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Behaviour change communication targeting four health behaviours in developing countries: A review of change techniques

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ABSTRACT

Behaviour change communication is vital for increasing the enactment of particular behaviours known to promote health and growth. The techniques used to change behaviour are important for determining how successful the intervention is. In order to integrate findings from different interventions, we need to define and organize the techniques previously used and connect them to effectiveness data. This paper reviews 24 interventions and programs implemented to change four health behaviours related to child health in developing countries: the use of bed nets, hand washing, face washing and complementary feeding. The techniques employed are organized under six categories: information, performance, problem solving, social support, materials, and media. The most successful interventions use three or even four categories of techniques, engaging participants at the behavioural, social, sensory, and cognitive levels. We discuss the link between techniques and theories. We propose that program development would be more systematic if researchers considered a menu of technique categories appropriate for the targeted behaviour and audience when designing their studies.

Introduction

Behaviour change communication is used by health programs to provide tailored messages and a supportive environment that persuades individuals and communities to make positive health behaviour changes. Many studies have examined behaviours like quitting smoking, dieting and exercise, since these are important contributors to urgent health issues in developed countries (Glanz & Bishop, 2010). However, it is becoming increasingly critical to address health issues in the developing world and to find new methods of promoting behaviours that might prevent illness. This is particularly the case for young children, namely those under 5 years of age, whose health is a priority. The need to improve the health of young children is reflected in Millennium Development Goal No. 4: to reduce by two-thirds, between 1990 and 2015, the under-five mortality rate. Despite this objective, the under-five mortality rate remains "unacceptably high" (United Nations, 2008) with approximately 7.6 million children dying before age five in 2010 (UNICEF, 2010). Specific health behaviours are known to prevent disease and mortality. This paper addresses four that are vital in reducing death and disability due to malaria, diarrhoea, trachoma and malnutrition.

The difficulty in eliciting healthy behaviour changes in spite of programs targeting these outcomes has been explored in both the developing and developed world (e.g., Bentley, Wasser, & Creed-Kanashiro, 2011; Hurley, Cross, & Hughes, 2011). A major limitation of many health behaviour change programs is the lack of a clear statement about the process of change and how it was implemented. This omission was raised by Davidson et al. (2003) and followed several years later by a taxonomy of change techniques (Abraham & Michie, 2008). For example, Davidson advised authors to report the concrete strategies used to bring about change, such as the message given, the medium used, and who delivered it. Specific processes of change are often tied to specific theories of change; for example, social learning theory emphasizes techniques such as modelling, reward, and practice (Bandura, 1986), whereas the Elaboration Likelihood communication theory emphasizes a match between the message and the recipient's ability and willingness to elaborate the message (Petty & Cacioppo, 1986). A number of recent articles have focused on the desirability of using theory to inform behaviour change programs (Glanz & Bishop, 2010; Painter, Borba, Hynes, Mays, & Glanz, 2008). The current paper complements this approach by addressing the need to specify techniques of change, in part because program developers search for techniques with evidence of success rather than theories. In other words, their goal is first to find an effective mix of techniques rather than to test a specific theory.

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Abraham and Michie (2008) provided an initial list of 26 change techniques used in research. These included techniques such as "provide information about others' approval," derived from theories that stipulate subjective norms as importantly related to behaviour and thus to behaviour change. Another was "model or demonstrate the behaviour," from social-cognitive theory. A third was "prompting practice," said to be associated with operant conditioning. There are a number of controversial issues to be noted here. One is that techniques are derived from more than one theory, and so their use does not directly test one theory over another. For example, prompting practice is associated not only with operant conditioning but also with social-cognitive learning theory, indeed with most learning theories, and is a cornerstone of improving self-efficacy. Thus, practice may be a particularly powerful technique if one's goal is to change behaviour, though it will not allow for a test of one theory.

A second issue is that many techniques listed by Abraham and Michie (2008) are highly cognitive in nature and so are not techniques of choice with populations that are not "cognitively willing and able" to engage in the change message (Petty & Cacioppo, 1986). Most of the listed techniques are found in individual-focused interventions to change behaviour, such as providing information about others' approval (called subjective norm), but not group-based interventions where actual norms are to be changed. Because so many individual-focused techniques are tied to cognitive constructs, such as subjective norms and intentions, the techniques are described largely in terms of the cognitive construct, while the activity or means of changing the construct is stated vaguely as "provide" or "prompt". Additional techniques must be added to the list to cover those commonly used by programs found in developing countries, for example techniques based on practice rather than solely information, and delivered to groups rather than to individuals. Many program developers rely on a limited number of techniques, such as adult education (Holford, 1995), not because they are theory- or evidence-based, but because they have face validity.

