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Communicating Handwashing to Children, as Told by Children

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INTRODUCTION

Illness is the major cause of absence in schools, accounting for 60.1% of all absences in English primary schools (children aged 4-11) (Department for Education, 2018). Not only does illness have a negative impact on children's health and education, but the health of teachers and family members may be affected too. There are also economic costs associated with physician visits, extra teaching provision and parental leave to care for sick children (Johansen, Denbæk, Bonnesen, & Due, 2015). Hand hygiene interventions have successfully reduced gastrointestinal illness in schoolchildren by 29.5-57.1% (Wang, Lapinski, Quilliam, Jaykus, & Fraser, 2017). However, interventions can be difficult to implement in school settings (Lendrum & Humphrey, 2012).

An undemanding and low-cost approach to encourage handwashing is to place posters in school toilets and classrooms. Barriers to handwashing in schools have been identified in many studies, most notably Chittleborough, Nicholson, Basker, Bell, & Campbell (2012). Using persuasive messaging, posters can change attitudes and / or behaviour (Jenner, Jones, Fletcher, Miller, & Scott, 2005b). We know little, though, about the effectiveness of handwashing posters targeted at children and the barriers they address. Educational interventions are often multi-component (a combination of lessons, booklets, games, posters, videos and products), so the effectiveness of posters is not isolated and evaluated (e.g. Chittleborough et al., 2012; Johansen et al., 2015).

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Despite much recent work advocating including children in the research process (Allison, 2007), we have only identified two handwashing studies where children were involved in the research (Graves, Daniell, Harris, Obure, & Quick, 2012; Randle et al., 2013). In our project, (www.123germfree.co.uk), we work with children (aged 6-11) to co-design images and messaging in the school toilet space to encourage handwashing. In this paper, we report on the first phase of the project where we worked with children to design messaging. Our first research question was (1) Can in-school handwashing barriers be addressed with messaging, and if so how? Our second research question was (2) Which in-school handwashing barriers are currently addressed in posters targeted at children, and how? We then compared the findings of our two research questions to see if handwashing posters are addressing barriers children think need addressing. In the next phase of our (ongoing) project we will evaluate whether children do indeed wash their hands more often when their messages, and the barriers they address, are located in their school toilets.

LITERATURE REVIEW

Co-designing with children

It is good practice for research *about* children to be produced *with* children rather than *on* children (James, 2007). In co-design where designers and end-users work together in the development of designs, the end user is considered the “expert of his/her experience” (Sanders & Stappers, 2008, p.12). Working with end users allows knowledge to be explored and tested in the environment where the outputs of the research will be adopted. It also has the potential to generate “different (and greater) intellectual insights” (Campbell & Vanderhoven, 2016, p.15). In other areas of health communication, researchers have involved children when developing messaging. Most notably, Borra, Kelly, Shirreffs, Neville, & Geiger (2003) worked with children (aged 8-12), parents and teachers to develop and refine messages that communicate healthy lifestyles.

We are only aware of one handwashing study where children were involved in designing poster messaging (Graves et al., 2012) and one study where children co-designed an educational device (Randle et al., 2013). In the Graves et al. (2012) study, children from nine Kenyan primary schools were asked to create their own handwashing posters. One poster from each school was selected by the research team and distributed to the original nine schools and twelve comparison schools. No measurable differences were observed in children's handwashing between pre- and post-intervention periods and between poster designing and comparison schools. In the Randle et al. (2013) study, children (aged 5-8) from two English primary schools were taught about germ transmission, and then asked to design an educational toy. Design engineering students then developed these initial designs. From the developed designs, children selected a "Glo-yo" – a yo-yo that incorporated an educational video screen and UV lights, and dispensed UV iridescent soap. A 34% improvement in children's handwashing was observed at the two schools after this educational toy was introduced. The authors attributed the intervention's success to involving children in the research process.

In both studies, ideas were selected from a large base of children by the research teams. In the Graves et al. (2012) study the research team selected which posters to distribute and in the Randle et al. (2013) study a toy was developed from the children's ideas but how these ideas were selected is not clear. In both studies, adults played a leading role in the message evaluation. Neither study considered the different ways children addressed handwashing.

Barriers to handwashing in schools

In schools, *reminders & encouragement, social norms, time, facilities, education & information*, all influence how and when children wash their hands (Chittleborough et al., 2012).

Teachers use *reminders & encouragement* to prompt children to wash their hands, but the tone of the reminders may be counterproductive (Randle et al., 2013), and teachers under *time* pressure have other priorities (Bonnesen, Plauborg, Denbæk, Due, & Johansen, 2015). Children may also prioritise play over handwashing (Chittleborough et al., 2012).

Even young children conform to social norms (Schmidt & Tomasello, 2012), and as handwashing is a *social norm*, children are likely influenced by the behaviour of other children, teachers and parents (Solehati, Kosasih, Susilawati, Lukman, & Paryati, 2017).

School toilet *facilities* are often in a poor condition and product supplies (such as soap) run out. Not only can it make it difficult for children to wash their hands, children may also express their dissatisfaction with facilities by way of antisocial behaviour (Burton, 2013).

