An evaluation of a toothbrushing programme in schools

Abstract

Purpose: This paper assesses the effectiveness of a toothbrushing intervention delivered in primary schools in Yorkshire and the Humber, a Northern district of England. The toothbrushing intervention was designed with the intention of improving the oral health of young children. The paper reports the effectiveness of the intervention and explores process issues related to its co-ordination and delivery.
Design/methodology/approach: The evaluation had three data gathering approaches. These were: in-depth case studies of three selected schools participating in the toothbrushing programme; interviews with oral health promoters responsible for the programme in the district; and a small scale questionnaire based survey which was sent to the 18 schools participating in the intervention.
Findings: The intervention was accepted by children and they enjoyed participating in the toothbrushing scheme. Children had often become more knowledgeable about toothbrushing and the consequences of not regularly cleaning their teeth. The scheme was contingent on key staff in the school and the programme was more successful where school's embraced, rather than rejected the notion of improving children's health alongside educational attainment. Whether the intervention made differences to brushing in the home requires further investigation, but there is a possibility that children can act as positive 'change agents' with siblings and other family members.
Practical implications: This paper suggests that schools can be an effective setting for implementing toothbrushing interventions.
Originality/value: Toothbrushing in schools programmes are a relatively new initiative that have not been fully explored, especially using qualitative approaches or focussing on the views of children. This paper makes a particular contribution to understanding the process and delivery of toothbrushing interventions delivered in primary schools. The implications for programmes outside of the UK context are discussed.

Keywords

Oral health, social inequality, toothbrushing, schools, evaluation, Mixed-Methods

Article classification Research paper

Introduction

Oral diseases are common across populations globally, with 60-90% of children experiencing dental caries (Gussy et al., 2006, WHO, 2012). The distribution of dental caries, however, does vary in different parts of the world. For example, the mean number of decayed, missing or filled teeth (dmft) in children is relatively high in the Americas (dmft=3.0) the European Region (2.6) and parts of Asia (2.2) (Hartono et al., 2002, Petersen et al., 2005). While in Sub-Saharan Africa the index is lower (1.7) (Petersen et al., 2005), with dmft scores of 0.14 being reported in Nigeria (Adekoya–Sofowora et al., 2006) and 0.3 in Ghana (Bruce et al., 2002). Reports by the World Health Organisation suggest that the incidence of dental caries is predicted to increase in parts of Sub-Saharan Africa and other developing countries. This is being attributed to the growing consumption and availability of sugars and inadequate exposure to fluoride (Petersen, 2004). The World Health Organisation, through policy strategies and prevention programmes in schools, have been committed to mitigating against oral diseases in children across the world (Petersen, 2004).

Within both developed and developing parts of the world, oral diseases in children are concentrated particularly in underprivileged communities (Petersen et al., 2005). In England,

epidemiological data suggests that there is a clear north-south geographical divide with the dental health of children in the Yorkshire and Humber region (a district in Northern England with seven cities: Bradford, Kingston upon Hull, Leeds, Ripon, Sheffield, Wakefield and York) and the North West and North East regions comparing poorly to Southern parts of the country (Doran et al., 2004). This reflects broader analysis which shows that the health of people in the North of England is generally poorer than individuals living in the South of the country (Copeland et al., 2014). Five year old children in Yorkshire and the Humber have a dmft score of 1.51 which compares unfavourably to the South East Coast of England (0.72) and the average across England as a whole (1.11) (Robertson et al., 2011). Almost 40 percent of five year old children in Yorkshire and the Humber experience dental decay compared to only 24 percent of children living in the South East Coast of England.

There is no universal explanation for social inequalities in oral health, although scholars are adamant that the relationship is not an artefact (Sisson, 2007). A life course perspective; materialist explanation; behavioural explanation; and psychosocial argument have all been proposed to explain social inequalities in oral health (Sisson, 2007). According to the WHO (2012), the current pattern of oral disease reflects issues related to living conditions, lifestyles and environmental factors, and the implementation of preventive oral health schemes. Despite no clear theoretical underpinning, multi-agency and intersectoral interventions to tackle oral health inequalities have been espoused with many commentators advocating that schools are a key setting for tackling inequalities in oral health (Kwan et al., 2005). Schools offer the opportunity to reach a large proportion of the global population and can be instrumental in shaping children's health related beliefs, attitudes, values and behaviours (Hubley et al., 2013). Moreover given that evidence suggests that good health in childhood can subsequently track into adulthood, schools can potentially play a crucial role in establishing the foundations for healthy patterns of behaviour (Tones and Tilford, 2001, Licence, 2004, Aunger, 2007, Green and Tones, 2010). The international evidence-base as a whole, as reviewed by the Cochrance Collaboration, is inconclusive in relation to the effectiveness of primary school-based behavioural interventions on oral health outcomes (Cooper et al., 2011). There are, nevertheless, several programmes that have shown very positive outcomes. Research in Hubei Province, located in Central China, demonstrated how an oral health promotion programme in schools, consisting of educational programmes; dental examinations; and the provision of fluoride toothpaste to each child once every two months, had positive outcomes on oral health behaviours in comparison to control schools (Tai et al., 2009). Similarly, analysis in schools in Brazil has shown how beneficial health promotion activities can be in achieving better oral health of school children (Moysés et al., 2003).

