacy Notice version 1.0, March 2021. (accessed here: tinyurl.com/ktab9355) *

○ Yes

○ No

3. I confirm that I agree to the way my data will be collected and processed and that data will be stored for up to 10 years in University archiving facilities in accordance with relevant Data Protection policies and regulations. *

○ Yes

○ No

4. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my legal rights being affected. *

○ Yes

○ No

5. I agree to take part in this survey. *

○ Yes

○ No

6. Please enter your name *

Enter your answer

7. What is your professional role? *

Enter your answer

Section 2   ...

Barriers prioritisation - Barriers relating to young children (0-3 years)

The intervention we are seeking to develop aims to optimise parental-supervised toothbrushing in young children from families deemed to be in need of additional support, through giving a structure for conversation and advice in the home setting.

Please consider each child-related barrier carefully and indicate the level of priority you would assign it for inclusion in this home-based toothbrushing intervention.

Then you will be asked to write in any child-related barriers you feel are missing.

8. How much do you agree that each barrier is a priority for inclusion in the home-based toothbrushing intervention we are seeking to develop, giving regard to the target population of families (deemed to be in need of additional support)? *

	1 - Strongly Disagree	2 - Disagree	3- N
Difficult child behaviour/non-compliance (e.g. lack of child co-operation, child refusal, child restlessness) is a priority	○	○	
Child too tired/child falling asleep is a priority	○	○	
Child appears upset - (e.g. child in tears/crying, shows discomfort) is a priority	○	○	

9. What other barriers, if any, RELATED TO CHILD FACTORS can you think of including in a home-based toothbrushing intervention that are missing here:

Enter your answer

Section 3 ···

Barriers prioritisation - Barriers related to parents/carers

Please consider each parent-related barrier carefully and indicate the level of priority you would assign it for inclusion in the home-based toothbrushing intervention we are seeking to develop. Then you will be asked to write in any parent-related barriers you feel are missing.

10. How much do you agree that each barrier is a priority for inclusion in the home-based toothbrushing intervention we are seeking to develop, giving regard to the target population of families (deemed to be in need of additional support)? *

	1 - Strongly disagree	2 - Disagree	3 -
Parent/carer knowledge (e.g. knowledge of decay, of fluoride, of need for twice daily toothbrushing, of age to start toothbrushing) is a priority	○	○	
Parent/carer capability (e.g. manual brushing skills, skills in managing child behaviour or resistance, not confident in their own ability to supervise effective toothbrushing, asserting parental brushing when child wants to brush themselves) is a priority	○	○	
Parent/carer attitudes or motivation (e.g. - parent doesn't see importance, parent doesn't want to force child, parent has given up or feels helpless to avoid decay) is a priority	○	○	
Parent/carer self-care (e.g. parent too tired, parent stressed, parent unfit or unwell) is a priority	○	○	

Section 4   ...

Barriers prioritisation - Barriers related to family environment

Please consider each environment-related barrier carefully and indicate the level of priority you would assign it for inclusion in the home-based toothbrushing intervention we are seeking to develop. Then you will be asked to write in any environment-related barriers you feel are missing.

12. How much do you agree that each barrier is a priority for inclusion in the home-based toothbrushing intervention we are seeking to develop, giving regard to the target population of families (deemed to be in need of additional support)? *

	1 - Strongly Disagree	2 - Disagree	3 -
Time constraints (e.g. other priorities, busy schedules) are a priority	○	○	
Social setting and influences (e.g. influence of others; lack of support from family and friends, unhelpful norms, poor role models, parent's own experience as a child) are a priority	○	○	
Structures and routines (e.g. disrupted routines; lack of routine, multiple care-givers, child lives between houses, multiple children to care for, parents often interrupted and/or forget) are a priority	○	○	
Family resources (e.g. financial problems, lack of toothbrushes/ toothpaste, no appropriate space for brushing) are a priority	○	○	
External input (e.g. complicated or confusing advice from professionals, lack of instruction, access to services) is a priority	○	○	
Cultural barriers (e.g. norms regarding toothbrushing practices, language barriers, access to culturally appropriate materials and resources) are a priority	○	○	

13. What other barriers, if any, RELATED TO SOCIAL OR ENVIRONMENTAL FACTORS can you think of including in a home-based toothbrushing intervention that are missing here:

Enter your answer

14. Do you have any additional comments or feedback you wish to give?

Enter your answer

Round 2

Expert Panel Delphi: Model of delivery for a home toothbrushing intervention

Thank you for taking part in this Delphi survey which is a component part of a PhD study.

The overarching aim is to adapt an existing parental supervised toothbrushing intervention called Uitblinkers (translation: "brilliant stars"), which was originally developed by The Academic Centre for Dentistry Amsterdam, to be used by Dental Health Support Workers (DHSWs) within the Childsmile programme in Scotland.

DHSWs provide oral health support to targeted families in their home. The target group for this intervention is families with young children, age 0-3 years, who are in need of additional support and may not be attending dental practice.

The first round of this Delphi survey prioritised the most important barriers to be included in our intervention to support and improve home toothbrushing in young children. Following this prioritisation exercise and subsequent validation of results, a set of 11 barriers was selected to be included in the intervention. These barriers are presented below.

1.   Difficult child behaviour/non-compliance (e.g. lack of child co-operation, child refusal, child restlessness)

2.   Structures and routines (e.g. disrupted routines; lack of routine, multiple care-givers, child lives between houses, multiple children to care for, parents often interrupted and/or forget)

3.   Parent/carer capability (e.g. manual brushing skills, skills in managing child behaviour or resistance, not confident in their own ability to supervise effective toothbrushing or asserting parental brushing when child wants to brush themselves)

4.   Social setting and influences (e.g. influence of others; lack of support from family and friends, unhelpful norms, poor role models, parent's own experience as a child)

5.   Parent/carer attitudes or motivation (e.g. parent doesn't see importance, parent doesn't want to force child, parent has given up or feels helpless to avoid decay)

6.   Time constraints (e.g. other priorities, busy schedules)

7.   Parent/carer self-care (e.g. parent too tired, parent stressed, parent unfit or unwell)

8.   Cultural barriers (e.g. norms regarding toothbrushing practices, language barriers, access to culturally appropriate materials and resources)

9.   Child appears upset (e.g. child in tears/crying, shows discomfort, child tired)

10. Family resources (e.g. financial problems, lack of toothbrushes/ toothpaste, no appropriate space for brushing)

11. Parent/carer knowledge (e.g. knowledge of decay, of fluoride, of need for twice daily toothbrushing, of age to start toothbrushing, confusing advice from professionals, lack of instruction)

To address these barriers, the Uitblinkers conversational method consists of three phases.
- Opening the conversation
- Identifying barriers
- Discussing strategies for improving brushing, including agreeing actions and follow up

In this short 'Delphi' survey we will briefly outline each of these stages and ask you for your opinion, and any suggestions for improvement you may have.