Through *education & information* children have a good understanding of germs (Chittleborough et al., 2012). However, germs are invisible and some children do not wash their hands because they think they are clean (Schmidt, Wloch, Biran, Curtis, & Mangtani, 2009). A decision on whether to wash hands may also depend on how likely it is thought that not washing hands could lead to illness and how serious the consequence of this illness would be (Appiah-Brempong, Harris, Newton, & Gulis, 2018).

To summarise, handwashing in schools is influenced by *reminders & encouragement*, *social norms*, *time*, *facilities* and *education & information* (Chittleborough et al., 2012), so although children know they should wash their hands, they might not. To encourage handwashing in schools, barriers need to be addressed. Messaging cannot directly improve *facilities*, but other barriers could be effectively addressed. However, the phrasing of the message, and which barriers would be best addressed, is not known.

Handwashing messages in other settings

A message is “a brief communication, either explicit or implicit” (Jenner, Jones, Fletcher, Miller, & Scott, 2005a, p.219) and is conveyed by text, image or a combination of the two. Messages can be used to address barriers that affect handwashing in the hope that this will change behaviour. Although handwashing barriers differ depending on the setting and the target audience, in lieu of research with children, messages used to influence adults’ handwashing in hospitals and other community settings are reviewed. This research is relevant because, conceivably, some of the messages that have been successful in other studies could be successful with children in schools.

Studies highlighting the consequence of washing / not washing hands have had mixed results. Consequence messages can be phrased as either gain- or loss-framed depending on whether the advocated action is performed (O’Keefe & Jensen, 2007). In one study of healthcare workers, gain-framed messages were more effective (Reisinger et al., 2014). In another study, messages that were loss-framed combined were more effective (Caris et al., 2018).

Studies of healthcare workers found that handwashing messages focused around protecting patients and others from illness are more effective than messages about highlighting the consequence to the potential hand washer (e.g. Taylor, 2017; Grant & Hoffman, 2011). The effectiveness of this type of messaging is thought to be linked to the professionalism of healthcare workers and their role.

As handwashing is motivated by social norms, some studies have highlighted other people washing / not washing their hands. This has been an effective message strategy in motorway restrooms (Judah et al., 2009), some hospital locations (Caris et al., 2018) but not in university restrooms (Mackert, Liang, & Champlin, 2013).

Provoking a disgust reaction by visualising or indicating dirt that is normally invisible has been effective for students in a university environment (Botta, Dunker, Fenson-Hood, Maltarich, & McDonald, 2008; Porzig-Drummond, Stevenson, Case, & Oaten, 2009) and for men in a motorway service station (Judah et al., 2009).

To summarise: three messages have been effective in promoting handwashing to adults in hospitals and other community settings. Two of these messages are educational: (1) The consequences of getting sick (oneself / others), and (2) Making invisible dirt visible. The third addresses social norms (3) Showing that other people wash their hands / are present. However, it is not known whether these messages would effectively address barriers to children's handwashing in a school setting.

METHODS

The research reported here is part of a larger project (www.123germfree.co.uk) that evaluates whether visual communication in the toilet space, developed with children (aged 6-11) using a co-design methodology, can encourage handwashing. In this paper, we report on activities in two workshops where children evaluated and generated handwashing messages, and an analysis (by the authors) of handwashing posters targeted at children.

To answer research question 1 (Can in-school handwashing barriers be addressed with messaging, and if so how?), seventy-nine children evaluated and generated handwashing messages during three separate activities. In activity 1, children evaluated handwashing messages (selected by the authors) that correspond to in-school handwashing barriers. In activity 2, children generated their own messages. In activity 3, children refined a key message that they found effective in the first two activities. To answer research question 2 (Which in-school handwashing barriers are currently addressed in posters targeted at children, and how?), messages in eighty-four handwashing posters targeted at children were

identified by the authors. These messages were then analysed for the factors they address, and how.

Three English primary schools (two urban and one suburban) were recruited. We strived for approximately equal number of participants from each school (23, 29, 28) and across different year groups (27 year 2, 26 years 3 and 4, 27 years 5 and 6) and sex (43 female, 37 male). As handwashing is a sensitive issue we asked teachers to approach children they thought would be comfortable participating in this study. Letters were sent home to these children's parents / carers explaining the study and asking for informed consent. At the start of each workshop, the study was explained again to the children by the authors. Children were told they could withdraw at any time. All children assented to participating in the study. One child asked to leave one workshop early. To ensure confidentiality the names of schools and children are anonymised. Permission to carry out the research was received from Leeds University Ethics Committee.

The three activities took place in two workshops that ran in all three schools. The same children attended each workshop unless they were absent from school. Only half the children completed activity 3; the other half completed another activity not reported here. All the authors and one other researcher attended the workshops. Children were split into groups of between three and six, headed by a member of the project team. Care was taken to make sure that all children understood each activity, and children were supported (when necessary) in completing the workbooks developed for this project. To guard against children copying each other it was stressed that there were no right answers and that each child's contribution was important. While we cannot be sure that children were not influenced by each other, we found that children were keen to express their own views. School staff and parents reported back to us, unprompted, that their children had enjoyed participating.