This paper reports on an evaluation of an oral health intervention delivered in selected primary schools in an area of Yorkshire and the Humber in the North of England. The evaluation sought to assess the effectiveness of the intervention and to explore process issues related to its co-ordination and delivery. The aim of the toothbrushing intervention was to respond to the poor dmft scores of children in this specific region (Robertson et al., 2011). The toothbrushing in schools scheme is an evidence-based intervention, drawing on principles and learning from comparable programmes in Scotland (Macpherson et al., 2010) and other research which shows that the application of fluoride toothpaste in a supervised school-based intervention can have a significant effect on children with high caries risk (Curnow et al., 2002).

This particular intervention aimed to introduce toothbrushing as a 'life skill' and improve the oral health of young children. The intervention involved approximately 1000 children aged between 3-5 years brushing their teeth during the school day. Appropriate consent was obtained by the parents of the children and where possible the children were involved in the intervention over a two year period. The actual time of brushing was not prescribed to the schools to ensure that it fits best with the regime; however, it was advised that this is not at

the start of the school day as this may encourage children not to brush their teeth at home. Resources (e.g. brushes, toothpaste and the 'brush bus' – a storage facility for brushes) were provided to all schools and replenished regularly. Training was also given to school staff to ensure that hygiene standards are maintained and cross-contamination of brushes was avoided. Training ensured that toothpaste was not applied directly onto the brush but squeezed onto a paper towel or plastic plate and transferred to the brush. This practice avoids cross infection and enables one tube of toothpaste to be used rather than one for each individual child.

Studies have evaluated the effects of school-based oral health programmes with toothbrushing as important component (Flanders, 1987, van Palenstein Helderman, 1997, Hartono et al., 2002, Macpherson et al., 2013), although they have reported mixed results. Based on the published literature, it is apparent that toothbrushing interventions delivered in the school setting still remain relatively rare and the effectiveness of these approaches remains largely unknown. This may be due to a number of factors, but includes the heterogeneity of toothbrushing interventions making comparisons difficult and the poor articulation of process issues in relation to 'how' the intervention was delivered (Cooper et al., 2011). The overarching aim of the evaluation was to assess the effectiveness of toothbrushing in schools scheme. However, the evaluation also set out to:

1. Identify what school characteristics are important for achieving effective implementation of the intervention.
2. Explore whether children are engaged (or not) in the intervention and identify areas of good practice.
3. Identify whether the intervention influences behaviour change in relation to toothbrushing within the home.

Methodology

The use of triangulation has been proposed as a means of achieving validity in evaluation (Green and Tones, 1999) and is particularly relevant to the toothbrushing in schools scheme. This approach relies on collecting evidence of impact from a variety of different sources and making conclusions based on the overall data collected (Torrance, 2012). In this evaluation traingulation consisted of both data triangulation (gathering data through different sampling strategies), investigator triangualtion (using more than one reseracher) and methodological triangulation (utilising mixed-methods). By triangulating different forms of evidence it allows more robust conclusions and recommendations to be made. The evaluation comprised of three key strands: in-depth case studies of three selected schools participating in the toothbrushing programme; interviews with oral health programme leads; and a small scale questionnaire-based survey which was sent to the 18 schools participating in the intervention.

The evaluation approach drew particularly on qualitative methodology to gain the richness and depth required to understand the mechanism and context in which the intervention was set. It is generally agreed that, through qualitative research methodology, it is possible to explore a wide array of dimensions, including people's understandings and experiences and the way that social processes, institutions and relationships work (Mason, 2002, Braun and Clarke, 2013). However, to complement this, quantitative data was also gathered in order to provide a broader overview of the scheme.

All ethical aspects of the study were approved by the Faculty of Health and Social Sciences at Leeds Metropolitan University. However, one of our ethical concerns was around consent procedures for the children participating in the research. Parental consent in a written format was obtained before the child participated in the draw and write session. In addition agreement was verbally sought from each pupil before each session commences.

Details of each strand of data collection activity follows.

School case studies

Case studies are a way of understanding interventions within context and are particularly useful when evaluating processes related to delivery and implementation (Hartley, 2004). Indeed, Flyvbjerg (2006) has argued about the importance of case studies for generating context-dependent knowledge and understanding of the world. Case studies allowed in-depth examination of the toothbrushing in schools scheme and enabled the evaluation team to develop understanding of the effect of local context within schools and the inevitable adaptation that occurs in the implementation of the programme. Three 'information rich' case study schools were sampled in negotiation with the oral health promotion team. These cases were purposively selected to represent the variability of engagement with the toothbrusing scheme so that maximum learning could be garnered. Participation in the evaluation was voluntary and two schools did reject the offer of being involved. Schools participating in the toothbrushing programme were in particular areas of socioeconomic deprivation, with the dmft scores of five year old children higher than other parts of Yorkshire and Humberside (Robertson et al., 2011).