Thank you again for contributing and if you have any questions or encounter any problems with the survey, please contact Emma Fletcher: e.fletcher.1@research.gla.ac.uk or academic supervisor Al Ross: alastair.ross@glasgow.ac.uk

Section 1	...

Consent

1. I confirm that I have read and understood the Participant Information Sheet, version 1.0, March 2021 (accessed here: tinyurl.com/4vbxmurf) and have had the opportunity to ask questions. *

○ Yes

○ No

2. I confirm that I have read and understood the Privacy Notice version 1.0, March 2021. (accessed here: tinyurl.com/ktab9355) *

○ Yes

○ No

3. I confirm that I agree to the way my data will be collected and processed and that data will be stored for up to 10 years in University archiving facilities in accordance with relevant Data Protection policies and regulations. *

○ Yes

○ No

4. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my legal rights being affected. *

○ Yes

○ No

5. I agree to take part in this survey. *

○ Yes

○ No

6. Please enter your name *

Enter your answer

7. What is your professional role? *

Enter your answer

Opening the conversation

The methodology starts by building a connection and creating a positive, non-judgmental atmosphere. This is done by focusing on the positives and reinforcing any competency that the parent/carer can describe, by giving compliments and through expression of empathy.

Prompts: First, ask what is going well with toothbrushing; give praise for even partial achievements (e.g. brushing once a day, some children do better than others, child accepts brushing sometimes); reinforce why what they are doing is so important.

Second, ask about the moments when toothbrushing is challenging or being skipped; encourage the parent to explore their own barriers by asking for an elaboration, explicit examples or more details of challenging situations; show understanding.

Reason behind this: Asking first about positive behaviours empowers the parent and avoids negative sentiment. Evidence shows that people are more intrinsically motivated to change their behaviour if they feel competent, autonomous (involved in the process & decisions) and connected (feeling accepted by the health professional).

8. What are your comment(s) on opening with positive behaviours? *

> Enter your answer

9. Are there any barriers or pitfalls you can think of with this approach? *

○ Yes

○ No

10. If you answered yes, please say what you think these are?

> Enter your answer

11. Do you have any alternative suggestions for opening the conversation on home brushing with young children?

> Enter your answer

Identifying barriers

During the next phase, a set of cards with validated barriers to home brushing is shown to allow the parent to self-identify with any issues they may be experiencing. The cards feature illustrations to support the conversation especially for those who may have difficulty reading.

The barriers are listed in the first section and can be viewed again here: https://tinyurl.com/3f365fph Each card begins "Brushing my child's teeth is difficult because..."

Prompts: ask which barrier most applies; if there are multiple, reassure that these can be addressed in turn; show understanding and be empathetic to any emotion or 'feeling of failure'; stress the norms i.e. how you often see people struggle with this; stress that these barrier(s) can be addressed and that you will work through them together; avoid 'telling them what to do' and stress that there are usually opportunities for people to find their own ways to get brushing done.

12. What are your comment(s) on presenting a set of barriers like this? *

Enter your answer

13. Do you have any alternative suggestions for identifying which of the known barriers to home brushing might be at play?

Enter your answer

14. Do you have any further suggestions for avoiding 'blame' and not making this too judgemental or negative?

Enter your answer

Discussing strategies for improving brushing (including agreeing actions and follow up)

Based on the barrier selected, an appropriate strategy is explored with the parent and agreed collaboratively. The back of each card summarizes appropriate approaches for each barrier, which the support worker 'goes over' with the parent.

Prompts: Strategies based on stimulus control and operant conditioning, together with positive parenting as above; goal setting is incorporated as a strategy for each barrier.

• Stimulus control is focused on the context or setting for the desired behaviour. Specifically, parents are advised how to set up the conditions at home in such a way that it promotes brushing. Advice focuses on structuring time and space, implementing set rules and habits, and being clear and consistent when persuading or guiding the child.

• Operant conditioning focuses on the consequences of behaviour. Desired behaviour is rewarded and undesired behavior is 'punished' or ignored. Specifically, parents are advised how to give praise or privileges for brushing and to provide negative feedback where the child may refuse or be unwilling. The main aim is to focus positive attention on brushing whereby it becomes associated strongly with positive outcomes. This technique also incorporates positive parenting which encourages parents to avoid overly strict attempts to 'enforce' home brushing but to focus on positive parent-child interactions, expressions of warmth, positive reinforcement, and a consistent and clear parenting style.

• Goal setting principles are employed when closing the conversation, agreeing to commit to try specific things that start in small, graduated steps and which are followed up at an agreed time to review

• The overall model of conversation is based on motivational interviewing (MI). MI is a step-by-step behavior change technique to intrinsically motivate patients to practice good health behaviours by exploring personal reasons for change and working towards a goal.

Different barriers of course require different specific approaches based on these general principles, but before we ask you a few questions about this phase we have included two short 'case studies' for you to read which are intended to help you get a holistic feel for the flow of the Uitblinkers conversation overall.
These case studies can be accessed here:

Case study 1 - Operant conditioning: tinyurl.com/t2m4k8h7
Case study 2 - Stimulus control: https://tinyurl.com/hnpsb28

Academic references can be viewed here:
https://tinyurl.com/jh98kjk

15. What are your comment(s) on the approach to improving supervised brushing for the target group outlined above and illustrated in the case studies? *

Enter your answer

16. To what extent do you agree that families would be receptive to advice if delivered in this way *

	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
	○	○	○	○	○

17. To what extent do you agree that the psychological approaches in the tool are appropriate and valid? *

	Strongly Disagree	Disagree	Neutral	Agree	Strongly ag
Stimulus control	○	○	○	○	○
Operant conditioning	○	○	○	○	○
Goal setting	○	○	○	○	○
Motivational interviewing	○	○	○	○	○

18. Do you have any alternative suggestions for any general theories of behaviour change or theory-based change mechanisms for parents supervising child brushing?

Enter your answer

Design and implementation

Finally, we are also interested in your wider opinion about design and implementation of the intervention.