In order to derive a more complete list of behaviour change techniques, we reviewed a limited number of high quality interventions from developing countries to identify the techniques used in each one. The focus was on four behaviours that are common goals for many child health interventions delivered in developing countries: caregivers using insecticide-treated bed nets (ITN) to prevent malaria; caregivers washing their own and their children's hands at key times to prevent child diarrhoea; washing children's faces regularly to prevent trachoma; and providing adequate amounts and diversity of complementary foods to prevent malnutrition in children. We examined six programs for each behaviour in order to identify the techniques used and their success. Our objectives were therefore to identify techniques of behaviour change used in developing countries to reduce child morbidity and mortality, to compare their use and effectiveness across studies, and to examine the role of theory in informing behaviour change techniques.

Method

The co-authors identified intervention programs separately. One of the co-authors used review articles on complementary feeding and hygiene (e.g., Dewey & Afu-Afarwuah, 2008), while the other co-author searched databases, such as Medline and Global Health Ovid. Reference lists of recent publications and an ongoing systematic review of parenting interventions were also used. To be included in this selective review, an article needed to: report an evaluation of an intervention involving one of the four behaviours (use of bed nets, hand washing, face washing or complementary feeding); target children's health (particularly age 5 and under); be delivered in a low-income country; be delivered in a geographic community; be available in English and published between January 1980 and December 2010; preferably have a behavioural outcome or if not, then a health outcome, one of which showed significant change. In addition, we looked for high quality studies that provided detailed information about the intervention. For some behaviours, such as feeding, there were many papers, while for bed nets there were fewer because it may now be unethical to have a control group. To keep the number of studies across targeted behaviours equal, we selected the six that best fit our criteria. Final decisions about the inclusion of articles were made through discussion and consensus between the co-authors. This was a selective, not systematic, review.

Each intervention was described in terms of the characteristics of the change program and its evaluation (see Table 1), and in particular the behaviour change techniques used. Concerning the techniques, the co-authors independently identified techniques using the Abraham and Michie (2008) list of 26 techniques. After coding several, we reworded and defined some more clearly, and added nine more. For example, "teach to use prompts or cues" (#15) was reworded as "provide home-based cues to action"; "plan social support" (#20) was reworded as "arrange who would provide social support and how". On the first 12 articles coded, agreement was 80%. One problematic code was "use follow-up prompts" after the intervention (#18) which was then reworded to refer to a delayed "booster session" or home visit that was nonetheless part of the intervention and not part of the assessment. Disagreements and remaining studies were coded by consensus.

The effectiveness of each intervention was assessed by nothing whether the result for each outcome was positive (desired direction), non-significant, or negative (undesired direction). Outcomes were categorized as observed behaviour (or behavioural indicator), self-reported behaviour, knowledge, and objective indicator of health. The knowledge outcome was included because many researchers felt it was important to change knowledge along with practice; although it could be tested as a mediator, no study had tested it as such. Objective indicators of child health were included because they are often the only outcome of interest to health researchers. Our primary interest was observed behaviour change, though the other outcomes provided useful evidence of change.

Results

The results are organized to present techniques of behaviour change before describing the effectiveness of the interventions (see Table 2).

Techniques of behaviour change

The goal was to examine techniques of behaviour change that may or may not overlap with those on the Abraham and Michie (2008) list. To their list we added others such as prompting recall of the message, arranging for authority/community/peer support, eliciting specific facilitators, engaging in problem solving, arousing competition among groups, providing materials, and providing or encouraging the development of visual or interpersonal media. However, rather than simply expanding the list, we found it more useful to organize techniques into six categories: Information, Performance, Problem solving, Social support, Materials and Media. The usual strategy of organizing into content versus mode of delivery was less useful because for most techniques the content was the practice itself, not a cognitive construct, and the mode of delivery was face-to-face oral communication. So, categories reflected the psychosocial domain through which participants were engaged to learn and maintain the practice, i.e., mode of

Table 1
Characteristics of interventions and evaluations.