Focus groups

Focus groups were chosen as an appropriate method to gauge the parents' perspective of the programme. Focus groups examine not only what individuals think, but how they think and why they think that way, using the participants' own language (Kitzinger, 1995, Wilkinson, 1998, Puig et al., 2008). Some of the other benefits of the focus group method is that it can encourage interaction between participants and it does not discriminate against people who cannot read or write (Then et al., 2014). Focus groups can be used as a stand-alone method or, in this case, as part of a series of data gathering techniques.

Within the case study schools a total of 18 parents were involved in focus group discussions. Unfortunately at one school, no parents responded to requests to participate in a focus group. The focus groups within the schools comprised of 16 females and 2 males. These individuals had been selected as they expressed an interest to participate and share their views of the toothbrushing scheme. The focus groups were facilitated by two researchers and the sessions were audio recorded after written consent had been obtained. Consistent with recommendations by Then et al. (2014) who suggests that incentives may be used in focus groups to demonstrate to individuals that their opinions and willingness to share their time are valued, a high street shopping voucher was provided. The general purpose of the focus groups was to explore the following:

- Parents' knowledge of the toothbrushing scheme;
- Their views on the scheme and how it operates;
- Whether participation in the toothbrushing scheme at school had influenced their child's toothbrushing behaviour at home;
- What further support, if any, parents felt they needed to enable their children to brush their teeth regularly.

Semi- structured interviews

Across the three schools, semi-structured interviews with five key staff involved with the toothbrushing scheme were also undertaken. These interviewees were the staff with the primary responsibility for delivering and co-ordinating the toothbrushing scheme in their schools. Three of the interviewees were teachers and two were teachers' assistants. The semi-structured interview is a useful method to gather rich and detailed understanding as it allows researchers the opportunity to probe and guide questioning (Braun and Clarke, 2013). Moreover, the semi-structured nature allows the interview to be completed within an agreed time frame (Willig, 2001). This was particularly important given how busy the staff were in

the schools. The aim of the interview was to broadly capture the operational realities of the scheme and to understand the characteristics necessary for achieving effective implementation of the toothbrushing scheme. Other areas of exploration included:

- The staffs' views concerning toothbrushing in class;
- Organisational barriers and facilitators in implementing the toothbrushing scheme;
- The support and training they had received;
- The contribution of the scheme to children's wider education and learning;
- The staffs' perspective of the intervention in influencing children's brushing in the home.

Draw and write

Given the central importance of children within the toothbrushing intervention (and their omission from previous studies exploring toothbrushing in schools), it was essential that their views were sought. In each of the case study schools, a draw and write technique was conducted with 21 children aged 3-5 years old (these children were based in the reception class or year 1 class). Draw and write was first developed in the United Kingdom during the 1980s (Hartel, 2014) and is regarded as a participatory method in which children of all ages can take part (Backett-Milburn and McKie, 1999). The draw and write approach is essentially a qualitative method for understanding how children construct ideas and concepts (Carter and Ford, 2013). Advocates of the technique argue that it is compatible with a variety of research interests and can be used to triangulate other forms of data (Hartel, 2014). As an example, it has been used effectively in a range of areas, including understanding children's views on road safety (Green et al., 2007) and children's perceptions of physical activity opportunities (Knowles et al., 2013). The premise of the method is relatively straightforward in that children are invited to draw a picture and to write what is happening in the picture. Where children are unable to write for themselves, adults can act as scribes (Carter and Ford, 2013).

Parental consent in a written format was obtained before the child took part in the draw and write session (most parents, 77%, did not provide consent and despite children's interest in supporting the evaluation they were unable to participate). In addition agreement was verbally sought from each pupil before the session commenced. Both boys and girls participated in the draw and write activity, with slightly more girls participating (n=13) than boys (n=8). In this evaluation, children were asked by the researchers to draw a picture of them brushing their teeth while in school. As the children were drawing, the researchers asked questions to clarify the drawings and, with permission, made notes on the children's work.

Programme level interviews

Three interviews with oral health promoters, responsible for the overall delivery of the toothbrushing programme, also took place to supplement the case study data. These interviews were semi-structured in nature and were conducted over the telephone and in person. The interviews were audio recorded after consent had been gained. These interviews explored several dimensions of the scheme, including: relationships with schools; operational realities and challenges; ingredients for success; and recommendations for future development.

On-line survey

Quantitative data was gathered through a small scale questionnaire based survey which was sent electronically to the 18 schools participating in the intervention. The survey asked an appropriate member of school staff to complete the questionnaire and was designed to provide a broad overview of the scheme across participating schools and complement qualitative data collected through the other methods. The questionnaire was administered online using SNAP and a total of 13 questionnaires were returned (this was after several

prompts to remind schools to complete the questionnaire), resulting in a satisfactory response rate of 72%. A copy of the questionnaire can be found in Appendix 1.