ACTIVITY 1: Children evaluate messages

To find out the types of messages that children think might encourage handwashing, we asked children to evaluate messages that address in-school handwashing barriers.

Method

Children were asked to evaluate three messages that have been effective in studies of adults (indicated by *) and two further messages, that together address the barriers known to affect handwashing in schools (Table 1). For this first activity we wanted children to think about the type of messaging that could be effective rather than the particular words used. The authors prepared five generic messages where the phrasing of the messages is unspecific. The generic messages (Table 1, column 2) were presented to the children in their workbook and were read aloud to each group, by a member of the research team, one message at a time. After reading each message children were asked “Do you think this message would encourage children to wash their hands? Tick the box if you think it would”. We did not tell the children which barriers the messages addressed.

[Insert Table 1 here - Handwashing messages activity 1]

The results were analysed by counting the number of times each message was selected. No tests for statistical significance were performed as the number of participants was small. However, the data were examined for whether any differences between participant groups, schools, year groups and sex could be determined, and none was found.

Results

The results are reported in Figure 1. Particularly noteworthy is that 95% (73/77) / 75% (58/77) thought the *education & information* messages (“cause children to be ill” / “hands have germs”), and 64 % (50/77) thought the *reminders & encouragement* message (“remember to wash your hands”) would encourage children to wash their hands. By contrast,

the *social norm* and *time* messages were only selected by 35% (27/77) and 47% (36/77) of children respectively.

[Insert Figure 1 here - Children's evaluation of common handwashing messages]

ACTIVITY 2: Children generate messages

So that the children were not restricted to the activity 1 messages nor to the barriers addressed, we asked them to generate handwashing messages. This also meant that we could further elicit which activity 1 messages children found effective by analysing which messages they found pertinent enough to either reiterate or repurpose.

Method

Children were asked to draw / write a message that would encourage handwashing on a sketch of a toilet door. The first step in the analysis was to identify the messages in the children's drawings. As a message is a "brief communication" (Jenner et al., 2005a, p.219) the first author identified in each child's drawing discrete chunks of text that could be used to persuade others of a course of action. For example, four messages were identified in the drawing by Child 8 (see supplemental material): (1) wash your hands (twice), (2) get rid of germs, (3) you won't go to hospital, (4) don't touch me. Some chunks of text were supported by images (e.g. "don't touch me in" the above example) and some images were standalone messages. The interpretation of these images was supported by children's descriptions given to the authors when completing the activity. Two drawings contained no obvious message (a picture of a germ placed on the door) and were removed from the dataset.

All messages were analysed by the first author for which in-school barrier was being addressed (Table 2, column 1) and how text and images were used to address barriers (Table 2, column 2). Many of the children's messages fell within the *education & information* category and so these messages were further analysed to generate seven new sub-categories

(Table 2, Column 1). To ensure research quality, the second author verified the coding scheme, firstly by independently identifying all the different messages in 10 (out of 77) of the children's drawings. Then secondly using Table 2 as a base, the second author coded the messages for the in-school barrier addressed. No new barriers were found and initially 20 out of 27 messages were coded to the same barrier. The first and second authors discussed the differences in coding and determined that ambiguity in the phrasing of the codebook accounted for most of the differences. The phrasing of the definitions in the codebook were then amended to address differences. This resulted in the same code application for 25 out of 27 messages (93% agreement). Table 2 was then later used during the analysis of handwashing posters targeted at children with two revisions indicated by **.

[Insert Table 2 here - Codebook for analysing handwashing messages (activity 2 and poster evaluation)]

Results

Seventy-seven drawings contained handwashing messages; of these sixty contained multiple messages spread across more than one category (Figure 2). As with activity 1, *reminders & encouragement* (85%, 64/75) and *education & information* (92%, 69/75) messages were more commonly addressed than *social norms* (16%, 12/75) and *time* (5%, 4/75).

We next consider how the activity 1 messages were deployed. Examples of the children's drawings can be viewed in supplemental material. The message "Showing reminders such as 'remember to wash your hands'" was mostly used without modification. The main repurposing of this message was to change it into a command to "wash your hands" (e.g. Child 8 & 53).

"Showing images of children washing their hands" was altered to depict a popular figure such as SpongeBob Square Pants (e.g. Child 36) or a valued class member (sometimes the drawer

themselves). This message could also be extended to suggest a social benefit by making a link between happiness and handwashing. “Showing it is quick to wash and dry hands (only takes 30 seconds)” was used without modification to address the in-school *time* factor but was also turned into an *instruction* advocating spending a longer time in four drawings (e.g. Child 9).

“Showing that germs may cause children to be ill” was used by 28 children, but this message was also extended to include further consequences such as going to hospital (e.g. Child 8) or not being able to play (e.g. Child 16). Children also alluded to other consequences such as “Yoda will haunt you” (Child 77), “lightening will strike”, and other threats. 82% (31/38) of *germ consequence* messages were gain-framed. Only four messages suggested a consequence for other people, and then even two of these messages included a consequence for the hand washer or perhaps for the drawer themselves (e.g. Child 17).

