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How to promote healthy behaviours in patients? An overview of evidence for behaviour change techniques

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SUMMARY

To identify the evidence for the effectiveness of behaviour change techniques, when used by health-care professionals, in accomplishing health-promoting behaviours in patients. Reviews were used to extract data at a study level. A taxonomy was used to classify behaviour change techniques. We included 23 systematic reviews: 14 on smoking cessation, 6 on physical exercise, and 2 on healthy diets and 1 on both exercise and diets. None of the behaviour change techniques demonstrated clear effects in a convincing majority of the studies in which they were evaluated. Techniques targeting knowledge (n = 210 studies) and facilitation of behaviour (n = 172) were

evaluated most frequently. However, self-monitoring of behaviour (positive effects in 56% of the studies), risk communication (52%) and use of social support (50%) were most often identified as effective. Insufficient insight into appropriateness of technique choice and quality of technique delivery hinder precise conclusions. Relatively, however, self-monitoring of behaviour, risk communication and use of social support are most effective. Health professionals should avoid thinking that providing knowledge, materials and professional support will be sufficient for patients to accomplish change and consider alternative strategies which may be more effective.

Key words: health behaviour; health promotion; patient care; review

INTRODUCTION

Healthy behaviours may reduce or prevent morbidity and mortality (Lin *et al.*, 2004). A healthy diet for instance, helps to prevent many diseases such as diabetes, coronary heart disease and cancer (van Kreijl *et al.*, 2004). Physical activity prevents diseases such as cardiovascular disease and diabetes (Koek *et al.*, 2003) and results in improved cardiovascular health, lowered blood pressure, reduced risk of mortality, increased muscle strength, decreased depression and anxiety and improved quality of life (Bouchard *et al.*, 1994). Smoking is the most important single risk factor for mortality and has been

related to 12% of the burden of disease in Western Europe (Feenstra *et al.*, 2006).

All of the above illustrate how behaviours are relevant to health. Yet unhealthy habits are highly prevalent. Studies from the Netherlands for instance demonstrated how the prevalence of obesity in adults doubled over the last 25 years (Feenstra *et al.*, 2006), while European as well as American studies demonstrated high prevalence of inactivity and smoking (www.euro.who.int/HEN/Syntheses/tobcontrol) (Lindstrom *et al.*, 2003; Ramsey *et al.*, 2008).

Health-care providers often feel competent in treating or caring for the condition that brought

the patient to the health-care system, but may be less confident in dealing with the promotion of healthy behaviours. Giving a single advice can render effects, but more than a single advice will often be needed (Stead *et al.*, 2008).

Theories applicable to health education and promotion problems offer various keys to behaviour change through concepts such as knowledge, awareness, intention, self-efficacy, social influence and many others (Glanz *et al.*, 2002). In relation to this, numerous theory-based approaches to behaviour change are suggested by or derived from theories, such as education (Abraham and Sheeran, 2005; Ajzen, 1988; Fishbein and Ajzen, 2010), risk communication (Abraham and Sheeran, 2005; Norman *et al.*, 2005), modelling (Bandura, 1986), goal setting (Latham and Locke, 2007), guided practice (Bandura, 1986), etc.

Effects of behaviour change programmes may vary with the concepts addressed and techniques employed. Thus for both research and practice, insight into techniques used in interventions that facilitate behaviour change in patient populations is essential. This insight can support health-care providers who struggle in coaching patients and could make a large contribution to better health outcomes and more cost-effective care.

Many systematic reviews have already offered overviews of the evidence in this area (Burke *et al.*, 1997; Ketola *et al.*, 2000; Avenell *et al.*, 2004; Fang *et al.*, 2004; Bradshaw *et al.*, 2005; Suhonen *et al.*, 2008). However, these reviews differ in scope, purpose, target populations and methods. All reviews clarify fragments of the body of evidence rather than the complete picture on general principles for behaviour change. Also, previously performed reviews often addressed healthy populations (Foster *et al.*, 2005; Ogilvie *et al.*, 2007) rather than patients. Findings from these reviews might not be valid for patient populations where health problems, disease related distress or the need to make decisions about medical care can interfere with the perceived need for behaviour change (Glanz *et al.*, 2002).

Furthermore, the scope of systematic reviews in this area was mostly narrowed down to single behaviours such as physical activity, (Ashworth *et al.*, 2005; Foster *et al.*, 2005) smoking (Rigotti *et al.*, 2002; Rice and Stead, 2004; Lancaster and Stead, 2005; Møller and Villebro, 2005) or diets (Summerbell *et al.*, 2003, 2005). While valuable

for health-care workers with a specific focus on one of these behaviours, these reviews do not provide the overall evidence across multiple areas of behaviour change. An overview of this evidence is much needed for the many health-care workers with a general focus such as general practitioners, hospital nurses, occupational health workers or community nurses. Also, this evidence is needed to provide proper training for health professionals across various health-care settings.