Data analysis

All focus group and interview recordings were transcribed verbatim and the data was coded and themes identified following guidance from recognised scholars in this area (Boyatzis, 1998, Ryan and Bernard, 2003, Braun and Clarke, 2013). In summary, time was allocated prior to the development of thematic categories for the research team to become fully immersed in the raw data. Then, codes to the transcripts were applied; coding entailed selecting passages of text and ascribing labels. Codes were predominantly based on recurring concepts or salient issues in relation to the toothbrushing programme. Broadly speaking, the initial coding process reduced the raw data into more discrete elements and allowed further reflection on the overall data set. To ensure rigor, inter-rater reliability was conducted. In practice, this entailed coding in the first instance being done by two researchers separately with any discrepancies discussed and resolved. From the codes, themes were extracted. According to Ryan and Bernard (2003), repetition is one of the simplest forms of theme identification. The more the same concept or idea reoccurs in the raw data the more likely it is to be a theme. This was similarly the case in this research whereby codes reoccurred throughout elements of the qualitative data (see Table 1 for an example). The drawings and written comments from the draw and write exercise were coded in the same way as for an interview transcript and the same form of analysis was used. Quantitative data derived from the on-line survey were analysed in Excel and descriptive statistics were performed as appropriate.

Table 1. Examples of coding and arriving at a theme

Codes	Theme	Explanation	Example
• Teachers doing things that parents used to do. • Teachers doing more than teaching. • Being a teacher is more than just following curriculum. • Toilet training children.	Teachers as pseudo-parents	The expectation that teaching staff should be responsible for children's learning and other fundamental skills development.	"I have been teaching for long time and more and more things the parents used to do I think it's put on to our heads….learning to use knife and folks, learning to get dressed, learning to go to the toilet all those things children used to come and be able to do."
• Home brushing has become easier. • Children have better knowledge. • No fuss now. • Children as 'change-agents' in the home.	Influencing brushing in the home	The transference of toothbrushing in schools to toothbrushing behaviour in the home.	"We have had reports from parents that there are less problems of brushing at home….they are more willing to do it themselves."

Findings

This section presents the findings of the evaluation. The findings have been organised in relation to the cross-cutting themes that emerged across the data gathering approaches. Where quotations have been used to illuminate an issue, these have been anonymised to protect the participants involved.

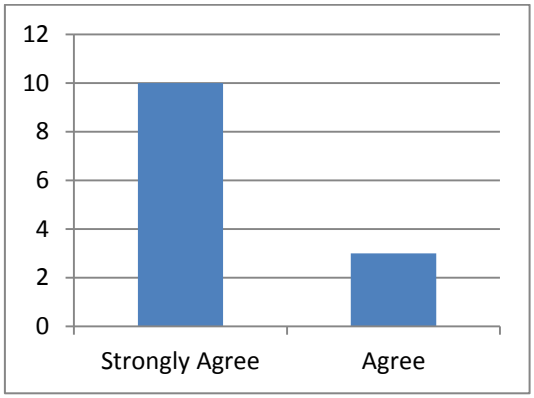
Children's engagement and increased knowledge

Across the data collection activities, one recurring and clear theme was that children enjoyed participating in the toothbrushing scheme. Universally, parents reported how their children enjoyed brushing their teeth and that the toothbrushing in school scheme had raised their interests:

> *"Yes my son enjoys it and has started asking me, 'Mummy can I get a new tooth brush'…he seems to enjoy brushing his teeth for lot longer, rather than it being taxing."* (Parent)

The survey data supported these assertions, as responding schools either 'strongly agreed' or 'agreed' that children were engaged in the toothbrusing scheme (see Figure 2).

Figure 2. Children in this school are generally engaged in the toothbrushing scheme



The majority of key staff within schools suggested how the activity of brushing had become habitualised and seen by the children as an integral and enjoyable part of the school day. This was noted by one of the open comments provided via the on-line survey:

> *"The children love the routine of brushing their teeth"*

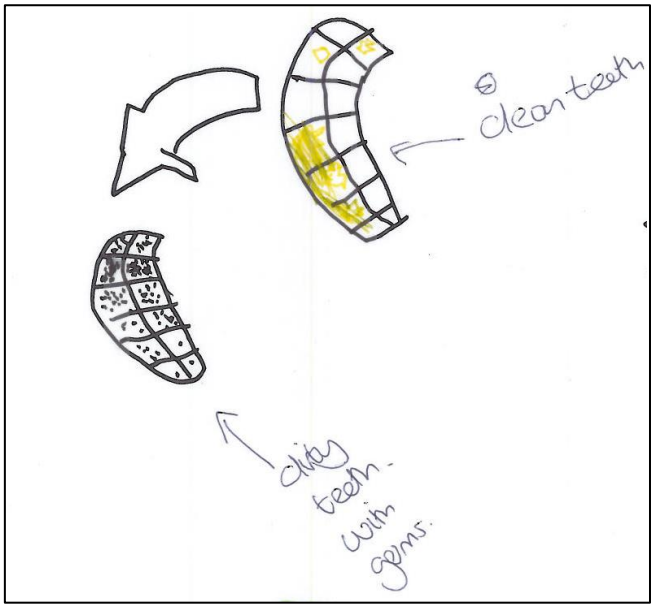
> *"It's such an integral part of the day."*

These general findings were reiterated during observations of toothbrushing within one of the schools selected for the evaluation. Moreover, data from the draw and write activities seem to consistently show children smiling and enjoying toothbrushing. Figure 3, for example, shows a drawing from a boy and girl; indeed, we found no differences in the main themes emerging from the drawings when analysed according to gender.