19. Please say how much you agree with the following statements: *

	Strongly Disagree	Disagree	Neutral	Agre
Support workers would need brief training in psychological theory to deliver the intervention	○	○	○	○
Online delivery such as via hand-held devices or tablets would be better than physical cards	○	○	○	○
This could realistically be delivered in the home setting	○	○	○	○
Resources/materials to leave with families (e.g. reminders, diaries) would help	○	○	○	○
This could be delivered effectively remotely (e.g. videos calls)	○	○	○	○

20. Do you have any additional comments with regards to design and implementation of the intervention?

Enter your answer

Appendix 7: Description of barriers presented to participants in modified Delphi Round 1

Description of barriers used in Delphi Round 1:

Child related barriers

- Difficult child behaviour/non-compliance (e.g. lack of child co-operation, child refusal, child restlessness)
- Child too tired/child falling asleep
- Child appears upset - (e.g. child in tears/crying, shows discomfort)

Parent/carer related barriers

- Parent/carer knowledge (e.g. knowledge of decay, of fluoride, of need for twice daily toothbrushing, of age to start toothbrushing)
- Parent/carer capability (e.g. manual brushing skills, skills in managing child behaviour or resistance, not confident in their own ability to supervise effective toothbrushing, asserting parental brushing when child wants to brush themselves)
- Parent/carer attitudes or motivation (e.g. - parent doesn't see importance, parent doesn't want to force child, parent has given up or feels helpless to avoid decay)
- Parent/carer self-care (e.g. parent too tired, parent stressed, parent unfit or unwell)

Family environment related barriers

- Time constraints (e.g. other priorities, busy schedules)
- Social setting and influences (e.g. influence of others; lack of support from family and friends, unhelpful norms, poor role models, parent's own experience as a child)
- Structures and routines (e.g. disrupted routine, lack of routine; multiple caregivers, child lives between houses, multiple children to care for, parents often interrupted and/or forget)
- Family resources (e.g. financial problems, lack of toothbrushes/toothpaste, no appropriate space for brushing)
- External input (e.g. complicated or confusing advice from professionals, lack of instruction, access to services)
- Cultural barriers (e.g. norms regarding toothbrushing practices, language barriers, access to culturally appropriate materials and resources)

Appendix 8: DHSW interview guide

Dental Health Support Worker Interview Guide

- Tell us a bit about yourself and your work in oral health support?

    o E.g. experience, role, location

- What do you think are the main issues facing parents of young children with regards to caring for their child's oral health?

    o Difficulties with toothbrushing?

        ▪ Prompts from modified Delphi exercise

- What if anything have you tried with parents/ carers before?

    o What worked, what didn't, why/ why not?

[From here, introduce concept of intervention – bit of background about Uitblinkers, what it is, what we are doing. Opening conversation with positive behaviours, non-judgemental atmosphere]

- What are your thoughts on this approach? – What do you like? What would you change? How would you normally start conversation?

[Show list of toothbrushing barriers with explanation as to where they came from]

- What do you think of the barriers to toothbrushing selected?

    o Are there any missing?

    o Do these barriers match with your experience working with parents?

[Introduce/show cards and how they are used - original Uitblinkers cards and alternatives – with photograph/illustration]

    o What are your thoughts on presenting the barriers like this?

    o What do you think of the cards themselves?

        ▪ Design, pictures, size, number, ease of use

    o Which style of card do you prefer? Any ideas as to how they could be improved?

    o How useful to you think use of these cards would be in discussing toothbrushing with parents referred to the DHSW service?

- o How would parents respond to their use?

- o Do you currently use any materials that you bring on home visits e.g. leaflets, folders, tablets etc

[Introduce techniques – use case studies as examples]

- What about the tips/ strategies to help parents/ carers?

  - o Do these 'solutions' match with your experience working with parents?

  - o Would the suggestions for follow up work?

  - o Do you currently leave any materials with parents e.g. reminder cards, information cards? Is this useful?

  - o What do you think would be best to leave with families in this situation? ?reminder card for dentist appointment?

- What about your own ability to carry this out? Or your colleagues?

  - o Confidence, skills, how it would feel

- What about parent / family factors?

  - o Attitudes, acceptance, ability to understand, adherence?

  - o How would you feel about carrying out this intervention?

- What are the practical issues with carrying out the intervention using these resources and/or what would help?

  - o Space, time, home setting/environment/ other resources required

  - o Management of the programme e.g. your job/ role/ training

  - o We are building up some scenarios/case studies such as previously mentioned – would these be useful for training purposes?

- Which parents do you think this intervention would be most useful for?

  - o Targeted? How to decide which parents?

- How do you think this fits with general initiatives/ policy for Scotland's young people?

- o   E.g. educational and other interventions, joined up working, community linking

- Is there anything else about the intervention we have not covered that you feel is

    important?

Appendix 9: Prototype cards used in DHSW interviews

Toothbrushing is challenging when my child won't allow me to brush their teeth

Toothbrushing is challenging when my child won't allow me to brush their teeth

Toothbrushing is challenging when my child won't allow me to brush their teeth

pixtastock.com – 63053615

Toothbrushing is challenging when I have a lot going <u>on</u>

Toothbrushing is challenging when my child won't allow me to brush their teeth

Appendix 10: Example Nvivo coding of DHSW interview transcripts

Appendix 11: Definitions of BCTs

BCT	Definition as described in the BCT taxonomy (Michie et al., 2013)
Self-monitoring of behaviour	Establish a method for the person to monitor and record their behaviour(s) as part of a behaviour change strategy
Graded tasks	Set easy-to-perform tasks, making them increasingly difficult, but achievable, until behaviour is performed
Behavioural rehearsal/practice	Prompt practice or rehearsal of the performance of the behaviour one or more times in a context or at a time when the performance may not be necessary, in order to increase habit and skill
Habit formation	Prompt rehearsal and repetition of the behaviour in the same context repeatedly so that the context elicits the behaviour
Rewards - incentives	Inform that performance will be rewarded contingent on behaviour in the future
Restructuring the social environment	Change, or advise to change the social environment in order to facilitate performance of the wanted behaviour or create barriers to the unwanted behaviour (other than prompts/cues, rewards and punishments)
Environmental changes (e.g. objects to facilitate behaviour)	Change the environment in order to facilitate the target behaviour (other than prompts, rewards and punishments, e.g. choice of food provided)

Avoidance/changing exposure to cues for the behaviour	Advise on how to avoid exposure to specific social and contextual/physical cues for the behaviour, including changing daily or weekly routines
Goal/target specified: behaviour or outcome	Set a goal defined in terms of the behaviour to be achieved
Emotional consequences	Provide information (e.g. written, verbal, visual) about emotional consequences of performing the behaviour
Comparative imaging of future outcome	Prompt or advise the imagining and comparing of future outcomes of changed versus unchanged behaviour
Verbal persuasion to boost self-efficacy	Tell the person that they can successfully perform the wanted behaviour, arguing against self-doubts and asserting that they can and will succeed
Persuasive communication	Credible source presents arguments in favour of the behaviour
Health consequences	Provide information (e.g. written, verbal, visual) about health consequences of performing the behaviour
Feedback on behaviour	Monitor and provide informative or evaluative feedback on performance of the behaviour *(e.g. form, frequency, duration, intensity)*
Instruction on how to perform the behaviour	Advise or agree on how to perform the behaviour
Goal-setting	Set or agree on a goal defined in terms of the behaviour to be achieved