Finally, reviews on the promotion of healthy behaviours often lacked a clear focus on theory-based components of the interventions evaluated. These reviews for instance conclude that 'nurse-delivered interventions for smoking cessation can be effective' (Rice and Stead, 2004, 2008) or that 'physical activity interventions have a moderate effect on self-reported physical activity' (Foster *et al.*, 2005), without offering conceptual clarity on the nature of interventions and thus providing little guidance for health-care providers who are willing to face the challenges they meet. To arrive at clarity on the content of behaviour change programmes, the taxonomy of behavioural change techniques (Abraham and Michie, 2008, de Bruijn *et al.*, 2009) was developed. This taxonomy provides nine main categories for techniques addressing knowledge, awareness, social influence, attitude, self-efficacy, intention, action control, maintenance and facilitation. Together, the nine categories include a total of 37 behaviour change techniques. Whereas using the classification can help to relate intervention content to evidence on effectiveness, it is still relatively new and was not previously used in this area of research.

Given the large numbers of systematic reviews, the scattered evidence, uncertainty about how the evidence from general populations applies to patients and insufficient clarity on evidence for alternative techniques, we decided to create a comprehensive and systematic overview of the evidence in the area of promoting healthy behaviour in patients.

Objective

Our objective was to identify the evidence for the effectiveness of behaviour change techniques, when used by health-care professionals, in accomplishing health-promoting behaviours in patients as described in systematic reviews.

We defined ‘patients’ as all who were diagnosed with physical or mental health problems and/or who were recruited through contacts with health professionals. To be able to compare interventions and the use of techniques within these interventions across different health behaviours, *smoking*, *poor diet* and *lack of exercise* were the selected topics of interest. These were chosen as these behaviours are relevant to many patient groups and as interventions addressing these topics are often reported in the literature.

METHODS

As various systematic reviews on our health behaviour topics were already available, we set out to identify these. At an early stage however, we realized we could not analyse at the level of systematic reviews. The reason for this was that behaviour change techniques and their effectiveness were not analysed by the reviewers. Instead, the reviews focused on the evidence for interventions regardless of intervention content, but with a view to specific patient groups (e.g. all behaviour change interventions targeting patients with cardiovascular disorders) or a specific way of intervention delivery (such as ‘all behaviour change interventions delivered by physicians’).

As many reviews were sufficiently systematic and provided detailed descriptions of studies included however, we used the reviews—and especially tables and appendices on studies included in the reviews—to gain data at the level of studies. The search strategies, the selection process and the process of quality assessment therefore focused on systematic reviews, whereas the data extraction focused on individual studies within these reviews.

Search strategies

Systematic reviews were retrieved by systematically searching Pubmed, CINAHL, PsycInfo and the *Cochrane Database of Systematic Reviews*. Search strategies for each topic (smoking, diet, exercise) and each database included both relevant index terms and free text words. Search strategies were the result of deliberations within the team of authors, performing pilot searches and adjusting the strategies after consulting experts with the topics as well as

librarians. Searches were pretested prior to performing the final search. Supplementary Appendix S1 (A–C) presents the search strategies for each topic. The searches were last performed on 1 October 2008.

Procedure

Each title and abstract retrieved was independently reviewed by two members of the research group (G.H.-d.W., N.K. and/or T.v.A.). Differences in the selection by the two reviewers were resolved through discussion, or consultation of a third reviewer in case of doubt. Full text papers were subsequently reviewed using the same procedure.

Quality assessment and data extraction again were performed by two reviewers. All authors participated in this process. As with the selection of publications, quality assessment and data extraction were compared for the two reviewers and disagreements were resolved through discussion or consultation of a third reviewer.

Selection criteria

Publications were included if they satisfied the following conditions.

- Reporting on a systematic review of the literature: for the initial selection based on abstracts, mention of a review of the literature was sufficient as not to miss any potentially relevant publications; for selection based on full text we used the criteria developed by Oxman *et al.* (Oxman, 1994; see data extraction for description) to assess whether a review was truly a systematic review. Reviews with very low scores (scores 1 and 2) on the Oxman instrument were excluded.
- Published in 1990 or more recently.
- Focussing on patient populations (majority of the studies included in the review), we defined ‘patients’ as all who were diagnosed with physical or mental diseases and/or who were recruited through contacts with health-care providers.
- Focussing on adults (≥ 18 years of age).
- Selection of RCTs within the reviews ($> 50\%$ of the studies).
- Focussing on smoking, exercise or diet.

- Addressing health-care workers attempting to promote healthy behaviours.
- Disclosure of interventions for promoting healthy behaviours for studies included in the reviews, we aimed at the inclusion of reviews which offered sufficient clarity on intervention content by offering a description of what was targeted (e.g. knowledge, attitude, social support, facilities, etc.) and how (for instance through education, feedback, peer influence, financial rewards, etc.); reviews providing only vague descriptions of interventions (such as ‘a health promotion programme in six 30 min sessions’) did not meet this criterion.
- Reporting on studies with behavioural outcome assessments (such as smoking behaviour, physical exercise or food intake) at any length of follow-up.