Figure 3. Smiling while brushing

Most parents suggested that as a result of the scheme their children had generally become more knowledgeable about toothbrusing and the consequences of not regularly cleaning their teeth. Some children in the school seemed extremely knowledgeable about toothbrushing. This was shown by one child who in their drawing demonstrated the consequences of not brushing regularly (Figure 4). However, in one of the schools the children seemed to be a lot less knowledgeable about teeth cleaning.

Figure 4. The consequence of not brushing regularly
(Researchers' comments on drawing after talking with the child)



The importance of committed school staff

The toothbrusing scheme was reported, primarily by oral health promoters to be contingent on key staff within the schools. The head teacher was seen as being fundamental to enabling the scheme to be implemented; however, a stable and consistent day-to-day contact person within the schools was also regarded as being critical to success, with their commitment, motivation and personality often being key for the scheme to flourish.

The oral health promoters were clear that teachers were not always their contact point and indeed some suggested how teaching support-workers were often in a better position to facilitate the intervention as one continual theme emerging from the evaluation was how busy teaching staff were and how pressurised their role had become:

> *"When we do the training we ask for someone who will be the lead and that's not necessarily the teacher, they may have appointed a teaching assistant…some people find that it is an important role they have been given, some people see it as a chore."* (Oral health promoter)

Potential issues in the toothbrushing scheme occurred when there were changes in staffing within the schools – this could often create instability and jeopardise the sustainability of the scheme. This was described by one of the oral health promoters:

> *"One or two schools have had quite a big change of staff…one school was running really well, but then they had a change in staff, a change in Head, and it became a bit chaotic and we thought we were going to lose the school….after the change in leadership we nearly lost it."* (Oral health promoter)

Data from the oral health promoters indicated that when schools do have a change in personnel, this becomes a potential 'weak point' in the intervention delivery. While a change of staff can create new opportunities, it frequently means that the toothbrushing scheme can be dismissed as a 'non-essential' part of the school regime. Moreover, where staff in schools feel isolated and unsupported by other teaching staff, this again creates potential for the scheme to be in jeopardy:

> *"In schools staff change all of the time and quite often that becomes a weak point."* (Oral health promoter)

> *"For other schools there isn't really that team approach and they are working as individuals. Some of the teaching assistants are doing it on their own and if they are struggling they feel quite isolated."* (Oral health promoter)

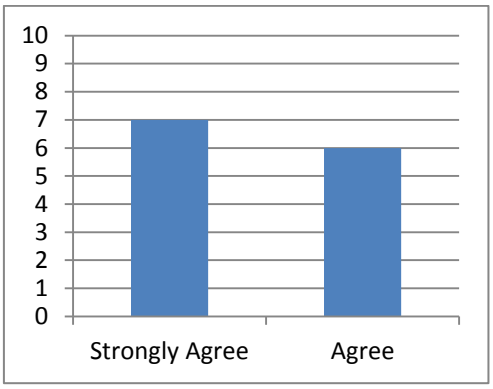
Fulfilling learning objectives and educational agendas

The survey data shows that the toothbrushing scheme is perceived to contribute to children's wider education and learning (see Figure 5). Moreover, the school staff that were interviewed claimed that linking the toothbrushing scheme with the broader curriculum was essential if the intervention was to be embedded in the school culture. Those schools that did this effectively, and saw the links between the curriculum and brushing were often reported to be more successful at carrying out the scheme than those schools that did not see the interconnections. The opportunity to link toothbrushing with colour and shape identification, counting etc. was deemed important by school staff, especially in those schools where the intervention had been considered a success. This was reiterated in several of the children's drawings whereby the colour of the brush was discussed (see Figure 6 as an illustrative example) and by one of the oral health promoters:

> *"The successful schools integrate the brushing as part of daily activities and link it to colours, counting"* (Oral health promoter)

Moreover, school staff suggested that the scheme may encourage independence which was deemed an important developmental stage in the early year child-development. One member of teaching staff also commented that the intervention may influence speech and language development.

Figure 5. The toothbrushing in school scheme contributes to children's wider education and learning



The opportunity to link the formal school curriculum and the toothbrushing intervention was used as a 'selling point' for the oral health promoters in engaging schools in the process. Having explicit recognition by OFSTED for the intervention would significantly help this process, although to date this had not been acquired.

