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Are tailored health education materials always more effective than non-tailored materials?

Matthew W. Kreuter, Debra L. Oswald[1], Fiona C. Bull[2] and Eddie M. Clark[1]

Abstract

While promising, the evidence in support of tailored health communication has not been overwhelming. One explanation is that tailored materials may be far superior to non-tailored materials in some cases, but only slightly better, no different or less effective in others. In this study, 198 overweight adults were randomly assigned to receive either tailored or non-tailored weight loss materials. Participants' cognitive, affective and behavioral responses to the materials were measured at an immediate and 1 month follow-up. Analyses compared those who received tailored materials to those who received non-tailored materials that were—by chance alone—either a good fit, moderate fit or poor fit, based on the match between behavioral characteristics of the participant and content of the non-tailored materials. Findings showed that good-fitting non-tailored materials performed as well or better than tailored materials for several cognitive, affective and behavioral outcomes. However, moderate- and poor-fitting non-tailored materials were consistently inferior to both approaches. The art and science of creating tailored health communication programs is still evolving. Data from this study suggest present approaches to tailoring are more effective than non-tailored materials in most, but not all cases. Specific recommendations are made describing ways to refine tailoring methods to maximize the effectiveness of this approach.

Health Communication Research Laboratory, Department of Community Health, School of Public Health and [1]Department of Psychology, St Louis University, St Louis, MO 63108, USA; [2]Department of Public Health, University of Western Australia, writing from the Health Communication Research Laboratory, School of Public Health, St Louis University, St Louis, MO 63108, USA

Introduction

Studies of tailored communication are exploding in a wide variety of fields. In health education, studies have shown that tailored print materials are generally more effective than non-tailored ones in helping individuals change health-related behaviors such as smoking, diet, physical activity, cancer and cholesterol screening, and can enhance participation in health promotion programs (Prochaska *et al.*, 1993; Campbell *et al.*, 1994; Skinner *et al.*, 1994; Strecher *et al.*, 1994; Kreuter and Strecher, 1996; Brug *et al.*, 1996, 1998; Brennan *et al.*, 1998; Bull *et al.*, 1998; Dijkstra *et al.*, 1998a,b; Marcus *et al.*, 1998). While promising, the evidence in support of tailoring has not been overwhelming. For example, although first-generation tailoring studies show that tailored materials are better read and remembered than non-tailored materials (Skinner *et al.*, 1998), a large proportion of participants *do not* read or remember the tailored materials they received (Campbell *et al.*, 1994; Skinner *et al.*, 1994; Kreuter and Strecher, 1996; Bull *et al.*, 1998). Furthermore, despite tailoring's goal of producing highly individualized communication, only about half of participants say the materials they received 'apply to me specifically' (Brug *et al.*, 1996, 1998; Kreuter, 1997).

These findings might be explained by variations

in the way different investigators apply tailoring principles or by the limited effects of print-based interventions, in general. Alternatively, it may be that tailored materials are far superior to non-tailored materials for some people, only slightly better for others and, for some, no different or less effective than non-tailored materials. From this latter perspective, the net effect of tailoring might be positive, though modest. To determine whether such gradations of effectiveness indeed exist between tailored and non-tailored print communication, we compared cognitive, affective and behavioral responses of 198 overweight adults who were randomly assigned to receive either tailored or non-tailored weight loss materials. Among those who received non-tailored materials, a 'goodness-of-fit' score was calculated to reflect how well these materials addressed (by chance alone) each person's unique weight loss needs. Analyses compared the effects of tailored weight loss materials to non-tailored materials that were a good fit, moderate fit or poor fit for the participants who received them. By gaining a more detailed understanding of the effects of tailored health communication, we may be able to use the approach more efficiently and effectively in future research and practice.

Methods

Institutional Review Board approval

The Institutional Review Board at the St Louis University Health Sciences Center approved all research activities in this project.

Study population

Participants were overweight adults (BMI $\geqslant$ 27) who responded to a one-time recruitment advertisement in a St Louis area newspaper. Individuals who called to enroll were given a brief description of the study and screened for eligibility (BMI $\geqslant$ 27, age $\geqslant$ 18 years, interested in losing weight, no use of prescription weight loss medication during the preceding 6 months). The number of callers far exceeded the study's capacity, and thus only the first 233 eligible callers were enrolled and scheduled for an on-site interview. Of these, 32 (13.7%) missed their appointment, and three had a BMI $<$ 27 when height and weight were confirmed at the study site. This left a final sample of 198. Each received a participation incentive of $25 upon completion of the on-site interview.

Study design

Participants completed a brief weight loss survey by telephone during their enrollment interview and made an appointment to complete the on-site portion of the study. Each was then randomly assigned to receive either tailored or non-tailored weight loss materials. On site, participants' eligibility was confirmed and, according to study group assignment, each was given printed weight loss materials that were either tailored or non-tailored. After reading the materials, participants completed a questionnaire rating the materials on 14 criteria indicative of effective communication, information processing, persuasion and behavior change, and also completed a thought listing task.