Quality assessment

The quality of the systematic reviews was assessed using the quality assessment tool developed by Oxman (Oxman, 1994). This tool consists of nine items on the methods used by the reviewers and addresses issues such as the comprehensiveness of the search, prevention of bias in the selection of studies and the methods used to combine findings of individual studies (see Table 2). Each of the items can be graded using ‘A’ for fulfilling the criterion stated in the item, ‘B’ for partially fulfilling the criterion and ‘C’ for a lack of quality. After assessing each of the items, a 1–7 score is given for the overall quality of the systematic review. We excluded reviews of very low quality (scores 1 and 2 out of 7) and included all reviews of moderate to high quality (3 and higher).

Data extraction

The general content of the reviews was extracted using a pre-structured form on characteristics of the review such as target groups, setting, numbers and types of studies included, and health-care providers involved in interventions (see Table 1).

The taxonomy of behavioural change techniques (Abraham and Michie, 2008) was used to classify techniques for behaviour change as reported in the reviews (see Supplementary

Appendix S2 for a selection of the most relevant techniques with this overview).

In extracting data from studies within the reviews, we looked at studies in patients only and excluded all studies on healthy subjects a review might contain.

Two reviewers independently extracted the statistical significance of (positive) effects on behavioural outcomes at any length of follow-up for all of the studies reported on within the reviews. In the same manner, we derived information on the content of interventions from the study descriptions and classified all intervention elements using the taxonomy described above. Original studies that were included in more than one review were used only once and descriptions of intervention content for these studies were compared across the reviews to classify the most comprehensive description of behaviour change techniques.

Analysis

As studies within the reviews were very heterogeneous in relation to target groups, ways of delivering behaviour change techniques, duration of interventions and length of follow-up, we decided against meta-analyses. Some of the reviews did contain meta-analyses, however these were not useful for our purpose as they did not focus on techniques within the interventions.

Instead, we performed a descriptive analysis to report the frequency of use of behaviour change techniques. After classifying techniques used in the studies, we combined this with the information on effectiveness to arrive at information on the effectiveness of techniques. We analysed the effectiveness at both: (i) the level of the main categories within the classification (e.g. knowledge-directed techniques, techniques targeting awareness, etc.) and (ii) the level of specific techniques.

The effectiveness of (categories of) techniques was clarified by comparing the number of studies with demonstrated effectiveness to the total number of studies testing these techniques. As we had to consider subgroups for the three health behaviours and as a minimum number of studies was needed for reporting meaningful results, we only report on behaviour change techniques used in more than eight different studies.

Table 1: Characteristics of the reviews on the promotion of smoking cessation, exercise and healthy diets

Review	Health behaviour	Population and setting	Setting	Interventions delivered by	Measurement of outcomes	Longest follow-up	Number of studies and designs ^a
Barth <i>et al.</i> , 2008	Smoking	Patients with coronary heart disease	Hospital	Physician, nurse, psychologist	Self-report; Biomarkers	12 months	$n = 16$; RCT = 16
Blenkinsopp <i>et al.</i> , 2003	Smoking	Patients with risk factors for coronary heart disease	Community	Pharmacist	Self-report; cotinine	12 months	$n = 4$; RCT = 2; CBA = 2
Lancaster and Stead, 2005	Smoking	Any patients	Any care setting	Cessation counsellors	Self-report; biomarkers	12 months	$n = 21$; RCT = 10; CCT = 11
Lumley <i>et al.</i> , 2004	Smoking	Pregnant women; any care setting	Any care setting	Physician, midwife, health educator, psychologist, nurse, others	Self-report; cotinine; CO exhaled	6 months	$n = 63$; RCT = 51; CCT = 9
Naughton, 2008	Smoking	Pregnant women	Outpatient, community	Does not apply: review on self-help materials	Biomarkers for smoking status	9 months	$n = 15$; RCT = 15
Revere and Dunbar, 2001	Smoking	Any patients	Outpatient setting	Not specified	Self-report	12 months	$n = 6$; RCT = 5; CCT = 1
Rice and Stead, 2006	Smoking	Patients with cardiovascular or respiratory disease or other health problems; community volunteers	Hospital, outpatient	Physician, nurse	Self-report; cotinine; CO exhaled	12 months	$n = 35$; RCT = 35
Rice and Stead, 2008	Smoking	Patients with cardiac disease or diabetes; healthy adults	Hospital, outpatient	Physician, health educator, nurse, nurse practitioner	Self-report; cotinine; CO exhaled	12 months	$n = 42$; RCT = 42
Rigotti <i>et al.</i> , 2007	Smoking	Patients with COPD, cardiovascular disease and other health problems	Hospital	Physician, nurse, psychologist, counselor, research staff, respiratory therapist	Self-report; cotinine; CO exhaled	12 months	$n = 33$; RCT = 29; CCT = 4
Sinclair <i>et al.</i> , 2004	Smoking	Any patients	Community	Pharmacist	Self-report; cotinine	12 months	$n = 2$; RCT = 2
Stead <i>et al.</i> , 2008	Smoking	Any patients	Hospital, outpatient, community	Physician	Self-report; biochemical validation	12 months	$n = 41$; RCT = 41
Van der Meer <i>et al.</i> , 2001	Smoking	Patients with COPD	Hospital, Outpatient	Physician, health educator, nurse, technician	Cotinine; CO exhaled; COHb	12 months	$n = 5$; RCT = 3; CCT = 2
Windsor <i>et al.</i> , 1998	Smoking	Pregnant women; any care setting	Any care setting	Physician, midwife, health educator, psychologist, nurse practitioner	Self-report; cotinine; CO exhaled	6 months	$n = 23$; RCT = 18; CCT = 5
Zaki <i>et al.</i> , 2008	Smoking	Patients scheduled for surgery	Outpatient	Nurses, research staff	Self-report; biomarkers	12 months	$n = 4$; RCT = 4