Figure 6. "My brush is light pink"

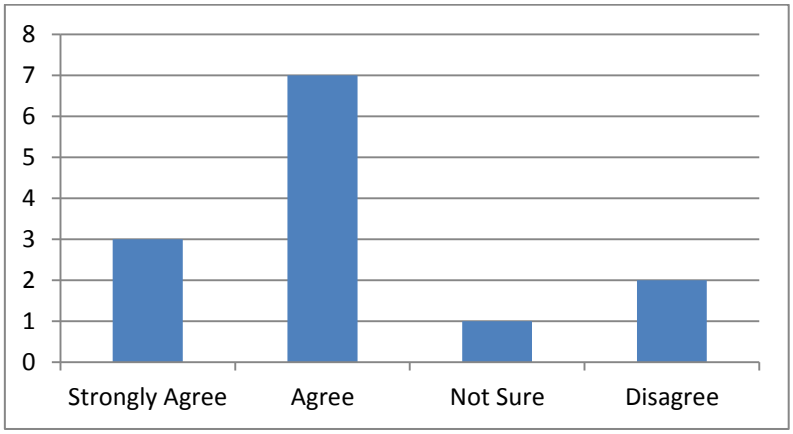
Influencing brushing in the home

Some of the data collected as part of the evaluation points to the positive transfer of toothbrushing in schools to toothbrushing in the home. According to many parents, brushing at home has become easier as a result of the scheme because children are heightened to the importance of regular brushing:

> *"They don't make a fuss about brushing at home in the morning. Maybe brushing at school has given them the knowledge about why we brush and maybe everything is linked right from school actually. The morning time fuss or the night time fuss is not there anymore, they know the importance of brushing."* (Parent)

Three of the schools that responded to the survey were less convinced that the toothbrusing scheme was making a difference to behaviour in the home (Figure 7) as three schools either 'disagreed' that it made any difference or were 'not sure'. Arguably, however, school staff are not in the best place to comment on differences to behaviours in the home.

Figure 7. The toothbrushing scheme has the potential to influence children's brushing in the home



While it was difficult to determine this quantitatively, the qualitative data suggests that there is also a 'ripple effect' whereby children pass on the information gained in school to their siblings and parents. For example, Figure 8 was a drawing by one child who, when explaining it to the researcher, noted how her Father did not brush his teeth properly. This suggests that children are taking the information gained from the school back home. Indeed this kind of scenario was discussed within the one parent focus group:

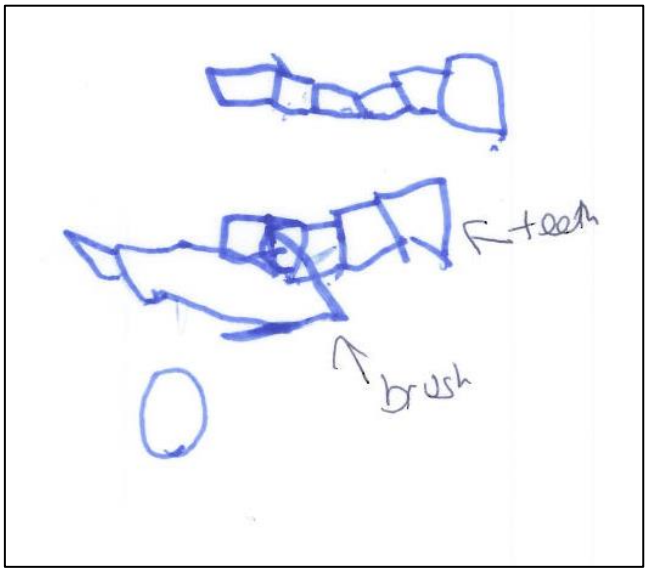
> *"Actually my son teaches me how to brush , he says no Mum you should not brush like that, you have to brush round and round and you have to brush up and down like that."* (Parent)

The oral health promoters also subscribed to the viewpoint that knowledge transfer occurs from the toothbrusing in schools scheme. Two of the oral health promoters noted:

> *"The child goes home and sees brushing as a much more important thing, as it's not just Mum or Dad telling them they have to do it. The child quite often goes home and gets their other siblings in the bathroom and says 'right we've got to brush our teeth'."*

> *"We have had reports from parents that there are less problems of brushing at home….they are more willing to do it themselves."*

Figure 8. "My daddy brushes wrong"



Links with parents

Parents were fairly unanimous in suggesting that the toothbrushing programme should be continued beyond the 3-5 year age bracket. Some parents clearly wanted to be more involved in the scheme and have more information and several parents suggested that they would appreciate feedback on how well their children were brushing their teeth and regular (weekly) updates on their child's engagement with toothbrushing. According to school staff and the oral health promoters, parents' sessions had been previously established within schools, but these had often been poorly attended. Indeed, in some of the schools it was mentioned that engaging with parents could be difficult, not only in relation to toothbrushing but other health and educational matters.

Parents in the focus group discussions suggested how, at times, it was useful that their children were brushing their teeth in the school as there had been occasions where brushing was not done at home prior to arriving at the school. This, however, seems to contradict the aim of the programme which is to encourage brushing in school *in addition to* (not instead of) brushing at home:

"There was some mornings when my daughter wouldn't brush her teeth at home 'cos she was crying, so it's good to know that she brushes them here [at school]*"* (Parent)

"It's alright for the morning rush, I'll say 'you haven't brushed your teeth, you can do it at school.'"