Social support (emotional)	Advise or agree on how to perform the behaviour
Problem-solving	Analyse, or prompt the person to analyse, factors influencing the behaviour and generate or select strategies that include overcoming barriers and/or increasing facilitators
Coping skills	Analyse the problem and generate or select solutions that include overcoming barriers and increasing facilitators
Reduce negative emotions	Advise on ways of reducing negative emotions to facilitate performance of the behaviour
Discrimitive (learned) cue	Identify an environmental stimulus that has been repeatedly associated with contingent reward for specified behaviour
Prompts/cues	Introduce or define environmental or social stimulus with the purpose of prompting or cueing the behaviour. The prompt or cue would normally occur at the time or place of performance
Social support (practical)	Advise on, arrange, or provide practical help *(e.g. from friends, relatives, colleagues, 'buddies' or staff)* for performance of the behaviour
Social comparison	Draw attention to others' performance to allow comparison with the person's own performance
Social support or encouragement	Advise on, arrange or provide social support *(e.g. from friends, relatives, colleagues,' buddies' or staff)* or non-contingent praise or reward for performance of the behaviour. It includes encouragement and counselling, but only when it is directed at the behaviour
Information about others' approval	Provide information about what other people think about the behaviour. The information clarifies whether others will like, approve or disapprove of what the person is doing or will do

Modelling/demonstration of behaviour	Provide an observable sample of the performance of the behaviour, directly in person or indirectly e.g. via film, pictures, for the person to aspire to or imitate
Planning, implementation	Prompt detailed planning of the behaviour goal (including at least one of context, frequency, intensity and duration of performance)
Action planning (including implementation intentions)	Prompt detailed planning of performance of the behaviour (must include at least one of context, frequency, duration and intensity). Context may be environmental (physical or social) or internal (physical, emotional or cognitive)
Adding objects to environment	Add objects to the environment in order to facilitate performance of the behaviour.

Appendix 12: Full prototype STAR tool used in simulation testing

the **star** toothbrushing tool

For more information, see the back page for contact details.

This tool has been designed to allow Dental Health Support Workers to engage with parents/carers in supportive conversations about home toothbrushing for young children. It helps parents and carers identify, and begin to overcome, common barriers that many people face in encouraging and supervising daily toothbrushing for young children. It aims to improve child toothbrushing behaviours by focusing on known barriers related to toothbrushing in the home.

the **star** process

The tool has been designed for use in home visits by Dental Health Support Workers but can be used in other settings such as dental practices.

It is intended to help parents/carers of young children whose toothbrushing is initiated and supervised by adults. While the tool has been designed for using with children age 0-3 years old, it can be adapted to help with older siblings also.

The star process follows 4 steps:

support Parent/ carer is asked what is going well with child toothbrushing, or things that have worked before and why

talk through barriers Parent / carer chooses from a list of common barriers which represent difficulties that they may be having in supporting child toothbrushing

apply Staff and parent/ carer go through potential tips that can help

recap Staff and parent/carer arrange to follow up and see how things are going

When using the STAR tool, it is often best to discuss one barrier at a time. If there are other issues to address, we recommend picking these up during subsequent visits or conversations.

the **star** toothbrushing tool

support Parent/ carer is asked what is going well with child's toothbrushing, or things that have worked before and why

Opening the conversation

Most parents/carers have tried various things to establish regular child toothbrushing. Some may have worked better than others.

The STAR tool follows a Motivational Interview model, allowing parents/ carers to choose their own barriers to address and to identify solutions with support. Communication follows the general OARS style:
O - Open Questions
A - Affirmations
R - Reflective Listening
S - Summarising

To begin with it is good to ask and assess what they think is working, or perhaps what has worked in the past.

We've included examples of 'what to say' throughout. This is not intended to be a 'script' that people read word for word, but to give a framework for guiding the conversation using an empathetic and parent-centred communication style.

> **Have you managed sometimes to get [name of child/children] to brush their teeth?**

> **Well done, it's never easy...!**

> **What do you think helps [name of child/children] to brush their teeth regularly?**

If it's hard for the parent/carer to explain, suggestions can be made- this could be in terms of practical things like when toothbrushing happens or where, or whether incentives for the child work, or who does the supervision, etc.

> **We'll just go through some of the things that can 'get in the road' of toothbrushing - is that OK? - and we can see if there's anything I can maybe help with, OK?**

t

talk through barriers Parent / carer chooses from a list of common barriers which represent difficulties that they may be having in supporting child toothbrushing

Using the cards

Many parents/carers experience issues with child toothbrushing. The STAR tool is designed such that all 11 cards are displayed, and parents/carers choose from the set. With judgement, and when support workers get to know families, or have had previous conversations, it may be that a particular set are presented that are likely to represent known issues.

Each card depicts a home toothbrushing barrier to do with children, parents/carers and family circumstances.

> **Let's have a look at things that we know can lead to problems with regular toothbrushing for children at home, OK?**

> **What we've got are images, with statements that indicate how you may be feeling, OK?**

> **We will go through them, and then you can choose which one best reflects any difficulty you may be having, so we can have a wee chat about that, OK?**

the **star** toothbrushing tool

BARRIER CARD 1

My child refuses to let me brush their teeth

This barrier concerns difficult child behaviour/non-compliance (e.g. lack of child co-operation, child refusal, child restlessness). It can apply to very young children, or to children who are trying to assert independence as they get a little bit older.

The ways to address this barrier are based on operant conditioning to reward positive behaviours and avoid reinforcing negative ones. Generally, this card is approached by supporting parent skills in overcoming the child's resistance. The positive behaviour of child brushing is also supported by role modelling and setting of realistic goals.

Advise parents that while it may seem easier to give in, this can cause tooth decay or gum problems

Point out that allowing children to skip toothbrushing may lead to them refusing other things, like eating healthy snacks, getting ready for school in time etc.