Eakin <i>et al.</i> , 2000	Exercise	Sedentary adults	Primary care	Physician, nurse, public health students	Self-report	12 months	$n = 15$; RCT = 9; CCT = 6
Eden <i>et al.</i> , 2002	Exercise	Sedentary adults	General practice	Physicians, teams of professionals	Self-report	6 months	$n = 8$; RCT = 7; CCT = 1
Hudon <i>et al.</i> , 2008	Exercise	Patients with chronic diseases	General practice community	Physician, nurse, nurse practitioner	Self-report	12 months	$n = 3$; RCT = 1; Cluster RCT = 2
Lawlor <i>et al.</i> , 2001	Exercise	All patients	Primary care	Primary care givers (not specified)	Exercise duration; Self-report	10 months	$n = 8$; RCT = 2; CCT = 6
Levack <i>et al.</i> , 2006	Exercise	Patients with muscular-skeletal or nervous system or mental health conditions	Any care setting	Various professionals (not specified)	CO ₂ max; functional status	12 months	$n = 19$; RCT = 19
Pinto <i>et al.</i> , 2000	Exercise	All patients	Hospital	Physician, nurse, experts, research staff	Self-report; maximum O ₂ uptake; walk test	6 months	$n = 15$; RCT = 15
Nield <i>et al.</i> , 2008	Diet	Patients with diabetes mellitus	Any care setting	Physician, nurse, dietician, nutritionist, counsellor, community diabetes advisor	Weight or BMI; blood pressure	48 months	$n = 18$; RCT = 18
Thompson <i>et al.</i> , 2003	Diet	Patients with high cholesterol, high lipids, high fasting glucose, risk factors for diabetes, obesity, previous heart disease	Any care setting	Physician, nurse, dietician, counsellor	Blood cholesterol; weight or BMI; LDL, HDL	12 months	$n = 12$; RCT = 12
Wilcox <i>et al.</i> , 2001	Diet and exercise	Patients at risk for cardiovascular disease	Any care setting	Physician, nurse, dietician, counsellor	Self-report for diet and exercise; weight/BMI; blood pressure; blood cholesterol	60 months	Diet, $n = 14$; RCT = 12, QE = 2; diet and exercise, $n = 12$; RCT = 8, QE = 4; exercise, $n = 17$; RCT = 14, QE = 3

^a n = total number of studies; RCT, randomised clinical trial; CCT, controlled (non-randomised) clinical trial; QE, quasi experiment.

Table 2: Quality assessment for the 23 systematic reviews included in this review of reviews