From the open comments on the on-line survey, several schools noted that more oral health information should be provided to parents so that toothbrushing in the school was consolidated at home. Those school staff interviewed also made recommendations about improving parent links. This included inviting parents to stay with their children at the start of the school day while their children were brushing their teeth.

Logistics and delivery

All of the schools in which case studies had been conducted noted how supportive the oral health promoters were at addressing concerns and how efficient they were at providing new supplies. Comments were unanimously positive as illustrated by one member of teaching staff:

"They [the oral health team] *are extremely supportive. I mean we have got their emails, we have got their phone numbers, got their mobile phone numbers and we ring up or email them when we need new supplies…they are really doing a really great job."* (School staff)

It seemed that regardless of how well schools were performing in the toothbrusing scheme, the schools were positive about both the communication processes between the school and the oral health promoters and the training and support provided to schools to deliver the toothbrushing scheme.

Teachers as pseudo-parents

Although outside the remit of this evaluation, the debate as to whether school staff should be delivering the toothbrushing programme or whether it was a role for parents in the home, was frequently raised and worthy of note. There were some tensions from both the school staff interviewed and parents on this debate.

The toothbrushing scheme was placed by some school staff within the wider context of teachers having increasing responsibility for supporting children in rudimentary activities. It was inferred that teachers felt that their role as educators was increasingly being replaced as pseudo-parents:

"I have been teaching for long time and more and more things the parents used to do I think it's put on to our heads….learning to use knife and folks, learning to get dressed, learning to go to the toilet all those things children used to come and be able to do." (School staff)

Conversely, some parents questioned the reason why schools were replacing their duty as parents and several parents had initial scepticism of the scheme, especially concerning the storage of brushes and hygiene practices. However, it seemed that these initial worries had been allayed by the systematic process of storing brushes:

"I was concerned about whose brush they were going to use, but later my daughter told me that they are divided into groups and they probably recognised what brush is theirs so that made me less concerned and I am fully ok with it right now." (Parent)

Where the programme seemed to be most successful was when the school philosophy embraced, rather than rejected the notion of improving children's health and social skills alongside educational attainment. Most teachers suggested that it was difficult to be passive when they were aware of the poor dmft scores of children in their area and the fact that they had seen the poor state of the children's teeth in their class:

"There are so many with black teeth, yellowy brown teeth, fallen out teeth." (School staff)

"If this is the only time some of them [the children] *brush their teeth, then we can't say no."* (School staff)

Discussion

Although schools can be seen as an artificial setting with which to encourage toothbrushing (Cooper et al., 2011), there was evidence of positive health and educational outcomes as a result of the programme. The following discussion intends to highlight key learning from the programme and discuss implications for future development.

Organisational components for success

While there is widespread discussion and debate about the role of schools in society (Hubley et al., 2013), the data from this evaluation suggests that one of the critical elements for successful implementation of the toothbrushing in schools programme is when stakeholders (i.e. teachers, head teachers and parents) are in agreement that the school's mission concerns more than educational attainment as its primary remit. Where schools, particularly head teachers, recognised the important role they played in developing children's life skills, the toothbrushing intervention seemed to be delivered more enthusiastically and consistently by the school. Where the toothbrushing scheme was less successful, the programme was often dismissed as being a non-essential element of the school curricula and a possible distraction from other activities. In this case, toothbrushing in school either occurred less frequently or not at all.

The importance of school staff in the day-to-day management of the toothbrushing programme was another critical ingredient in the success (or not) of the programme and should not be understated. Green and Tones (2010) have suggested previously that the commitment of staff is a facilitating factor in the implementation of healthy school initiatives. However, the data collected as part of this evaluation would stress this further as evidence suggests that the individual commitment of staff was *essential* if the toothbrushing scheme was to be delivered as intended. As an example, when committed staff left the school this became a potential 'weak point' in the intervention delivery.

It was apparent from the data that toothbrushing in school relied almost solely on a single individual and that this reliance could be problematic if staff left the school. Furthermore, the qualitative data suggested that teachers may not always be the most effective individuals to drive the toothbrushing scheme forward; indeed, it may be that teaching assistants and other support staff within schools may be able to commit more time and resources to the intervention delivery and management. School staff also seemed to work in isolation and were not connected to staff in other schools. Connecting these staff together and forming a peer network may be worthwhile and could allow problems to be shared amongst staff and solutions to be identified. The advice provided by the network may also be more 'credible' as network members would be able to understand the context and pressures under which schools are asked to operate within.

One clear theme to emerge from the data was the work and dedication of the oral health promoters who were unanimously praised for their commitment and ability to deal with problems that schools faced. Any future roll-out of the programme must ensure that oral health promoters are given the time and space to develop relationships with schools as this seems to be one of the critical ingredients for success.

Children's engagement

Children across the participating schools were engaged in the scheme and enjoyed brushing their teeth within the school environment. Whether brushing occurred daily in schools, or less frequently did not seem to dampen the children's enjoyment. Unlike the findings of previous studies (Gill et al., 2011), several children that participated in the evaluation acknowledged how toothbrushing cleared debris and germs and improved personal appearance. The children were also able to link the consequences of poor oral health to decayed and filled teeth. While this was not universally observed in the children that participated in the evaluation, this confirms evidence that there can be improvements in children's oral health knowledge and awareness as a result of school based interventions (Watt et al., 2001).