“Showing how hands have germs on them we can’t see” was reiterated with drawings of germs on the hands, and occasionally on the body as a whole. The message was further extended to show germs in the toilet space (usually the door handle) (e.g. Child 36) or a message stating that germs could be everywhere. This result could have been prompted by an activity in a previous workshop where children had been asked to indicate on photographs of toilets and a drawing of the body where they thought germs could be found. Five new types of message that address *education & information* were generated (*germ transmission prevention, germ transmission enabling, germ avoidance, how to wash, when to wash*). *Germ transmission prevention* was indicated in 24% (18/75) with drawings showing that washing hands removes germs, principally by using before and after pictures. 15% (11/75) of drawings highlighted *germ transmission enabling*. For example, Child 46 illustrates how germs are spread through touching the door handle, but when hands are washed, germs are

sent down the plug hole. *Germ avoidance* was indicated in 21% (16/75) of drawings with either images of crossed-out germs or messages such as “*not to touch*” coming directly from germs (e.g. Child 8). Two of the new message types were instructions. 17% (13/75) of drawings contained instructions on *how to wash* hands (e.g. Child 9) that included using soap and taking more time. 9% (7/75) instructed *when to wash* such as before eating.

Overall, there was a large variety of imaginative realisations of the messages. *Education & information* and *reminders & encouragement* were most frequently addressed.

ACTIVITY 3: Children refine message phrasing

So children could consider the precise wording of the message as opposed to the generic messages presented in activity 1, we asked children to refine the phrasing of a key message.

Method

As “*causing children to be ill*” was the most selected message (activity 1) and nearly half of the children’s drawings (activity 2) highlighted *germ consequence*, children were presented with different ways of phrasing this message. We created four versions of the same message by manipulating who would benefit and the framing (Table 3).

[Insert Table 3 here - Germ consequence message phrasing]

The messages were presented to children in a list. Since studies highlight the potential difficulty of using scales with children (Mellor & Moore, 2013) we ensured message variations, including the differences between them, were carefully explained. Children were asked to number the messages 1 to 4, where 1 is the message that would make you most likely to wash your hands and 4 least likely. When observed, the children appeared to carry out the task systematically without prompting. Children were also asked to give their reasons for selection. To analyse this activity, first the number of most likely scores were counted. Then to further check the effectiveness of each message a total score was given, with 4 points

awarded each time a message was selected most likely, 3 points when selected likely and so on. The explanations children gave when selecting messages was also used to support this analysis.

Results

Both the social group consequence messages count and score strongly against the personal consequence messages (Table 4). Children explained that they liked helping people and did not want to make people sick. This was not always altruistic. Child 3 explained “*if that happened to their friend then they had no one to play with*”. And some children commented that what they really wanted to tick was “*you, friends and family*”.

There is little difference between the count and scores of the gain- / loss-framed phrasing.

When asked about their selections, none of the children commented on the action (washing / not washing). Several children did, however, comment on whether a desirable / undesirable (healthy / sick) outcome would be more effective, and for this there was little consensus.

Child 5 thought that sick was easier to understand than health as “[*children*] understand what sick is [*but*] kids when they think healthy they are guessing vegetables and healthy food”. As well, Child 73 thought that being healthy was not a concern “*if you think washing your hands keeps you healthy you think ok, oh well, I am healthy anyway. If it was make you feel sick they’ll worry*”. Conversely, Child 64 thought sickness an unwelcome message “*I don’t really want to hear that I’ll be ill if I don’t wash my hands.*” Child 34 and several others thought sickness an ineffective message “*because kids would think ah if I’m sick I won’t have to go to school*”.

[Insert Table 4 here - Germ consequence message phrasing results]

SUMMARY ACTIVITIES 1-3

Children considered messages that targeted *education & information*, and *reminders & encouragement* the most effective. Messages that targeted *time* and *social norms* were not considered as effective and when generating their own messages children did not seem to find an easy way to address perceived lack of time and competing priorities.

EVALUATION (authors) of handwashing posters targeted at children

To find out which in-school barriers are addressed, and how, in handwashing posters targeted at children, the authors identified and evaluated messages in eighty-four posters.

Method

Handwashing posters were sampled by searching for “*handwashing posters for children*” in Google Images. Schools may also use other sources for handwashing posters, but it was thought reasonable to assume that Google Images is a key resource and is indicative of source popularity (though not necessarily quality or effectiveness). So that the search results could not have been influenced by previous searches, the search was conducted on a computer that had not previously been used by any of the authors. Before finalising on the “*handwashing posters for children*” query, different search terms were trialled on a separate computer (for example, replacing “*handwashing*” with “*hand hygiene*”) but little variation was seen in the search results. The first 100 posters in the search results were selected for analysis. This was considered more than adequate as most people do not scroll. Of the 100 posters selected, sixteen posters were removed from the analysis because either they were not targeted at children (6), were miscellaneous images rather than posters (7), or were repeats of the same poster (3). The analysis and research quality techniques used in activity 2 were repeated for the posters. This resulted in the first and second authors applying the same codes for 19 out of 22 messages (86% agreement).