Review author, year	Health behavior	Search methods stated	Search comprehensive	Inclusion/exclusion criteria	Bias in selection studies avoided	Criteria for validity assessment reported	Valid criteria used in selection and analyses	Methods combining findings reported	Findings related to primary question	Conclusion supported by data and analysis	Quality rate ^a
Barth <i>et al.</i> , 2008	Smoking	A	B	A	A	C	B	A	A	A	6
Blenkinsopp <i>et al.</i> , 2003	Smoking	A	A	B	B	B	B	C	B	A	5
Lancaster and Stead, 2005	Smoking	B	A	A	B	B	A	A	A	A	6
Lumley <i>et al.</i> , 2004	Smoking	A	A	A	B	A	A	A	A	A	7
Naughton <i>et al.</i> , 2008	Smoking	A	B	A	A	A	A	A	A	A	6
Revere and Dunbar 2001	Smoking	A	A	A	B	A	C	B	A	A	6
Rice, 1999	Smoking	B	A	A	B	B	B	A	A	A	6
Rice and Stead, 2006	Smoking	A	A	A	B	B	B	A	A	A	6
Rice and Stead, 2008	Smoking	A	A	A	B	A	A	A	A	A	7
Rigotti <i>et al.</i> , 2007	Smoking	A	A	A	A	B	C	A	A	A	6
Sinclair <i>et al.</i> , 2004	Smoking	A	A	A	B	A	B	B	B	A	6
Stead <i>et al.</i> , 2008	Smoking	A	A	A	A	A	A	A	A	A	7
Van de Meer <i>et al.</i> , 2001	Smoking	A	A	A	A	A	A	C	A	A	6
Windsor <i>et al.</i> , 1998	Smoking	B	B	A	B	A	A	C	C	A	5
Zaki <i>et al.</i> , 2008	Smoking	A	B	A	A	A	B	A	A	A	6
Eakin <i>et al.</i> , 2000	Exercise	B	A	A	B	A	A	C	A	A	6
Eden <i>et al.</i> , 2002	Exercise	A	A	A	B	A	A	C	A	A	6
Lawlor <i>et al.</i> , 2001	Exercise	A	A	A	B	A	A	A	C	B	6
Levack <i>et al.</i> , 2006	Exercise	B	A	A	A	A	A	A	A	A	7

Hudon <i>et al.</i> , 2008	Exercise	A	B	A	B	A	A	B	A	A	6
Pinto <i>et al.</i> , 2000	Exercise	B	B	B	C	C	C	C	B	A	3
Nield <i>et al.</i> , 2006	Diet	A	A	A	A	C	C	A	A	A	6
Thompson <i>et al.</i> , 2003	Diet	A	B	A	B	C	C	A	A	A	5
Wilcox <i>et al.</i> , 2001	Diet	A	B	A	B	C	C	A	A	A	5
		18 × A	16 × A	22 × A	8 × A	14 × A	12 × A	15 × A	19 × A	23 × A	
		6 × B	8 × B	2 × B	15 × B	5 × B	6 × B	3 × B	3 × B		
					1 × C	5 × C	6 × C	6 × C	2 × C	1 × B	

With all scores: A, Yes; B, partially (cannot tell) C, No.

^aAfter each item is assessed using a three-point scale (i.e. no, partially/cannot tell or yes). A final question elicits an overall scientific quality of the systematic review based on the previous items on a scale of 1–7, with 7 indicating superior quality and a score of ≥ 5 indicating that the study has only minimal or minor flaws (Oxman & Guyatt, 1991; Oxman, 1994). To standardize this between raters, we gave 2 points for every A and 1 point for every B, thus adding up to a total score between 0 and 18. We transformed this to the proposed 1–7 score in the following manner: $0-1 = 1/2-4 = 2/5-7 = 3/8-10 = 4/11-13 = 5/14-16 = 6/17-18 = 7$.

We explored the possibility of subgroup analyses for length of follow-up (up to 6 months versus >6 months). As follow-up periods of >6 months were relatively rare however, this was not feasible. We also attempted to distinguish between studies using a single behaviour change technique and studies using a combination of two or more techniques. However, as study interventions hardly ever used a single technique, we can only report on the evidence for techniques when used in combination with other techniques.

RESULTS

The search techniques (Supplementary Appendix S1) resulted in 3764 hits. Based on title and abstract, 277 manuscripts were selected (141, 96 and 40, for smoking, exercise and diet, respectively; see Supplementary Appendix S3). A relatively small group of 35 were duplicates, resulting in 242 unique publications.

Nine publications could not be retrieved. Approximately 10% of all the publications of which the full text was retrieved were finally selected. The—sometimes multiple or overlapping—reasons for exclusion were that publications were not focusing on patients (31% of all papers), offering insufficient clarity on the content of interventions (31%), describing interventions for other purposes than health behaviour change (27%), not reporting on behavioural outcomes (27%), reviews that were not systematically performed (20%) and inclusion of low-quality designs in the reviews (20%).

Finally, the selection based on full text resulted in a total number of 23 systematic reviews: 14 on smoking cessation (Windsor *et al.*, 1998; Revere and Dunbar, 2001; van der Meer *et al.*, 2001; Blenkinsopp *et al.*, 2003; Lumley *et al.*, 2004; Sinclair *et al.*, 2004; Lancaster and Stead, 2005; Rice and Stead, 2006; Rigotti *et al.*, 2007; Barth *et al.*, 2008; Naughton *et al.*, 2008; Rice and Stead, 2008; Stead *et al.*, 2008; Zaki *et al.*, 2008) 6 on exercise promotion (Eakin *et al.*, 2000; Pinto *et al.*, 2000; Lawlor and Hanratty, 2001; Eden *et al.*, 2002; Levack *et al.*, 2006; Hudon *et al.*, 2008), 2 on healthy diets (Thompson *et al.*, 2003; Nield *et al.*, 2008) and 1 on both exercise and diets (Wilcox *et al.*, 2001; Thompson *et al.*, 2003; Nield *et al.*, 2008).