Contribution to educational markers

The evidence suggests that the toothbrushing scheme may contribute to children's education and learning, although further evidence will be required to test this further. Survey data suggested that schools 'agree' or 'strongly agree' that the scheme contributes to children's wider education and learning. Those schools that were delivering the scheme effectively embraced the opportunity to link together the practice of toothbrushing with developing children's counting skills, colour and shape identification. In developing the scheme further, it may be prudent to monitor not only health outcomes in children but also educational outcomes. While this may be potentially complex and could include quasi-experimental designs, demonstrating impact on this level may potentially show how the toothbrushing in schools scheme benefits 'core business objectives' of the setting. By doing this, it would encourage greater institutional 'buy-in' and commitment of schools.

Influencing toothbrushing in the home

There is a growing evidence base that suggests that oral health interventions delivered in schools increase children's knowledge, but that it may not have any long-term impact on behavioural change (Watt et al., 2001). Cooper et al. (2011), for example, note that in spite of the increased number of school-based oral health programmes in recent years, the majority have not produced sustained behavioural change. Moreover, brushing teeth at school can result in a significant increase in frequency of toothbrushing, but these effects are not maintained at one-year follow-up (Wind et al., 2005).

This evaluation was unable to provide any longitudinal follow-up on toothbrushing in the home; however, data does suggest that children's toothbrushing behaviour in the home is positively influenced by toothbrushing in school. There was also evidence to suggest that children act as 'change agents' as it was reported that they frequently passed on the information gained in school to their siblings and parents. Indeed, the evaluation supports the work of Christensen (2004) who has advanced the notion of the child as a health-promoting actor in the family context.

An integral part of the health-promoting school approach is the development of sound links and partnerships with parents (Denman, 1998). This has been reaffirmed by the World Health Organisation in their efforts to reduce oral diseases in children globally (Petersen, 2004). One issue which may require further attention in the toothbrushing programme is the importance of forging partnerships with parents so that oral health messages that are provided in the school setting are reinforced in the home. It was apparent that links had been formed with some parents in some of the schools, but this was not consistently the case across the participating schools. In some instances, parents had clearly wanted to be more involved in the toothbrushing scheme, but often did not know how to go about this. Reinforcing toothbrushing practices in the school, the home and other settings in which children engage with is essential to tackle the inequalities in oral health. Indeed, by focussing on school settings in isolation from the wider context of health inequalities, there is a potential danger that the approach fosters *"insularity and fragmentation"* (Dooris, 2006,

p.5). A practical recommendation to begin this dialogue may be to develop parental self-efficacy around supporting children to brush their teeth (Cooper et al., 2011).

Study limitations

The participatory nature of the research and the pluralistic nature of the data gathered are particular strengths of the research; however, there are several limitations to the research presented. One issue concerns the sample size within each of the data gathering approaches. The online survey yielded a very satisfactory response, but did not include all schools. Moreover, due to access difficulties, time and financial constraints, the researchers were only able to gather data in three case study schools – a relatively small sample of the total population of schools involved. Within those schools, not all children participating in the toothbrushing programme were able to participate in the draw and write activities. Perhaps one issue concerned asking parents to consent to opt their children into the activity – anecdotally, teachers had warned the evaluation team against this strategy (information can get lost or parents forget to return documents), but from an ethical perspective this was necessary.

Conclusions

This paper has reported on a toothbrushing programme delivered in schools in Yorkshire and the Humber – a part of Northern England – drawing on various data sources. Given the central importance of children within the toothbrushing intervention this is, to our understanding, one of the first studies to gather the views of children on a toothbrushing scheme using participatory methods. While it is difficult from this evaluation design to suggest the longer-term impact on oral health inequalities, evidence from elsewhere shows that the introduction and uptake of a similar toothbrushing program contributed positively to the dental health of children and reduced dental health inequalities (Macpherson et al., 2013).

While the focus of this paper was on a specific scheme in a Northern region of England, the findings have wider resonance and application to other international contexts. Indeed, the World Health Organisation have stressed that it is likely that incidence of oral diseases in certain parts of the world, particularly Sub-Saharan Africa, will increase given the wider availability of sugary diets (Petersen, 2004). The paper makes a particular contribution toward understanding the process of delivering toothbrushing interventions in schools and has highlighted key learning that can be transferred to other contexts, specifically the importance of dedicated school staff; commitment from senior figures in schools; and strong links with parents.

The toothbrushing in schools scheme reinforces and supports the development of a key health skill that may not be routinely taught in the home. Although the school could be perceived as an ‘artificial’ setting for toothbrushing, the evidence from this evaluation suggests that children are fully engaged in the programme, have an awareness of oral health issues and that this influences their own and others’ behaviour in the home. The evidence suggests that the service is making a difference to the oral health of children in a particular region in England, but needs to be considered as part of a wider work programme aimed at tackling inequalities in health.

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