Suggest that children brush (or mimic brushing) the parent's teeth at the same time to encourage them and allow habit formation; child may also practice on their doll or teddy first

Suggest singing/playing a song alongside brushing to make it fun

Encourage parents to try brushing in small steps initially then gradually build up. For slightly older children, brushing a few teeth at a time or 'counting to five' while brushing can be a scaffold from which to increase brushing time

Encourage the parent to praise their child when they do well with brushing; older children can receive a suitable reward e.g. extra bedtime stories, stickers, choosing a game to play

Doing it 'with them' and not 'to them' can make it easier to build trust

'Giving in' is understandable and can seem the easiest thing to do – but we know it'll lead to harder things to manage in future, like dental visits or other health problems

A little practice and a lot of praise can go a long way!

My child appears upset when I'm trying to get them to brush

This barrier concerns children that are showing pain or discomfort, or perhaps tiredness or irritation. Try to determine the reason for the child being upset.

The ways to address this barrier are based on Operant Conditioning (rewarding positive behaviours and avoiding reinforcement of negative behaviours) and Stimulus Control (to find the best setting for toothbrushing to take place). The positive behaviour of child brushing is also supported by role modelling and setting of realistic goals.

Reassure parents that this is a very common issue especially in very young children

Try to determine the cause of the child being upset – it's important to rule out any physical pain first so ask if the parent has noticed any bleeding gums or marks on teeth – refer to a dentist if necessary

If pain is suspected, suggest using a soft brush, starting in an area that isn't sore

Stress that avoiding brushing could lead to more pain

Suggest that children brush (or mimic brushing) the parent's teeth at the same time to encourage them

Suggest singing/playing a song alongside brushing to make it fun

Encourage parents to try brushing in small steps initially then gradually build up. For slightly older children, brushing a few teeth at a time or 'counting to five' while brushing

If it seems the child is tired, encourage brushing earlier in the evening

Encourage parents to avoid showing irritation e.g. by raising their voice when the child is upset; suggest offering praise and rewards like bedtime stories or stickers to encourage the child to allow brushing

Avoiding brushing can seem kind but is actually not the best thing for children

Children will come round with a little perseverance

I often think I am not brushing my child's teeth in the right way

This barrier concerns parent/carer capability. This is often an issue with new parents or with very young children.

The ways to address this barrier are based on behaviour change techniques to do with self-belief and self-efficacy; capability is encouraged, and good technique is reinforced.

Generally, this card is approached by supporting parent confidence.

Find out a bit more – what is it about their brushing they feel unsure about – is it the actual brushing, fear of upsetting the child, inability to manage behaviour, or something else

Reassure the parent that many if not all people feel like this at some point– especially when starting out or with very young children

Demonstrate toothbrushing and explain it in easy steps - tailor this to suit the parent's stage and ability to absorb the information

Reinforce the importance of keeping up with twice daily brushing - this will quickly help strengthen their confidence and skills

Help make an appointment with the dentist to check teeth and gums which will stress the importance, and hopefully confirm that brushing is going well

Everybody starts somewhere - I bet you're doing better than you think you are

You might find it easier to get brushing started by sitting yourself/child in this position

The more you do it, the easier it becomes!

the **star** toothbrushing tool

I can't really see the point in forcing my child to brush

This barrier concerns parent/carer motivation. Try to determine what specific issues they have (e.g. parent doesn't see importance, parent doesn't think it's their job, parent has given up or feels helpless to avoid decay particularly in baby teeth).

The ways to address this barrier are drawn from theory-based techniques on habit formation and perceptions of consequences. Information on the important outcomes of oral health behaviours should be reinforced. In addition, the setting of realistic goals can help work towards the formation of healthy toothbrushing behaviours.

Reassure parents that this is a common feeling you see in parents/carers

Find out a bit more – what issues are they having and do they always feel like this or only sometimes

Stress the importance of regular brushing to avoid any dental health problems like bleeding/sore gums or tooth decay

Explain that by brushing twice daily and reducing sugar, it is possible to prevent decay in baby teeth – and if they have healthy baby teeth, they are more likely to have healthy adult teeth too

Encourage parents to get into a routine with toothbrushing, ideally brushing at the same time each day, so their child will anticipate it and be less likely to act up

Reassure parents that if there's a time when they are finding it difficult, it's ok to walk away and try again later when things are a bit calmer

Everybody has felt like giving up at some point

Toothbrushing is something that really is worth the effort

Establishing a toothbrushing routine is one of the best things you can do for your child's health

I don't really know what I'm supposed to do or where to start

the **star** toothbrushing tool

This barrier concerns parent/carer knowledge. Try to determine what it is that they are unsure of or confused by (e.g. knowledge of decay, of fluoride, of need for twice daily toothbrushing, of age to start toothbrushing, confusing advice from professionals, lack of instruction).

Information on good oral health behaviours should be provided. The ways to address this barrier are drawn from theory-based techniques on explanation and demonstration of the behaviour, followed by habit formation. In addition, the setting of realistic goals can help work towards the formation of healthy toothbrushing behaviours.

Find out a bit more about what the parent feels they struggle with and if there is anything in particular they would like help with

Ensure they have basic knowledge on brushes, toothpaste, fluoride, and technique

Advise parents to start brushing as soon as the first tooth erupts to allow healthy habits to start early

Give parents the opportunity to ask questions or even try brushing if they feel comfortable

Offer to help parents to figure out the best toothbrushing routine for them and their family

Explain that baby teeth can be particularly susceptible to decay but starting a good toothbrushing routine along with a healthy diet can avoid any problems and set up good habits which can mean they are less likely to experience decay in their adult teeth too

All this information can be confusing and can feel like overload at times!

Don't worry, I'll just go over the basics to start and we can talk through everything together

Start brushing as soon as your baby has their first tooth so they get an early start in healthy habits!