Authors	Country	Who delivered it	Recipient	Target	Duration and intensity	Design	Post-test & follow-up	Sample size
Bed nets								
Alaii, Hawley et al. (2003); Alaii, Van den Borne, Kachur, Mwenesi et al. (2003); Alaii, Van den Borne, Kachur, Shelley et al. (2003)	Kenya	Traditional Birth Attendants	All villagers	Children; focus on <5years	2 years	Randomized Pre-post	Every 3 months for 2 years	784 households
Binka et al. (1996)	Ghana	Field staff	All villagers	Children (6 months–4 years)	1 session	Randomized Pre-post	1 & 2 years	120 compounds $n = 1400$
Habluetzel et al. (1997)	Burkina Faso	Field workers of the Centre National de Lutte Contre le Paludisme	All villagers	Children (6–59 months)	1 session	Randomized Post-only	1 & 2 years	158 villages
Lindblade et al. (2004)	Kenya	Traditional Birth Attendants, other field staff trained in workshops	All villagers	Children<5years	1 year	Randomized Pre-post	1 & 2 years 6 year follow-up	211 villages
Panter-Brick, Clarke, Lomas, Pinder, and Lindsay (2006)	Gambia	Field workers & Peers	All villagers	All villagers, including young children	3 months	Intervention-only Pre-post	Immediate 1 month follow-up	2 villages
Schellenberg et al. (1999)	Tanzania	Field workers & Peers	All villagers	All villagers, including young children	18 months	Intervention-only Pre-post	Immediate	11,480 households
Hand washing								
Cairncross et al. (2005)	India	Health staff and Integrated Child Development Service (nursery) workers	All ages	All ages (focus on women)	3–12 months (depending on area)	Cluster randomized Pre-post	12 months	500 households in 10 clusters
Curtis et al. (2001)	Burkina Faso	Community volunteers, trained in communication and hygiene	Female caregivers	Female caregivers	3 years	Intervention-only Pre-post	Immediate	616 mother–child pairs
Luby et al. (2001)	Pakistan	Trained field workers (recruited from the study or nearby communities)	Entire household	Children <15 years	Weekly for 1 year	Cluster randomized Pre-post	Immediate	58 households
Luby et al. (2010)	Bangladesh	Trained field workers	Entire household	All villagers	13 weeks	Cluster randomized Pre-post	Immediate	700 people
Monte et al. (1997)	Brazil	Respected community members recruited and trained as field workers	Mothers of infants	Mothers (who are weaning infants)	11 months	Randomized Pre-post	Immediate	60 mothers
Pinfold and Horan (1996)	Thailand	Field workers	Adults (primarily female)	Children<5 years	3–6 months	Groups not randomized Pre-post	Immediate	37 villages
Face washing								
Edwards, Cumberland, Hailu, and Todd (2006)	Ethiopia	NGO workers, radio	All villagers	Children 3–9 years	Not specified	Cluster randomized Pre-post	<12 months	2008 people
Khandekar, Tannah, and Thi (2006)	Vietnam	International Development Enterprise health educators and coached trainers	All villagers	All villagers (Children under 15 analyzed separately)	2 years	Cluster randomized Pre-post	Immediately after 2 year intervention	2 villages $n = 605$
Lansdown, Issae, Katala, and Mwaisumo (2005)	Tanzania	School teachers, trained via workshops	Children 7–13 years	Children 7–13 years	6 months	Intervention-only Pre-post	Immediate	10 schools $n = 2000$
Lewallen et al. (2008)	Tanzania	School teachers, trained via workshops	Children (gr 3, 4, 5)	Children (gr 3, 4, 5)	2–4 times/month over several months	Cluster randomized Pre-post	Immediate	20 schools $n = 1346$
Lynch et al. (1994)	Tanzania	Local villagers (trained) Traditional Healers	All villagers	Children	3 months	Intervention-only Pre-post	4 months, 6 months, and 1 year	70 households
West et al. (1995)	Tanzania	Field workers	All villagers	Children 1–7 years	1 month	Cluster randomized Pre-post	1 month, 5 months, and 11 months	6 villages $n = 1303$
Compl. feeding								