Results

[Insert Figure 2 here - Barriers addressed in children's messages (activity 2) and messages targeted at children]

As with the children's drawings, the factors addressed in posters targeted at children were predominantly *reminders & encouragement* (99%, 83/84) and *education & information* (89%, 75/84) with *social norms* (14%, 12/84) and *time* (4%, 3/84) less frequently addressed (Figure 2). The techniques to depict *social norms* were analogous to those used by children, with posters either showing others washing their hands, and /or linking handwashing to happiness. With regards to *time*, one poster suggested that handwashing saved time (less time at doctors and more time at school) – a variation of the message used in activity 1. Two posters took an entirely different approach by suggesting that handwashing should be made a habit.

[Insert Figure 3 here - Education & information messages - children's messages (activity 2) and messages targeted at children]

Within the *education & information* category the professional posters focused on *instruction*, whereas children's drawings focused on *germs* (Figure 3). Only 20% of the posters depicted germs anywhere on the poster, and when germs were shown they were often benign looking or even cute and cuddly. This stands in stark contrast with the children's drawings where many of the germs were made to look scary, and the threat of germs made clear. The most common *germ* messaging on posters was how to prevent germs spreading (37%, 31/84). Only 1% (1/84) of the posters suggested that germs can be transmitted to other people, and similarly only 1% (1/84) suggested that germs should be avoided. Only 8% (7/84) of the posters showed that germs are located on the hand, and none showed germs in the toilet environment. 12% (10/84) of the posters highlighted germ consequence; interestingly two of

these messages were derived from posters designed by children in competitions. The effect stated in all but one of the professional posters was that germs can make you sick.

DISCUSSION

Children considered messages that addressed *education & information* and *reminders & encouragement* most effective. Messages that addressed *time* and *social norms* were not considered as effective. Posters targeted at children addressed the same barriers in roughly the same proportion. However, what is communicated within the *education & information* category is very different from the children's drawings. Children's *education & information* messaging mostly focused on *germs*, while the professional posters focused on *instruction*.

Simply providing people with information will not lead to an increase in handwashing (Birnbach, Rosen, Fitzpatrick, Everett-Thomas, & Arheart, 2017) as messages also need to persuade. Many of the messages in posters targeted at children were reminders and instructions. The problem with instructions is that they are "*telling rather than selling*" the message (Jenner et al., 2005b, p.218). Although children also included (unprompted) instruction messages in their drawings, most of the messages that children generated appeared much more persuasive in that they did more than simply instruct how to "*wash your hands*". It seems that largely missing from the posters targeted at children is a link between handwashing and a tangible reason why hands need washing. In the children's drawings the issue of *germ consequence* is more widely addressed. It seems an oversight, given that consequence messages have been effective in studies with adults (e.g. Taylor, 2017), that they are infrequently addressed in posters targeted at children. When children generated *germ consequence* messages in activity 2, these messages were mainly gain-framed around avoiding an undesirable consequence. This fits with health problem prevention studies where gain-framed messages are thought more effective than loss-framed when the risk is slight

(Rothman & Salovey, 1997). However, despite promising results in studies of dental hygiene, there is some doubt that gain-framing messages really is effective in other fields (O’Keefe & Jensen, 2007). When we asked children to choose between a gain-framed and a loss-framed version of the same message, the results were inconclusive. When generating their own messages in activity 2, perhaps influenced by activity 1, children mostly highlighted the risk of acquiring germs to the hand washer. However, when this was tested in activity 3, the majority of the children chose others over themselves, suggesting that this desire to look after others seen in hospital workers (Grant & Hoffman, 2011) could be universally applicable. Children also generated messages that went beyond health consequences to include play. Perhaps for children who are prioritising play over handwashing (Chittleborough et al., 2012) it is the pertinence and immediateness of this consequence that works.

Children also used fear appeals and threats to encourage handwashing. Several of the messages were quite extreme suggesting death and terrible events. It may be that the children enjoyed doing the activities and got carried away in the moment but overall they seemed to take seriously the opportunity to help improve the use of their school toilets. Furthermore, recent work in healthcare settings suggest that emotional motivators may be more effective than rational arguments in promoting handwashing (McCay, 2015). Williams and Noyes (2007, p.6) caution that for warning messages to be effective they must communicate the “appropriate level of risk”. It is unlikely that English primary school children really think they are in imminent danger of death if they do not wash their hands. Such threatening messages could actually inhibit use of the toilet space altogether, and there is a growing consensus that fear appeals are a “damaging classroom strategy” (Putwain & Best, 2011, p.580). Nevertheless, children thought these messages would be effective.

Some caution is also needed with regards to interpreting *reminders & encouragement*, as particularly for activity 2, where we asked children to generate their own messages, this perhaps was the easiest message to generate. However, *reminders & encouragement* were consistently highly placed across two of the activities. It does perhaps suggest that children do need reminding in the place where the handwashing activity takes place, and that it is not enough just to teach children about handwashing in the classroom. This could also account for why children thought *education & information* messages would be effective. Children are knowledgeable about germs (Chittleborough et al., 2012) but it is possible that they are still not very aware of them in their daily lives. As invisible entities it is easy to forget their presence, and handwashing lessons tend to take place in the classroom rather than the toilet. This study suggests that to encourage handwashing, children need to be made more aware of germs when they are in the toilet space. Most posters targeted at children do not do this, focusing on instruction instead. In our study children drew germs on hands and on the facilities to indicate *germ location* and warn of *transmission*. Interestingly, in studies of adults, visualisations of germs evoke disgust that then prompts handwashing (e.g. Porzig-Drummond et al., 2009).