General characteristics of reviews and studies

Basic characteristics of the 23 reviews are summarized in Table 1. Most of the reviews ($n = 14$) reported on patients with specific somatic diseases or health risks, whereas mental health issues were targeted in one review only. The remaining reviews addressed pregnant women ($n = 3$) or 'any type of patient' ($n = 5$). A third of the reviews ($n = 8$) included all care settings, while another third ($n = 9$) focused on primary care or outpatient settings and the remaining of the reviews ($n = 7$) focused on a combination of outpatient and hospital care or hospital care exclusively.

Physicians (16 reviews) and nurses (14 reviews) most often delivered interventions. In 18 of the 23 reviews, patients' self-reports were used in the assessment of outcomes. Often (15 reviews), self-reports were combined with clinical tests such as cotinine tests for smoking or walking tests for exercise. In the reviews on the promotion of healthy diets, weight was always a key outcome. Follow-up for study outcomes varied considerably from 1 week up to 60 months.

Taken together, the reviews included 210 studies with intervention elements focusing on patients' knowledge, 68 studies on awareness, 13 on social influence, 48 on attitudes, 40 on self-efficacy, 50 on intentions, 9 on action control, 26 on maintenance, 173 on facilitating behaviour and 143 studies where one or more intervention elements were unclear; 88% of the studies included in the reviews were RCTs.

Quality of the reviews included in this overview

Scores for the quality of reviews were moderate to high (mean 5.9), with most of the reviews rated at 5, 6 or 7 on the 1–7 quality scale (Table 2).

With five of the nine criteria, the highest score 'A' was assigned to over two-thirds of the reviews. Relatively lower scores were given for the prevention of bias in the selection of studies and for assessing study validity and using this in the combination of findings.

Use of techniques

Following the taxonomy of behaviour change techniques (Supplementary Appendix S2),

Table 3: Effectiveness of techniques targeting specific determinants of behavior change^a

Techniques addressing	All studies within the reviews [% studies with sign pos effects (n)]			
	Smoking	Exercise	Diet	All health behaviors
Knowledge	26 (156)	60 (28)	73 (26)	36 (210)
Awareness	39 (46)	63 (8)	79 (14)	50 (68)
Social influence	33 (9)	100 (1)	67 (3)	53 (13)
Attitude	30 (46)	50 (2)	— (0)	31 (48)
Self-efficacy	32 (37)	100 (2)	1 (1)	38 (40)
Intention	26 (46)	43 (7)	75 (4)	38 (50)
Action control	63 (8)	— (0)	100 (1)	67 (9)
Maintenance	9 (23)	100 (1)	100 (2)	19 (26)
Facilitation of behavior	24 (138)	62 (26)	58 (19)	35 (173)
Technique unclear for one or more elements of study interventions	101 studies	17 studies	25 studies	143 studies
Common combinations of techniques addressing				
Knowledge × awareness	25 (24)	75 (4)	60 (15)	42 (43)
Knowledge × facilitation	33 (94)	40 (10)	70 (10)	37 (114)
Knowledge × awareness × facilitation	34 (12)	—	50 (4)	63 (16)
Intention × facilitation	42 (12)	—	60 (5)	47 (17)

^aStudies where the statistical significance of results was not clear from the reports were not included in this table.

techniques were first ordered along the conceptual equivalents of the determinants they addressed (Table 3). *Knowledge* techniques were typically operationalized as the transfer of information using brochures, videos or giving advice in individual consultations or groups. *Facilitation of behaviour* could include the use of supportive materials, services or continued professional support such as telephone consultations on demand. The use of *facilitation of behaviour* was especially frequent in studies on promoting exercise levels ($n = 26$), where offering exercise classes was a common operationalization.

Social influence ($n = 13$) and *action control* ($n = 9$) techniques were little used. The use of other types of techniques somewhat varied across the three health behaviours, with some techniques almost only evaluated in studies on smoking cessation.

We included reviews which described studies and their intervention content in sufficient detail; however with all of the health behaviours, a significant number of studies still contained one or more intervention elements which could not be classified in the taxonomy ($n = 143$ studies in total). Lack of clarity existed where only communication formats ('a video', 'a discussion', 'a meeting', etc.) or very general descriptions (e.g. 'a smoking cessation programme') were mentioned, and no explanations of what went on in meetings, programmes, etc. were given.

Evidence for behaviour change techniques

Core findings for the effectiveness of behaviour change techniques are summarized in Tables 3 and 4.

A first finding is that none of the groups of techniques seem to consistently demonstrate statistically significant positive effects (Table 3) as the percentages of studies with significantly positive effects were moderate to low where many studies were performed (e.g. 36% of no less than 205 studies found positive effects of knowledge strategies) whereas high success percentages were mostly found with techniques, which were not very often studied (e.g. 67% of only nine studies on action control techniques reported behaviour change effects).