Aboud et al. (2009)	Bangladesh	Local, trained peer educators	Mothers	Children 8–20 months	5 weekly sessions + booster session	Cluster randomized Pre-post	2 weeks post; 5 months follow-up	200 mother–child pairs
Bhandari et al. (2004)	India	Health workers (e.g., auxiliary nurse midwives), community representatives	Mothers	Children< 2 years	Monthly over 18 months	Cluster randomized Pre-post	Immediate	8 communities $n = 829$
Horz and Gibson (2005)	Malawi	Health Surveillance Assistants & Health Committee Members	Mothers	Infants (aged 6–23 months)	8 weeks (4 lessons) + booster session	Groups not randomized Pre-post	1 month post	$n = 178$
Pachón et al. (2002)	Vietnam	Local health volunteers	Mothers	Children 5–25 months	18 sessions over 9 months	Cluster randomized Pre-post	3 month post	$n = 238$
Penny et al. (2005)	Peru	Health workers	Caregiver	Children 0–18 months	18 months	Cluster randomized Pre-post	Immediate	12 health facilities $n = 377$
Roy et al. (2005)	Bangladesh	Community Nutrition Promoters (locally-recruited graduate-level health assistants)	Mothers	Children 6–24 months	twice weekly for 3 months	Cluster randomized Pre-post	Immediate 6 month follow-up	15 community centres $n = 282$

engagement rather than mode of delivery. For each category, we described the techniques and how they were implemented.

It should be stated here that only two of 24 studies explicitly used theory to inform their choice of technique: Aboud, Shafique, and Akhter (2009) used social learning theory to select techniques such as a peer model, rehearsal, feedback on performance, and identification of child cues to elicit responsive feeding practice; while Luby et al. (2010) used the transtheoretical stages of change to draw all participants through the stages of awareness, preparation to adopt hand washing, and finally reward and support for acting and maintaining it. Consequently, it would be artificial for us to conduct an analysis of the relevant theories here. The implications for theory use are discussed later.

Informational techniques

All of the interventions provided some information about the health problem being tackled. The health problem was usually linked to causal environmental factors, such as mosquitoes, flies or food, and to the behaviour being addressed. In almost all cases, information about the health problem and its cause was given orally and directly to participants. Instructions on how to perform the behaviour were given orally in 14 out of 24 interventions. Participants were told how to treat or install nets, how to wash their hands, and how to prepare and feed children certain foods. Instructions usually focused on information about specific steps in the procedure that would lead to a desirable outcome, such as excluding all mosquitoes around the sleeping child. Information about others' approval to change the subjective norm was never provided; instead the interventions had community members and authority figures speak for themselves (social support).

Performance-based techniques

Performance included modelling or demonstrations, actual rehearsal or practice of the behaviour in the intervention setting, feedback on performance, contingent rewards, and identification of cues to action such as events requiring hand washing and signals of child hunger. Techniques that concerned intentions, goals, and self-monitoring were not used in these studies. The most common technique was to model or demonstrate the behaviour such as treating or arranging the nets, washing hands and faces, preparing complementary foods of the right consistency and diversity, and feeding children responsively rather than forcefully. Thirteen out of 24 interventions included modelling. However, only four helped participants identify cues that would elicit the behaviours, such as the time of day, preceding activities, or the child's signals. Only three had all participants rehearse the behaviour during the intervention session and receive either feedback or reward. Thus, few went beyond having a model enact the behaviour, to have participants enact the behaviour themselves, and receive feedback.

Problem solving

Problem solving included the identification of facilitators of the behaviour, internal or external barriers, and solutions to overcoming the barriers, performed with individuals or groups. Five of the 24 interventions addressed barriers and helped participants solve problems about enacting the behaviour in their home setting. Participants who said they did not have sufficient water for washing were shown how water could be re-used. Caregivers were helped to try different solutions to overcome children's refusal of food and to purchase inexpensive food. Common problems and solutions were discussed in group sessions; individual issues with enacting the practice were managed by counselling caregivers during home visits. Because a number of interventions combined group meetings with individual home visits, we might infer that the home visit was intended for problem solving. However, the

Table 2
Effectiveness and techniques of interventions.