Messages that relate to *social norms* have been effective in studies of adults (Judah et al., 2009; Caris et al., 2018), but the results of our study suggest that simply showing images of other children washing their hands as seen in posters targeted at children is unlikely to be effective. In their drawings, images of children were replaced with role models and high status individuals that in reality may be impracticable to implement. This suggests that other ways of depicting social norms to child audiences needs to be explored. Similarly, *time* was rarely addressed in both the children's drawings and professional posters. Whether these barriers cannot be addressed through messaging, or whether we need to use our collective imagination to develop more effective messaging, is unclear.

LIMITATIONS

A key limitation of this study is that it addresses what children think will encourage handwashing and not what actually does influence handwashing. We believe, though, that including children in the research process is an important first step to developing handwashing messages that are effective.

We strived to recruit diverse schools, and a balance of sex and age groups, but ultimately our sample was dictated by the need for children to want to participate and to feel comfortable discussing a sensitive topic. That we asked children to evaluate handwashing messages (activity 1) before generating their own (activity 2) meant that children could have been somewhat influenced by the messages selected by the authors for activity 1. However, the latter had been presented in terms of general types of messages (and other ideas had been sought) and the children's generation yielded very specific (and diverse) wordings as demonstrated by the five new *education and information* messages. Furthermore, children were not "empty vessels" and were already familiar with, and likely influenced by, handwashing posters (seen in schools, doctor's surgeries and public toilets). Our findings also suggest that children reiterated messages that they found pertinent. A limitation of the poster analysis is whether the sample taken from Google Images is a fair representation of those used in schools. As Google in part orders results according download frequency it is thought an acceptable representation.

FUTURE WORK

In future work, a synthesis of the designs and messages generated by the children in the workshops will be installed in the toilets of the participating schools. Whether handwashing increases will be evaluated, as well as how the designs and messages are received and understood.

CONCLUSION

Using a co-design methodology we worked with children to evaluate and generate messages that correspond to in-school handwashing barriers. Through this process new insights into the type of messaging that might encourage children to wash their hands were generated.

Strikingly, the children's choice of messaging differs considerably from the type of messaging used in posters targeted at them. We will be using these findings to add messaging to the toilet space in the three schools that participated in this study, and believe that these findings will be useful for others developing handwashing interventions.

Children in our study thought that messaging that addresses *reminders & encouragement* and *education & information* are most likely to be effective. Messaging that addresses *social norms* and *time* was not considered as effective. Children know they should wash their hands, but they still need *reminders & encouragement* to be incorporated into the handwashing environment. *Education & information* messages that simply instruct children on how and when to wash hands are less likely to be effective than messages informing children about germs. Messages that highlight the presence of germs on the body and in the environment, explain how germs are transmitted, explain how handwashing removes germs, and emphasise the consequence of washing / not washing are likely to be the most effective. Consequences such as play (not just health) that are pertinent to the immediate handwashing context should be highlighted, and that family and friends benefit not just the hand washer.

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Table 1: Handwashing messages activity 1

Handwashing barrier addressed	Message
Reminders & encouragement	Showing reminders such as “remember to wash your hands”
Social norms	* Showing images of children washing their hands
Time	Showing it is quick to wash and dry hands (only takes 30 seconds)
Education & information	* Showing that germs may cause children to be ill
	* Showing how hands have germs on them that we can't see

Table 2: Codebook for analysing handwashing messages (activity 2 and poster evaluation)

In-school barriers		How factors are addressed
Reminders & encouragement		States “ <i>wash your hands</i> ” (or similar). May include words such as “ <i>remember</i> ” and “ <i>don’t forget</i> ”.
Social norms		(1) Shows a class member or role model washing their hands. (2) Suggests that washing hands makes people happy e.g. a drawing of a smiling person saying “ <i>thank you</i> ”.
Time		(1) States that handwashing does not take long e.g. “ <i>only 30 seconds</i> ” Note: stating how long hands should be washed is considered an instruction (see below). (2)** States that handwashing saves time. (3) ** States that handwashing should be habitual.
Education & information		-
Germ	location	(1) *Shows there are germs in the toilet by drawing germs on a toilet facility. (2) Shows there are germs on the body by drawing germs on a body / body part. May include labels such as “ <i>Germs are here</i> ” (or similar). (3) *States that germs can be everywhere.
	consequence	(1) States an effect that germs can have, e.g. “ <i>you will get ill</i> ” / “ <i>you cannot play</i> ”. (2) Shows an effect of germs e.g. draws a sick person. (3) States a general warning that a bad thing can happen
	transmission prevention	(1) States that washing hands will remove germs e.g. “ <i>wash your hands and get rid of germs</i> ”. (2) Shows that washing hands will remove germs e.g. before and after pictures. (3) **States that washing hands stops germs spreading
	transmission enabling	(1) States that germs are spread through touch e.g. “ <i>we touch door and we have germs</i> ”. (2) Shows germ transmission across the toilet space through narrative drawing.
	avoidance	(1) States or shows that germs should be evaded e.g. “ <i>don’t touch me</i> ” on image of germ *(2) States or shows that no germs should be in the toilet space / on body e.g. a crossed-out germ drawing.
Instruction	how to wash	(1) States or shows the different steps to wash hands e.g. “ <i>wash your hands with soap</i> ” or images of soap being dispensed. Note: simply showing a hand in water is considered a reminder & encouragement. (2) States that time must be taken.
	when to wash	States or shows when hands should be washed. e.g. “ <i>before food</i> ”. Note: “ <i>wash hands now</i> ” or similar is considered a reminder & encouragement.