With this in mind, the most successful techniques were *action control* techniques (positive effects in 67% of all studies), *social influence* techniques (58%) and techniques targeting *awareness* (50%).

Results for the three health behaviours differed for various techniques, but with some techniques very few studies were performed. Knowing this, relatively positive results for techniques directed towards knowledge, awareness and facilitation of behaviour in studies on diet and exercise are probably most noteworthy.

Table 4 summarizes the evidence for specific techniques. Due to insufficient numbers of

Table 4: Effectiveness of specific behaviour change techniques^a

Strategies	All studies within the reviews [%pos (<i>n</i>)]			
	Smoking	Exercise	Diet	All health behaviors
Knowledge				
Provide general information	25 (119)	67 (28)	60 (25)	39 (171)
Awareness				
Risk communication	44 (25)	0 (2)	100 (6)	52 (33)
Self-monitoring of behaviour	50 (4)	75 (4)	100 (2)	56 (9)
Delayed feedback of behaviour	20 (5)	40 (5)	100 (1)	36 (11)
Social influence				
Insufficient studies for specific strategy analyses	—	—	—	—
Attitude				
Reevaluation of outcomes (self-evaluation)	0 (14)	— (0)	— (0)	0 (14)
Persuasive communication (belief selection)	33 (24)	— (0)	— (0)	33 (24)
Reinforcement on behavioural progress (rewards)	43 (23)	100 (1)	— (0)	46 (24)
Self-efficacy				
Plan coping responses	40 (10)	— (0)	100 (1)	45 (11)
Intention				
Specific goal setting	27 (11)	40 (5)	100 (3)	42 (19)
Use of social support	50 (24)	— (0)	— (0)	50 (24)
Action control				
Insufficient studies for specific strategy analyses	—	—	—	—
Maintenance				
Relapse prevention	5 (21)	100 (1)	— (0)	9 (22)
Facilitation of behavior				
Provide material to facilitate behaviour	17 (66)	62 (13)	33 (15)	33 (94)
Continuous professional support	39 (85)	33 (9)	44 (18)	39 (112)

% pos, percentage of studies with statistically significant improvement at any length of follow-up/*n* = total number of studies on this technique.

^aStudies where the statistical significance of results was not clear from the reports were not included in this table.

studies, clear results on the evidence for the use of specific *action control techniques* and *social influence techniques* are lacking.

The numbers of studies with significantly positive results were highest for the awareness-directed techniques *self-monitoring of behaviour* (56%) and *risk communication* (52%) whereas the intention directed strategy *use of social support* (50%) was almost as successful. Relatively high percentages of successful studies were also found for the attitude technique *reinforcement on behavioural progress* (46%), the self-efficacy technique of *planning coping responses* (45%) and the intention technique *specific goal setting* (42%).

Other techniques were less often successful, with very low scores for *relapse prevention* techniques (9%) and *re-evaluation of outcomes* (0%).

Another finding from Table 4 is that the evidence from smoking cessation research largely differs from the evidence for the other two health topics. Some techniques were (almost) only studied in smoking cessation research

(re-evaluation of outcomes, persuasive communication, reinforcement on behavioural progress, planning coping responses, use of social support). With other techniques results were different and often more positive in studies on exercise and diet.

Commonly combined techniques

At the level of specific techniques, numbers were too small to allow for an analysis of combinations of techniques. At the level of groups of techniques however, we explored the effectiveness of the most prevalent combinations (lower part of Table 3). Combinations of offering knowledge and facilitation were found in over a hundred studies (*n* = 114). Other common combinations involved combined knowledge and awareness techniques (*n* = 43), concurrent use of knowledge, awareness and facilitation techniques (*n* = 16) and combinations of intention and facilitation techniques (*n* = 17). For these combinations, the numbers of studies with significantly positive results

ranged from 37 to 63%. Here too results were less positive with studies on smoking cessation. Success was most often reported for the combinations of knowledge, facilitation and awareness strategies (63%).

DISCUSSION AND CONCLUSION

Discussion

We set out to review the evidence for the effectiveness of behaviour change techniques in patient populations and successfully arrived at a broad overview of the body of evidence.

Main findings

A first and important finding is that the content of interventions for the promotion of healthy behaviours is often insufficiently reported. Furthermore, none of the behaviour change techniques demonstrated clear effects in convincing majorities of the studies in which they were evaluated.

Self-monitoring of behaviour, risk communication, and use of social support were most often identified as effective. The frequently used *knowledge* and *facilitation* techniques were clearly less often effective. *Relapse prevention* techniques and *re-evaluation of outcomes* were hardly ever successful. Only a few combinations of techniques were very frequently found, with highest success rates for combinations of knowledge, awareness and facilitation techniques.