Behaviour/study	Outcomes	Observed behaviour	Self-reported behaviour	Knowledge	Objective indicator of health	Techniques of behaviour change					
						Information	Performance	Problem solving	Social support	Materials	Media
Bed nets											
Alaii, Hawley et al. (2003); Alaii, Van den Borne, Kachur, Mwenesi et al. (2003); Alaii, Van den Borne, Kachur, Shelley et al. (2003)	Use of bed net Bed net knowledge	+		+		Information Instruction				Bed nets	Small media
Binka et al. (1996)	Use of bed net Mortality	+			+ +	Information Instruction	Model			Bed nets	
Habluetzel et al. (1997)	Use of bed net Mortality	ns			+ +	Information Instruction	Model			Bed nets	
Lindblade et al. (2004)	Use of bed net Mosquito densities Morbidity Mortality	+			+ + +	Information	Model			Bed nets	
Panter-Brick et al. (2006)	Repair of bed net holes	+				Information			Peers		Small media
Schellenberg et al. (1999)	Treating bed nets Purchase and use of bed nets	+ +				Information			Authority		Small & mass media
Hand washing											
Cairncross et al. (2005)	Hand washing Hand washing (voting) Knowledge	+ +	+ +			Information Instruction	Model Feedback on perform		Community Authority		Small media
Curtis et al. (2001)	Hand washing	+				Information	Cue to act		Community Authority	Soap	Small media Mass media
Luby et al. (2001)	Hand contamination	+				Information Instruction	Model Cue to act		Community Authority	Soap	
Luby et al.(2010)	Hand washing Hand contamination	+ +				Information Instruction	Model Cue to act Reward		Peers	Soap or sanitizer	Small media
Monte et al. (1997)	Hand washing Recall of messages	+		 +		Information Instruction	Cue to act	Barriers Facilitators Solutions			
Pinfold and Horan (1996)	Knowledge Fingertip contamination Self report diarrhoea	 +		+ 	 +	Information Instruction				Soap	Small media
Face washing											
Edwards et al. (2006)	Knowledge Active trachoma			+ 	 ns	Information					Mass media
Khandekar et al. (2006)	Knowledge Active trachoma			+ 	 +	Information			Authority	Ointment	Small media
Lansdown et al. (2005)	Clean face Knowledge Active trachoma	+		 +	 +	Information			Authority		
Lewallen et al. (2008)	Clean face Nasal discharge Knowledge Ocular discharge	+ +		 +	 ns	Information			Authority		
Lynch et al. (1994)	Clean face	+				Information Instruction	Model	Barriers solutions	Community Authority		Small media
West et al. (1995)	Clean face Active trachoma	+			 +	Information Instruction	Reward	Barriers solutions	Community Authority	Ointment	Small media
Compl. feeding											

Aboud et al. (2009)	Self-fed mouthfuls	+				Information	Model	Prob solve	Peer		Small media
	Maternal responsiveness	+					Cue to act				
	Responsive feeding position	+					Practice				
	Recall messages			+			Feedback				
	Weight for age				ns						
Bhandari et al. (2004)	Active feeding		+			Information	Model	Barriers	Community	Food	Small media
	Diet		+			Instruction		solutions			
	Length				+						
	Weight				ns						
Hotz and Gibson (2005)	Amount of food intake		+			Information	Model			Food	
	Diet (protein, energy)		+			Instruction					
	Food preparation		+								
Pachón et al. (2002)	Frequency of feeding		+			Information	Model			Food	
	Diet (good foods)		ns			Instruction	Practice				
	Amount of food				ns						
	Energy intake				ns						
Penny et al. (2005)	Feeding practices, e.g., thick purees first		ns			Information Instruction	Model		Authority		Small media
	Amount of food intake		+								
	Knowledge re foods to feed			+							
	Diet with animal protein				+						
	Height				+						
	Weight				+						
Roy et al. (2005)	Food preparation		+			Information	Model			Food	Small media
	Feeding		+			Instruction					
	Weight				+						

Notes. Effectiveness is recorded as '+' if intervention group benefited or as ns if no difference was reported.
Information includes information about the link between behaviour and health, causes and consequences, and instruction on how to perform the behaviour.
Practice includes someone modelling or demonstrating the practice, having participants engage in the practice, giving verbal feedback on the practice, giving a reward, identifying and providing cues for action.
Problem solving includes identification of facilitators, barriers and solutions to problems.
Social support includes support of authority figures, opinion leaders, community groups, and individual peers.
Materials include the provision of materials such as bed nets, soap, and food.
Media included small media such as interpersonal drama, song, and flash cards, as well as mass media such as radio.

technique of identifying barriers and solutions was coded only if described explicitly; this was rare.