* Children’s drawings only ** Posters targeted at children only

Table 3: Germ consequence message phrasing

	Gain-framed	Loss-framed
Personal benefit	Washing hands keeps you healthy	Not washing hands makes you sick
Social group benefit	Washing hands keeps friends and family healthy	Not washing hands makes friends and family sick

Table 4: Germ consequence message phrasing results

	Gain-framed (Washing & healthy)	Loss-framed (Not washing & sick)
Personal benefit (You)	3 (total score 100)	5 (total score 91)
Social group benefit (Family & friends)	19 (total score 132)	18 (total score 127)

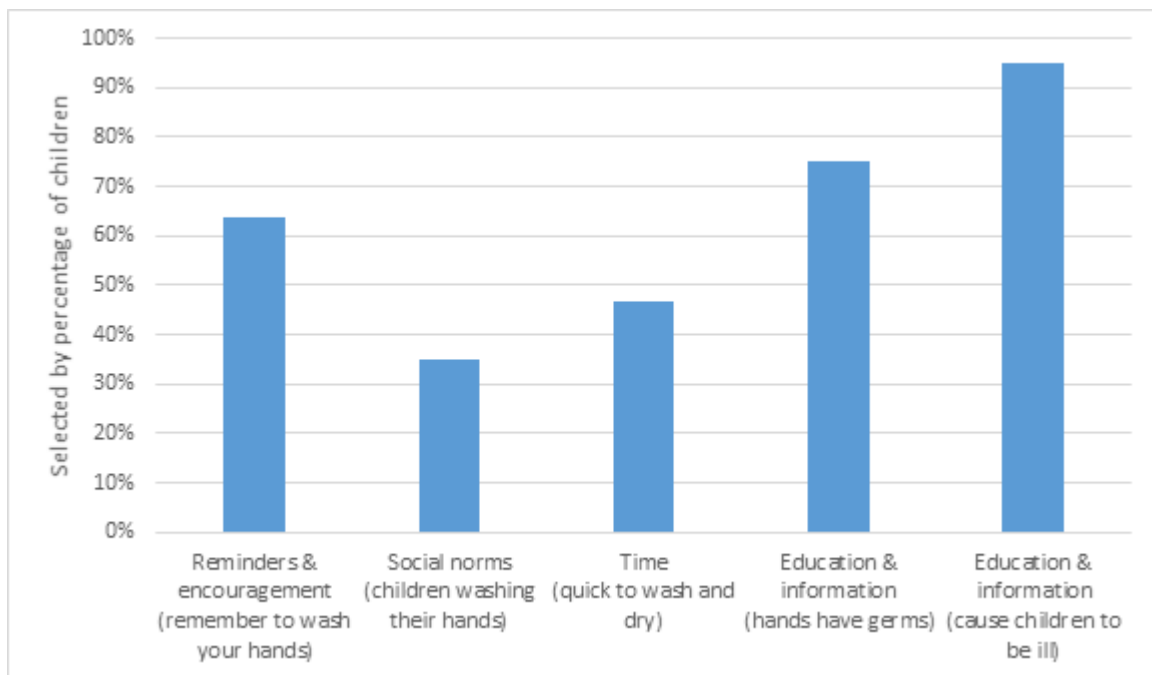


Figure 1: Children’s evaluation of common handwashing messages

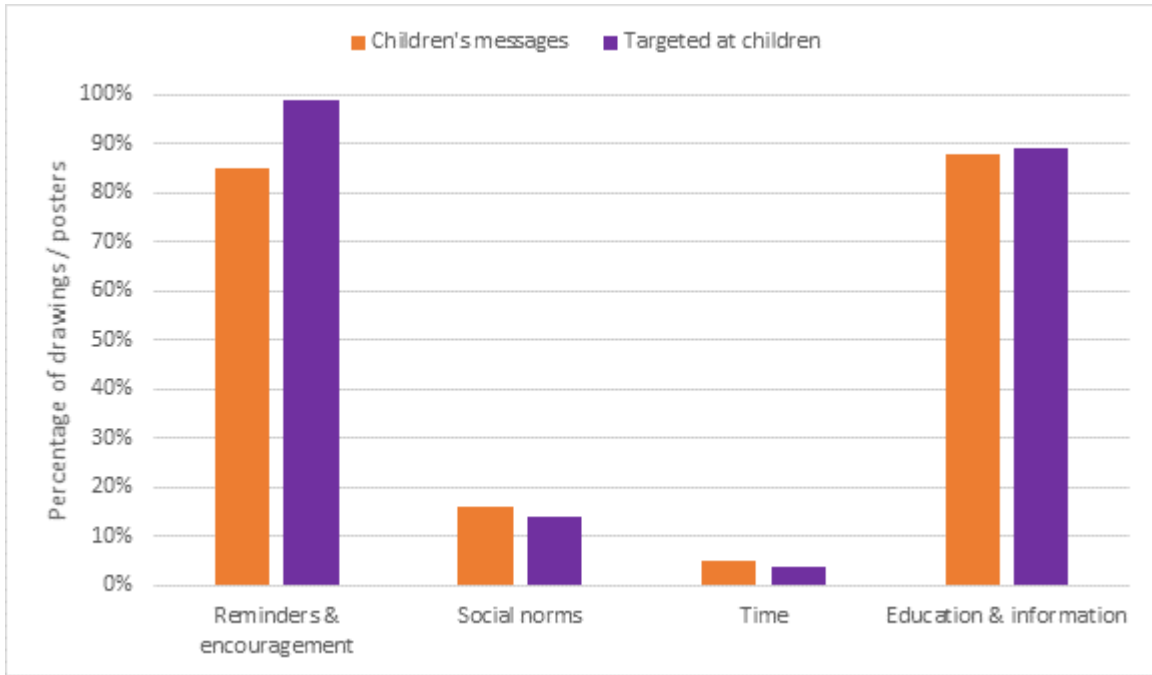


Figure 2: Barriers addressed in children’s messages (activity 2) and messages targeted at children

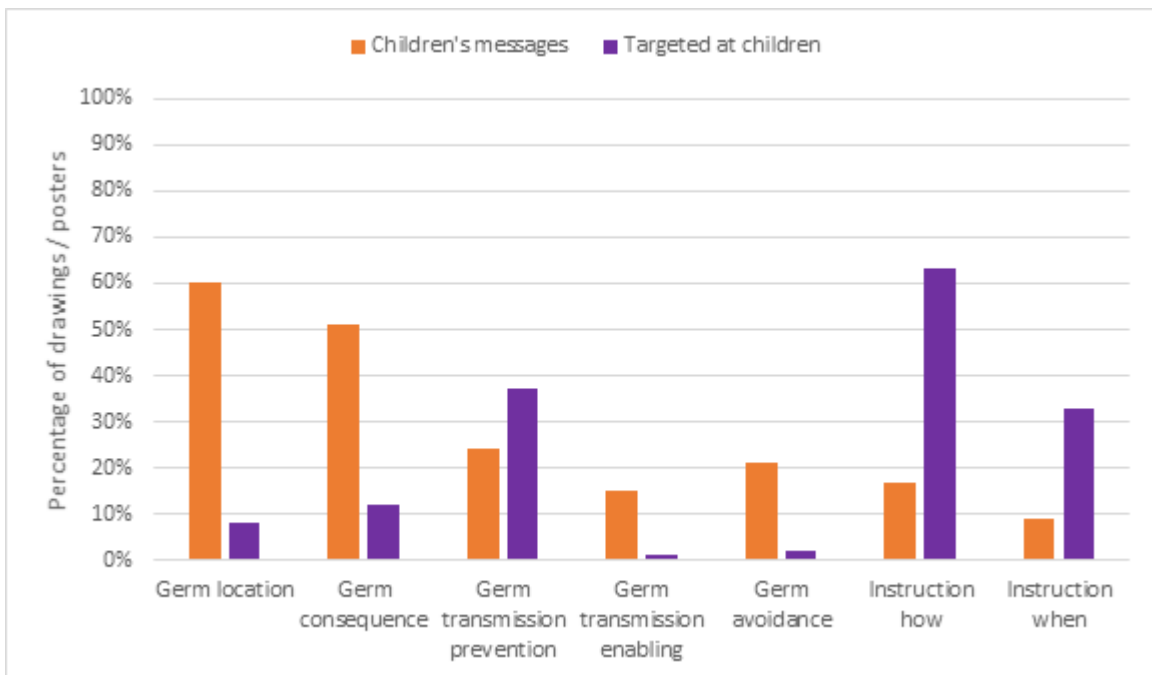


Figure 3: Education & information messages - children’s messages (activity 2) and messages targeted at children



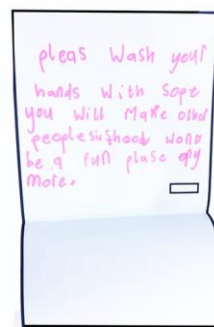
Child 8



Child 9



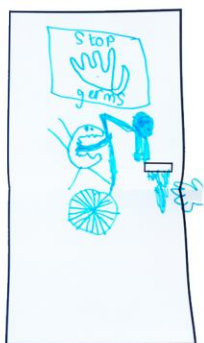
Child 16



Child 17



Child 36



Child 46



Child 53



Child 77

Supplementary material: Children's drawings