While success rates were low with all techniques, one should keep in mind how our overall results were dominated by large numbers of studies on smoking cessation. As poor success rates were especially found in smoking cessation studies, these drew heavily on our overall findings.

Strengths and limitations

We focused on the content of behaviour change techniques within interventions, a focus too often ignored, yet crucial to understanding effectiveness.

We used comprehensive search strategies and included the most relevant databases. With all steps of the review process, validity was considered by using standardized methods and forms as well as multiple raters. Also, we

guarded validity of findings by excluding reviews with ‘major limitations’ and selecting only reviews where a majority of the studies were RCTs.

The taxonomy of behavioural change techniques (Abraham and Michie, 2008; de Bruin *et al.*, 2010) was a valuable tool, as it helped us to relate descriptions of intervention content to definitions of behaviour change techniques. Referring to such a taxonomy is a particular strength of our overview as it is vital to common understanding of patient-directed behaviour change approaches.

Although we succeeded in creating the intended overview, some limitations should be considered. Firstly a review of reviews suffers from publication delay for reviews as well as original studies and is somewhat behind on scientific progress by definition. We had to step down to the level of studies within the reviews, as none of the reviews were organized in a way that allowed for drawing conclusions on the effectiveness of behaviour change techniques. By using study data as reported in reviews, we were efficient on the one hand, but cannot totally rule out bias due to using ‘indirect sources’ on the other. However, we only included reviews with good quality descriptions of studies. Also, many studies were identified through more than one review and the descriptions of intervention content for these studies were usually the same.

In performing a review, a good deal of reductionism is inevitable. We categorized techniques used in studies as demonstrating an effect on patients’ health behaviours or as unable to demonstrate such effects. We could not differentiate between short- and long-term outcomes. Furthermore, we included all health behaviour outcomes, various contexts and all care providers and could not analyse for alternative outcomes, contexts or alternative providers separately.

In the process of creating the overview, it was impossible to check for appropriateness of techniques within the studies, while this is crucial to intervention success (Kok *et al.*, 2004; Abraham *et al.*, 2009). Lacking effects could have been caused by ill-chosen techniques such as knowledge techniques with knowledgeable patients or awareness techniques with patients who were already aware of the need for behaviour change. Furthermore, once techniques are chosen, actual delivery of behaviour change techniques

could be problematic. Goal setting for example, requires setting behavioural specific, measurable, observable and challenging yet realistic goals (Locke and Latham, 1990; Strecher *et al.*, 1995; Locke and Latham, 2002). Descriptions of interventions in publications however, typically provide insufficient detail to check for appropriate delivery of this technique as well as other techniques.

Given the combination of strengths and limitations, we should acknowledge how our review provides an original and valuable broad overview of the body of evidence on behaviour change techniques which is necessarily also a somewhat rough clarification of the big picture. With this in mind, we believe the overview is worthwhile, as it provides the general evidence as a stepping stone for health professionals and points at areas for future research.

Conclusions

We cannot draw clear conclusions on the exact level of evidence for each of the behaviour change techniques as studies as reported in systematic reviews give insufficient insight into the appropriateness of their choice of techniques and offer no insight into the quality of technique delivery. Therefore, it is more meaningful to focus on the relative successfulness of various techniques.

Self-monitoring of behaviour, a technique to promote patients' awareness of personal risk behaviour, is the technique most likely to contribute to successful behaviour change in patient populations regardless of the health behaviour at hand. Risk communication and use of social support seem almost as effective, although results may vary for health behaviours.

Professional support is a popular yet not highly effective approach to promoting healthy behaviours in patients. Providing knowledge is not very successful in promoting smoking cessation, but could still be worthwhile when promoting healthy diets or physical activity. Providing materials seems promising in the promotion of physical activity only.

Looking at combinations of techniques, combining knowledge, awareness and facilitation techniques could be most promising. However, this might simply reflect how including more strategies increases chances at success.

Finally, we conclude that transparent reporting on intervention content and intervention

delivery is pivotal. Journals can contribute to this by demanding clear descriptions of interventions and offering sufficient space to do so.

Practice implications

Health professionals should avoid the pitfall of thinking that providing knowledge, materials and professional support will be sufficient for patients to accomplish change and be more creative in the practical application of behaviour change interventions. Professionals who intend to assist patients in behaviour change could improve their chances at success when they target patients' awareness using risk communication and self-monitoring of behaviour, when they address intention with goal setting, increase social support or increase self-efficacy through planning coping responses.

Apart from looking at success rates however, care professionals should consider the match between techniques and characteristics of the target group, individual patients and the health behaviour at hand. Considering relevant determinants such as knowledge levels, awareness, motivation, self-efficacy, etc. is most likely to result in well-chosen behaviour change techniques. Addressing the question 'why would this intervention help this patient?' will contribute to both the evidence base in this area, as well as the quality of patient care.

SUPPLEMENTARY DATA

Supplementary data is available at *Health Promotion International* online.

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