the **star** toothbrushing tool
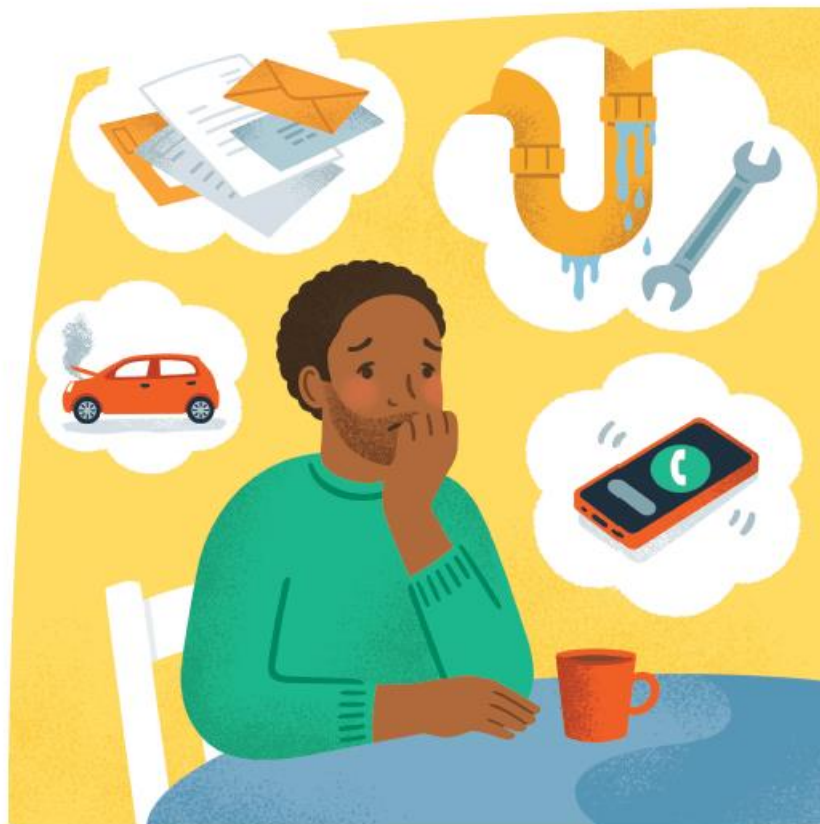
I am stressed

This concerns parent/carer self-care. Try to determine the nature of any issues (e.g. parent tired, parent stressed, parent unfit or unwell).

The ways to address this barrier are drawn from theory-based techniques on positive reinforcement, embedded routines, problem solving and reducing negative emotions. In addition, the setting of realistic goals can help work towards the formation of healthy toothbrushing behaviours.

- Reassure parents that it is normal to feel like this sometimes and ask if you can talk this through with them

- Ask parents to talk through their day-to-day routine and discuss any stressors

- Explain that regular brushing makes children more cooperative, which will require less energy on their part

- Advise that toothbrushing time can be flexible depending on when it is most suitable for them and/or when they may be less tired or less busy (for example just after dinner as long as the child doesn't snack after this)

- Depending on the nature of the problem, you may need to judge if referral to other services is required or an appointment with the parent's GP is more suitable

We have all been there sometimes- feeling tired, stressed or pulled in multiple directions

I know you're trying to do what's best for your children. Doing what's best for your own health can help.

We don't have the same routine or people in the house every day

the **star** toothbrushing tool
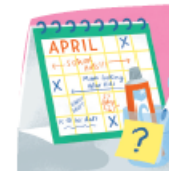
This barrier concerns general caring structures and routines. Try to work out the nature of the family's present routine (e.g. disrupted routines; lack of routine, multiple care-givers, child lives between houses, multiple children to care for).

The ways to address this barrier are based on Stimulus Control (to find the best setting for toothbrushing to take place). In addition, the setting of realistic goals can help work towards the formation of healthy toothbrushing behaviours.

Ask parents to talk through their current routine and how it is making toothbrushing difficult

Help parents to work out the best place(s) and time(s) for toothbrushing to fit in and where it is least likely to be disrupted

Give suggestions/ideas of different ways they could make brushing easier to take place. For example, in the evenings, brushing straight after dinner or before putting on pyjamas and laying out children's clothes/bag the night before to save time in the morning to accommodate brushing

Encourage parents to have a discussion with other caregivers about their child's toothbrushing routine – suggest writing it down or making a chart which you could help with if parent would prefer

Give extra toothbrushing packs to make sure their child always has a brush and toothpaste when they stay elsewhere

Stress the importance of brushing twice daily when they are looking after their child

Organising toothbrushing can be difficult

Try taking charge and making sure everyone is on the same page

You can set the example by making sure the child is brushing when they are with you

the star toothbrushing tool

I don't really feel support from other people

This barrier concerns social setting and influences (e.g. influence of others; lack of support from family and friends, unhelpful norms, poor role models, parent's own experience as a child)

The ways to address this barrier are drawn from theory-based techniques on habit formation, social support and addressing social norms, and providing information about the important outcomes of health behaviours. In addition, role modelling and the setting of realistic goals support the formation of healthy toothbrushing behaviours.

Allow the parent to explain how this barrier makes them feel and how it impacts on toothbrushing

Ask if they are able to have a conversation with others about their feelings and wishes regarding their child's toothbrushing routine or snack intake; explain why they need to take control, while remaining calm and firm

If the parent would prefer, offer to be present during this conversation for support or advice/input

Provide contacts for groups or services to provide parent with extra support; often this gives a platform by showing how many others face the same issues

Parents may not have been used to brushing themselves. Explain the importance of brushing twice a day from when teeth first erupt to prevent tooth or gum problems in the future

Suggest that others brush alongside the child. This is much better than offering sweets but is also fun and still something the child will enjoy

Support can almost always be found, once you recognise that you need it

Feeling that you're not in charge sometimes is normal - let's start with what you can control

Healthy habits mean healthy babies mean healthy adults!

I'm so busy and it's difficult to find time for toothbrushing

This barrier concerns time constraints (e.g. lots to do, interruptions, other priorities, busy with other children).

The ways to address this barrier are based on Stimulus Control (to find the best setting for toothbrushing to take place). In addition, the setting of realistic goals can help work towards the formation of healthy toothbrushing behaviours.

Ask parents to talk you through their current time management to find out more about what problems they have been having

Work with parents to try to establish time and place for toothbrushing, and who will carry it out, so that it is least likely to be disrupted

Give suggestions/ideas of different ways they could make brushing easier to take place. For example, in the evenings, brushing straight after dinner or before putting on pyjamas and laying out children's clothes/bag the night before to save time in the morning to accommodate brushing

Explain to parents that if they can find a good time to fit in toothbrushing, it is more likely to happen without having too much of an impact on the rest of their day or routine

That sounds difficult when you're just so busy and it doesn't feel like you have enough hours in a day.

Toothbrushing is really important and only takes a few minutes

Let's figure out a protected time and place for toothbrushing for your family

The information I get doesn't seem to be for people like me

the **star** toothbrushing tool

This barrier concerns cultural barriers. Try to determine specifically what they are struggling with (e.g. norms regarding toothbrushing practices, language barriers, access to culturally appropriate materials and resources).

The ways to address this barrier are drawn from theory-based techniques on habit formation, addressing social norms, and providing information about the important outcomes of health behaviours. In addition, role modelling and the setting of realistic goals support the formation of healthy toothbrushing behaviours.