Social support

Thirteen out of the 24 interventions used some kind of social support. Often whole communities were assembled to discuss the health problem and recommended behaviour. The program implementers sometimes worked through community organizations, such as women's groups, water management committees or schools. Peer support was present in three studies where peer educators delivered the message to groups, and caregivers were encouraged to help each other. Authority support for the recommended behaviour appeared in ten of the interventions, particularly the hand and face washing interventions. The idea was generally to elicit support from a broad band of the community, akin to community mobilization activities, so that advocacy for the behaviour might be ubiquitous. Support tended to lend normative weight to the message rather than simply informational or instrumental support.

Materials

Materials were offered by 14 interventions. Providing materials was intended to encourage people to attempt the health behaviour that would otherwise never be performed because it required purchasing a product. In these low-income countries, people were unlikely to pay money for an untried product. Bed nets were often provided to participants, but people were then required to have the nets re-treated at a later date. Likewise, soap was provided for hand washing in areas where people were not convinced that the benefit of hand soap was worth the money. An initial treatment of trachoma was required so that families would subsequently be able to see the benefits of face washing. Children were fed food whenever session leaders demonstrated to caregivers how to prepare a diverse diet. For example, a cooking class that produced a rice- or porridge-based meal or an animal-source food for young children generally resulted in children being fed the food. The added advantage was that caregivers could directly observe if their child accepted the new food. Providing materials was thus quite common and may be an incentive to participate in the intervention and an immediate sensory cue (a concrete object) to associate with the behaviour.

Media

Fifteen interventions used some form of media, usually interpersonal or small media. Songs, dramatic role plays, pictures, flash cards, and posters served many purposes, such as informational, emotional, entertainment, and companionship. In these cultures, small media brought people together so they could repeat the messages in different forms and with more personal/cultural meanings. Mass media in the form of radio broadcasts were used in only two interventions; they too were often entertaining dramas. Both forms of media broaden the reach of the message, though small media were more interpersonal and less controlled.

Effectiveness of interventions

As mentioned initially, the 24 interventions were chosen because they were generally successful and were evaluated using appropriate designs and measures. Consequently the results were not based on a random, representative sample of interventions. Across the 24 studies, 64 outcomes were measured. Twenty-two outcomes were observed behaviours, such as use of bed nets, hand washing, clean faces and hands, and child feeding practices. Out of the 22, 21 outcomes showed an advantage for the intervention over a baseline or comparison group. One showed no significant difference. Twelve outcomes were self-reports of behaviour, usually child feeding, and ten of these showed a benefit for the intervention participants. Ten outcomes included some measure of knowledge related to the messages or the behaviour, and ten were significantly positive as a result of the intervention. Finally, 20 outcomes were objective indicators of health, such as malaria, diarrhoea, trachoma, or stunting, and 14 of these showed a benefit for the intervention children. In total, 86% of the outcomes showed a significantly positive result. Among these successful interventions, 21 out of 24 used techniques from three or more categories, usually information, performance and media or materials. Eleven of these used four or more categories, usually adding social support. None used information only. In fact, the most common of these effective interventions used a combination of material (14 offered bed nets, soap, eye ointment, or food) with modelling and information. Behaviours changed more frequently than health outcomes.

Discussion

A number of techniques were identified in these studies that appear to be effective in promoting health behaviour change. Rather than adding nine new techniques to the Abraham and Michie (2008) list, we felt it more useful to organize the techniques into categories. Six categories made conceptual sense of the techniques commonly used in the 24 interventions, each engaging a specific psychosocial domain of learning, such as behavioural (motor), social, sensory, and cognitive. Although only two interventions were explicitly developed from theories, we later discuss tentative connections between the technique categories and current theories of behaviour change.

Techniques of behaviour change for child health and growth

Only nine of our identified techniques overlapped with the 26 listed by Abraham and Michie (2008), and nine were not on their list. Thus, techniques used to improve child health in developing countries may not be those commonly used for lifestyle changes such as weight loss and physical activity. Another difference was in the use of information: it was used here to communicate the sources of the health problem rather than the consequences, as well as to provide instructions on how to perform the behaviour. Information was rarely used to give information about other social-cognitive constructs such as norms. Performance techniques were common in both the lifestyle change research and our set. Sixteen out of 24 interventions included at least one performance technique. So, even when instructional information was provided on how to wash or feed a child, a field worker or peer also demonstrated the practice. Thus, we conclude that interventions may have been successful because they used several technique categories to communicate the new practice, thereby engaging multiple domains that might help consolidate the learning experience and maintain the practice.