Offer parents the assistance of an interpreter if they would feel more comfortable

Offer to help make an appointment with a dentist to have a look at their child's teeth and gums to make sure brushing is going ok

Provide information on the best way to brush a child's teeth, explaining that most children including babies have their teeth brushed twice per day

Ask parents to explain in their own terms any ways in which they are struggling with brushing; ask if there is anyone in their own community that might be able to help

Provide leaflets in their preferred language for parents to go through and offer to answer any questions

I understand how accessing materials and services can be daunting to begin with

We want all families in Scotland to feel supported

the **star** toothbrushing tool

We often don't have things like toothbrushes or toothpaste

This barrier concerns family resources. (e.g. financial problems, lack of toothbrushes/toothpaste, no appropriate space for brushing).

Try and explore any underlying family issues. The ways to address this barrier are drawn from theory-based techniques on the provision of social support and adding essential items to the environment. In addition, the setting of realistic goals can help work towards the formation of healthy toothbrushing behaviours.

Find out a bit more about what issues the parent/family are experiencing

Offer to leave a supply of toothbrushes and toothpaste, including for other siblings in the house

Advise parents that the toothpaste is also suitable for adults to use as it contains the correct amount of fluoride

Leave contact details so parents can let you know when they are running low on toothbrushing supplies

Depending on what problems the family are having, you can suggest referral/ linking with other services to help the parent manage these

Don't worry we can make sure you have all you need

We can put you in touch with people that can help with issues you might be struggling with

the **star** toothbrushing tool

apply Staff and parent/ carer go through potential tips that can help

Going over tips to help overcome the barrier

Use the suggestions on the back of each 'barrier' image. Clarify what the barrier represents and check this is something that the parent/carer identifies with. With all barriers, stress the importance of regular brushing. There are general things you can say that apply to all the cards.

> I can really see why this could be hard. But we know toothbrushing is one of the most important things you can do for [child name]'s teeth and gums so that they get into the habit.

> Nurses, doctors, health visitors, teachers will all tell you how important toothbrushing is.

Involving parents in the process is vital- both in choosing barriers they can identify with, and in coming up with realistic solutions.

> What do you think might help? Is that going to be worth a try do you think?

Then see what tips the parent might be able to carry out.

> I won't ask you to try anything too hard, or that you don't think will work, OK?

If parents choose more than one, reassure them that these can be addressed in turn or in future visits. Show understanding and stress how normal this is. There may be other things from your own experience as a parent/carer or that have worked with your Childsmile families before.

> One thing I have seen that sometimes works for other mums/ carers like you is...

recap Staff and parent/carer arrange to follow up and see how things are going

Closing the conversation and agreeing the plan of action

This step is vital. Affirming what's been discussed and agreed, and setting expectation for reviewing and following up, is crucial to maintaining motivation. The aim is to finish with something that may be a challenge but is within the parent/carer's reach and capability.

End the conversation by summarising what you have discussed and creating an 'action plan' with the parent/carer that is suitable and realistic for them and contains a timeframe to follow up.

A key part of trying to sustain behaviour change is to agree realistic, simple tasks at the right time for the right person, and to accept and plan for something not working out straight away.

> Ok so we are going to try [...] OK?

> How do you feel about trying this? I really think you can manage this.

> Don't worry if it doesn't work straight away. Keep trying and we can discuss next time OK?

Depending on the barrier and circumstances of the visit, it may be possible for the parent/carer to try out some of the tips and toothbrushing suggestions with the help of the support worker.

The main thing is to choose actions that can be reasonably attempted, not those that seem a 'long shot', or 'everything at once'.

the **star** toothbrushing tool

Contact details for further information

e.fletcher.1@research.gla.ac.uk

alastair.ross@glasgow.ac.uk

andrea.sherriff@glasgow.ac.uk

Notes

Appendix 13: Vignettes used for training as part of simulation workshop

Parent 1

Parent: Claire Brown
Age: 23

The Dental Health Support Worker (DHSW) has come to visit you in your home because you are having difficulty brushing your child's teeth.

The DHSW will:
1. Ask you what you have tried and what seems to work
2. Give you a set of cards to choose from which show difficulties people have with brushing
3. Discuss the card you choose and how to support toothbrushing
4. Recap and agree a plan for seeing you again

You are 6 months pregnant and have a daughter, Abby, who is 18 months old. You are married, but your husband is a long-distance lorry driver, and is often away from home for several days at a time. This means you are looking after Abby, very much on your own. Your mother was a help with the childcare, but she can't help out as much at the moment as she's been unwell.

Guide:

When asked what is going well with brushing

Say that it is a bit better in the mornings when you feel Abby is less tired. You know you're supposed to brush twice a day but sometimes it's difficult.

When prompted by the DHSW to look through the cards

Choose card number 2 '*My child appears upset when I am trying to get them to brush*' [but say you can relate to a lot of them]

The DHSW will talk you through some of the techniques that you could try out with Abby.

Be a bit hesitant at first that you could have trouble trying these tips out:

- *Abby is prone to having tantrums when you try to brush her teeth, especially at night time*
- *When Abby is upset, it can cause you to get really stressed*
- *You try your best but often end up skipping brushing as it's the only way to calm her down*
- *You often feel like you are failing by not brushing her teeth every day but you can't see any other way*
- *You sometimes forget to brush until just before Abby is going to bed and she can be a bit grumpy before you've even started brushing.*

If asked - you haven't noticed any bleeding gums or holes in Abby's teeth and don't think she is in any pain.

They may suggest: using soft brushes, doing your own teeth so that Abby joins in, singing/ playing songs when brushing, starting with small steps (counting to 5) then building up, etc.

You hadn't thought or heard about some of these tips before – you are a bit worried it might be hard work but finally you allow yourself to be persuaded and agree to try out the suggestions that the support worker makes and that you will let them know how you have gotten on in a couple of weeks.

Parent 2

Parent: Samantha White:
Age: 29

The Dental Health Support Worker (DHSW) has come to visit you in your home because you are having difficulty with brushing your youngest child's teeth.

They will:
- Ask you what you have tried and what seems to work
- Give you a set of cards to choose from which show difficulties people have with brushing
- Discuss the card you choose and how to support toothbrushing
- Recap and agree a plan for seeing you again

You are a single mother of three children aged 2, 8 and 10. The DHSW will focus on how brushing is going for your 2 year old, Jamie. Your children also stay every other week at your ex-partner's house along with his partner and her children

Guide:

When asked what is going well with brushing

You find that brushing tends to be ok at night time because the two older children watch TV before bed and you have a set earlier bedtime for the younger one. Brushing isn't so much of problem in the evenings when your children are staying with you, and you feel fairly comfortable with the brushing itself but just struggle to fit it in sometimes. Your older children are able to brush themselves so you just let them get on with it.