The main difference with the Abraham and Michie (2008) list was in the way interventions here incorporated barriers, social support and materials. Barriers were discussed along with facilitators and problem solving in the context of group sessions and home visits. Likewise, social support was expanded. Authority support, coming from religious and community leaders or people from the village who were seen as experts, may have indicated to participants that the behaviour was normative, both in the prescriptive sense that people should adopt it and in the descriptive sense that it had already been adopted by influential people. Peer support may have been a bi-product of meeting in group sessions or having a peer educator, but this was more than a mode of

delivery; as with the other forms of social support, peers provided normative and emotional support.

Materials were frequently provided to participants in the reviewed interventions. Materials were useful in many respects. First, they provided an incentive to engage with the intervention; second, they provided a concrete cue that elicited the behaviour and was probably the same cue that would appear in the participants' homes. Materials also provided a standard to aim for, such as specifically what kind of net or soap or food was required. Some participants may have thought that expensive food or clean washing water were required when this was not the case.

Media was given its own technique category because it was more than a mode of delivery. Small media, such as picture cards given to caregivers, posters placed on latrines and hand washing stations, and drama and song at community meetings provided social and sensory input about the practice. Some small media may simply have provided information about the behaviour-health link, but most went beyond this to provide cues to action (picture cards, posters on hand washing stations), instruction (drama, posters), socio-emotional support (songs), and prescriptive norm influences (counselling cards). Likewise, techniques used in mass media included not only information and instruction, but also the emotional and normative support found in entertainment-education dramas (Finnegan & Viswanath, 2008; Wakefield, Loken, & Hornik, 2010).

Effectiveness of techniques

By intention, the included interventions had at least one positive behavioural or objective outcome, so the variation in effectiveness was too small to permit meaningful correlations with techniques. Our conclusions are therefore more about the combinations of techniques. All went beyond the provision of information, and almost half included four or more technique categories. The most common were performance, social support, small media, and materials. For example, successful hand washing interventions tended to provide three or four communication inputs, such as instruction, modelling, social support and soap (Cairncross, Shordt, Zacharia, &Govindan, 2005; Curtis et al., 2001; Luby et al., 2001, 2010; Monte et al., 1997). Complementary feeding interventions that targeted food preparation with diverse foods tended to hold cooking demonstrations while providing instruction and food (Hotz & Gibson, 2005; Pachón et al., 2002; Penny et al., 2005; Roy et al., 2005). The use of multiple techniques may have been intended to impact several psychosocial domains (or processes), especially behavioural, social, sensory and cognitive. The value in engaging multiple domains is the association of the message with different processes, and thus the increased likelihood of learning, recalling and sustaining the practice. Evidence for better learning and recall came from studies where intervention participants received the message through four or more domains compared to the control group who received information alone (e.g., Aboud et al., 2009). Thus, the best formula for behaviour change in this context appears to be the use of multi-domain input for active learning and sustained recall.

Techniques and theories of behaviour change

The techniques identified in these interventions were rarely linked to theories of behaviour change. This is a common complaint of those conducting reviews of behaviour change (e.g., Glanz & Bishop, 2010; Painter et al., 2008). The techniques recommended by theories of communication, learning, and social action were used to inform programs, but not in a systematic way. Information techniques implicitly relied on the individual social-cognitive constructs of the Health Belief model regarding the severity of the health problem and benefits of the new practice (Champion & Skinner, 2008), as well as Diffusion of Innovation's construct of procedural knowledge (Oldenburg & Glanz, 2008). Performance techniques implicitly used mechanisms from Social Learning theory to provide cues to action, models, practice, and feedback/reward (Bandura, 1986). Problem solving techniques focused on the barriers and facilitators from the Health Belief model (Champion & Skinner, 2008) and on problem solving to raise self-efficacy, which comes from Social-Cognitive learning theory (Bandura, 1986); group problem solving is less commonly a part of behaviour change theories (but see D'Zurilla & Goldfried, 1971). Social support was directly addressed in theories of social support (Heaney & Israel, 2008) and also Diffusion of Innovations (Oldenburg & Glanz, 2008), which asserts the value of opinion leaders and other early adopters. Finally, both media and materials are important techniques proposed by Social Marketing theories (Storey, Saffitz, & Rimon, 2008).