When prompted by the DHSW to look through the cards

Choose card number 7 '*We don't have the same routine or people in the house every day*' [but say you can relate to a lot of them]

The DHSW will talk you through some of the techniques you could try out

Be a bit hesitant at first that you could have trouble trying these tips out:

- *In the mornings it is 'chaos' with lots of interruptions and everyone trying to leave the house at the same time so often you forget or don't have time to brush*
- *Brushing is often forgotten on days when the children are going between the houses as there is just so much going on*
- *You don't have any idea how often the children's teeth are brushed when they are staying at their dad's house but you often notice your Jamie's teeth don't look very clean when you brush his teeth when he gets back from there*
- *You get on ok with your ex-partner but haven't every really discussed toothbrushing with him and would find it a bit awkward*

The DHSW may suggest: different ideas for adjusting your morning routine to make it simpler to brush Jamie's teeth, advice on how to manage brushing when between different households, encourage conversation with other caregivers about brushing routine.

You hadn't thought about some of these tips before – you are a bit worried it might be hard work but finally you allow yourself to be persuaded and agree to try out the suggestions that the support worker makes and that you will let them know how you have gotten on in a couple of weeks.

Parent 3

Name: Chloe Smith
Age: 22

You one child, a daughter Evie who is 9 months old. You have a partner you lives with you who works during the day. You usually look after Evie yourself but sometimes get help from your mum on days when she is not working.

You don't attend the dentist regularly yourself, only really when you have a problem. You have a few fillings in your teeth and had to get 2 teeth out a couple of years ago as they had holes in them and you were in agony.

Guide:

When asked what is going well with brushing

You get on ok when she is in a better mood but otherwise you struggle

When prompted by the DHSW to look through the cards

Choose card number 4 *'I can't really see the point in forcing my child to brush'*

The DHSW will talk you through some of the techniques that you could try out with Evie.

Be a bit hesitant at first that you could have trouble trying these tips out:

- *You think Evie has only got 2 or 3 teeth.*
- *You have sometimes tried to brush her teeth but she usually won't open her mouth or ends up crying and screaming.*
- *You now only brush when she's in a good mood as it just ends up stressing both you and Evie out otherwise.*
- *Baby teeth always get end up with holes in them but they just fall out anyway so you don't think it is that big of a deal.*
- *You'd rather just leave brushing for a while until she's a bit older when it will be easier.*

They may suggest: how to get in to a brushing routine so your child can get used to brushing, importance of regular brushing at a young to avoid any problems with both baby and adult teeth by setting up healthy habits.

You hadn't thought about how important brushing baby teeth is but it woud be good if Evie didn't have problems with her teeth like you have had. You are a bit worried it might be hard

work but finally you allow yourself to be persuaded and agree to try out the suggestions that the support worker makes and that you will let them know how you have gotten on in a couple of weeks.

Parent 4

Name: Jessica Sloane
Age: 24

The Dental Health Support Worker has come to visit you in your home because you are having difficulty with brushing your child's teeth.

They will:
- Ask you what you have tried and what seems to work
- Give you a set of cards to choose from which show difficulties people have with brushing
- Discuss the card you choose and how to support toothbrushing
- Recap and agree a plan for seeing you again

You are a single mum to your son Alfie, who is almost 2 years old. You work in a care home where you often do shift work so your mum looks after Alfie when you are at work. With your shift patterns, you are sometimes not home for morning or evening brushing.

Guide:

When asked what is going well with brushing

You sometimes find brushing ok, especially when you have a few days off in a row which means you can get a routine going.

When prompted by the DHSW to look through the cards

Choose card number 8 *'I don't really feel support from other people'*

The DHSW will talk you through some of the techniques that you could try out.

Be a bit hesitant at first that you could have trouble trying these tips out:

- *You do try to stick to a routine often find it difficult to brush as Alfie refuses*
- *You have asked your mum how she gets on and she tells you that she sometimes forgets to brush his teeth and sometimes she tries but skips it as he doesn't really like it.*
- *You are aware that this isn't right but are not sure what else you can do as you are at work when this happens.*
- *You are also aware that your mum often gives sweets and juice to Alfie during the day when you are at work which you know is bad for his teeth.*
- *You have mentioned it to your mum once but she told you it was just a treat but you worry that he gets sweets too often.*
- *You are hesitant about speaking to your mum again as you don't want to sound too critical as you know she is doing you a favour looking after Alfie.*
- *You are not sure what else you can do to help the situation and often feel like you need more support.*
- *You want to make sure Alfie doesn't have any problems with his teeth like you have had with your own teeth.*

The DHSW may suggest: advice on how you can have a conversation with your mum about importance of brushing regular brushing and avoiding sugar, information about other services/groups which can provide extra support.

You are a bit unsure at first as you know it will be awkward to have that conversation with your mum but allow yourself to be reassured that it is really important that you do so and are grateful for any help given to have that conversation. You also didn't know about the groups where there are other parents having the same issues as you. You agree to try out the advice and let the DHSW know how you are getting on in a couple of weeks.

Appendix 14: Interview guide used for exit interviews with DHSWs and parents following simulation workshop

Workshop brief exit and follow up interview guide

<u>Workshop exit interview questions for DHSWs</u>

- What are your overall thoughts on today?

- What went well/ not so well?

    o Did you feel comfortable/confident using the tool(s)? Why/why not?

    o Was it practical e.g. time/ space/ readability?

    o How do you think the families felt?

- Do you think the intervention will be useful for parents/families like those you were

  working with today?

    o Why/why not?

- How prepared did you feel after training?

    o Was it what you were expecting?

    o How could we improve the training?

- If we were using the tool across Scotland, what changes/improvements could be made

  first?

Prompts from conversation itself e.g. anything they appeared to struggle with

Workshop exit interview questions for parents

- What are your overall thoughts on today?

- Do you think the tool(s) you went through would be useful/helpful to you personally?

   Other parents?

   o   What features did you like and why?

   o   Are there any aspects you didn't like and why?

- Will you be trying out any of the things you discussed on toothbrushing?

   o   Do you think they will work?

   o   What else would help?

- Would it be useful to be left anything after the visit by your DHSW? E.g. reminders

   o   What type of reminder would be most useful to you or would you be most likely

       to look at?

   o   Cards/fridge magnet/text or video reminder?

- What would you change? Why?

6 week follow up questions for parents

- Has the tool/discussion with DHSWs been helpful/useful to you?

- Have you made any changes as a result?

    o What changes have you made?

- Is there anything else you think would be helpful/additions/changes?

- Have tips had any benefit in any other aspects outside toothbrushing e.g. diet, bedtime routines
- Have the tips had any impact on other family members/siblings?