When theories are mentioned in this kind of research, they are often not the current ones. For example, communication theory in its relatively unsophisticated form, which includes the sender, medium, and audience (McGuire, 1984), is often used rather than the "two routes to persuasion" theory of Petty and Cacioppo (1986). The latter identifies two different ways to construct messages and designate senders, depending on the audience's ability and willingness to process the message. The peripheral route is probably more suited to developing country research but is rarely cited. Entertainment-education is a technique used by small and mass media to combine both routes to persuasion, namely central and peripheral routes (Slater & Rouner, 2002).

Likewise, an older version of the Theory of Planned Behaviour is often cited rather than the updated one (e.g., Fishbein & Yzer, 2003). Many intra-individual theories identify cognitive constructs to be changed rather than techniques of change. Changing only the cognitive construct rather than its social or real-life referent may limit sustainability. For example, actual rather than subjective norms are considered important to change in developing countries, and are the reason why many interventions include the whole community. Consequently, programs should be informed by Cialdini's theory on how new norms are made sufficiently salient to change behaviour (Cialdini, Kallgren, & Reno, 1991; Kallgren, Reno, &Cialdini, 2000). Interventions should also be informed by social action research and theories that aim to change norms from the top–down or bottom–up of a community (e.g., Aboud, Huq, Larson, & Ottisova, 2010; Minkler, Wallerstein, & Wilson, 2008). Social support techniques, often used in peer education programs, should likewise cite current reviews of the theory (e.g., Heaney & Israel, 2008) and identify the specific functions of support utilized. For example, supports such as counsellors or home visitors are often used to help people identify and overcome barriers and to provide emotional support.

Programs would benefit if they were constructed from theories that have well-defined mechanisms of change. However, to be realistic, we acknowledge that program people are usually working from a logic model that defines their outcomes and proposed activities. Theories of change are usually missing from this logic model. Theories of change could help identify activities most likely to yield desired outcomes. If behaviour change is required at the individual level, say with caregivers in households, then appropriate techniques from all six categories should be considered in light of the audience and the gap between current and desired outcomes. Community-level change theories and their proposed techniques (see social action and community-readiness approaches e.g., Minkler et al., 2008) may be necessary to enable and sustain behaviour change among caregivers. Refinement of the techniques might be undertaken by scrutinizing more than one relevant theory.

evidence regarding the technique's effectiveness, and findings from formative research on one's own targeted audience. Research would benefit from constructing a control or comparison group-based on a different set of techniques. For example, control groups often receive standard care, which may consist of simply being provided information or instruction in the form of counselling or brochures. Thus, one set of techniques derived from, for example, social learning or diffusion of innovations could be compared with techniques derived from the basic information approach common to adult education.

Limitations

Only 24 interventions were analyzed in this review; therefore, it is possible that there are more techniques being used in developing countries that have not been discussed here. Because descriptions of the programs as written in the reports were short on detail, it is also possible that we missed some techniques. Techniques that were used in the control or comparison groups were neglected in many reports, making it impossible to directly compare the techniques offered in the intervention versus the comparison group. Furthermore, because of the overall high quality and effectiveness of the programs selected, it was difficult to analyze systematically which techniques may have been more effective than others. This analysis will be possible in the future, when programs describe their techniques more systematically and in greater detail.

Conclusion

After reviewing 24 programs aimed at improving child morbidity and mortality rates in developing countries, we noted a number of techniques of behaviour change that should be considered when designing interventions. These "best practice" programs used techniques from three or four categories to engage participants at the behavioural level (performance techniques), the social level (social support, interpersonal media), sensory level (materials, media), and cognitive level (problem solving, information). The systematic use of multiple techniques may consolidate learning and recall in contexts where the behaviour is to be performed. We echo Davidson et al. (2003) who recommended the inclusion of details on intervention implementation; descriptions of the techniques of the comparison group should also be well described. Future reviews can then organize the techniques into functionally or theoretically similar categories. This will facilitate future analyses and reviews of techniques, and the continued development of effective programs.

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