Measures

An eligibility screening questionnaire (Q1) and tailoring assessment questionnaire (Q2) were administered by telephone when participants first called to enroll in the study. When they arrived for the on-site portion of the study, a second screening questionnaire was administered to verify eligibility (Q3). After reviewing their weight loss materials, each participant rated the materials on selected criteria and completed a cognitive response survey (Q4).

In Q1 and Q3, participants' self-reported height, weight, age, use of prescription weight loss medications and stage of readiness to lose weight were recorded. Assessment Q2 collected data on behavioral and psychosocial variables to be used in tailoring the weight loss materials. It included questions assessing participants' beliefs about weight loss (e.g. identifying a reasonable target weight), motives for losing weight (e.g. health benefits, appearance), perceived usefulness of different weight loss approaches (e.g. self-help groups, commercial programs), barriers to physical

activity (e.g. lack of time, no equipment), triggers for eating and overeating (e.g. loneliness, boredom, stress; Brownell and Kramer, 1989; Brownell and Wadden, 1992), self-efficacy (Bandura, 1977) for eating healthier foods, eating less fat, increasing physical activity, and making progress towards weight loss goals, actual dietary habits and preferences (e.g. use of diet or reduced-calorie foods), food shopping and preparation routines (e.g. shopping for food, preparing or cooking food), preference for sources of weight loss information (e.g. video tape, web site), and preference for solo versus social learning activities (Brownell, 1994). Questions in Q2 were primarily close-ended, offering participants two to eight possible response choices.

Assessment Q4 measured participants' cognitive responses to the weight loss materials. Participants listed on a standardized form all the thoughts and ideas that occurred to them while reading the weight loss materials. When completed, they were asked to review these thoughts and indicate whether each was positive, negative or neutral toward the weight loss materials [i.e. self-rated polarity (Cacioppo *et al*., 1981)]. This thought listing task was unobtrusively timed, but not time limited.

In Q4, participants also rated the weight loss materials on selected cognitive, affective and behavioral criteria using a seven-point Likert response scale with anchor statements at the extremes. Specific items assessed the extent to which materials were perceived as attention-catching ('Did the weight loss materials catch your attention?'; not at all–very much), attractive ('How attractive were the weight loss materials?'; not at all–very attractive), informative ('How informative were the weight loss materials?'; not at all informative–very informative), understandable ('How easy was it for you to understand the materials?'; not at all easy–very easy), encouraging ('How encouraging were the weight loss materials?'; not at all encouraging–very encouraging), useful ('How useful would the materials be in helping you lose weight?'; very useful–not at all useful), applicable to the participant's life ('How much did the information in the weight loss materials apply to your life?'; applied very little–applied very much), liked ('How much did you like the weight loss materials you read?'; did not like at all–liked very much), trustworthy ('In your opinion, how trustworthy was the information in the weight loss materials?'; not at all trustworthy–very trustworthy) and containing new information ('Were you already familiar with the information in the weight loss materials?'; very familiar–not at all familiar). Other items measured the likelihood of behavioral responses such as reading the materials ('If you had received the weight loss materials in your mailbox at home, how much of it would you have read?'; none of it–all of it), re-reading them ('How likely is it that you will read the weight loss materials again in the future?'; not at all likely–very likely), showing them to others ('How likely is it that you will show the weight loss materials to people you know?'; not at all likely–very likely) and making lifestyle changes ('How likely is it that you will make changes in your behavior or lifestyle based on what you read in the weight loss materials?'; not at all likely–very likely).

Assessment Q5 measured behavioral outcomes 1 month post-intervention. Dietary outcomes included self-reported measures of frequency of choosing low-fat alternatives, eating meals low in fat, eating smaller portions and cutting calories (every time/most of the time/half the time/less than half the time/not at all). Physical activity was measured by asking participants, 'During the last month, how often were you moderately physically active for 30 minutes or more?' Response choices were classified as 0 times, 2 days in the last month, once per week, twice per week, 3–4 times per week or 5 times or more per week.

Weight loss materials

The tailored weight loss materials generated in this study were based entirely upon participants' answers to questions in Q2 (i.e. beliefs, motives, barriers, triggers, self-efficacy, diet, physical activity, goal-setting, food shopping and preparation, preferred media, and learning style), plus their BMI and gender. Each of these questions included

multiple response options, thus messages were created for all possible answers. For example, in a question assessing perceived barriers to increased physical activity, participants could identify any of eight factors that might keep them from getting more exercise. Accordingly, messages addressing each of these factors were created before the study began. Messages were developed by behavioral scientists, clinicians and weight loss experts for use in the Point of Change weight management program offered to patients taking the prescription weight loss drug Meridia. In this study, all references to the program or drug name were removed. In all, there were 99 total messages in the tailored message library. Each set of tailored materials included only 14 of these messages, although more than 2.4 billion different combinations of messages were possible. All materials were fully tailored; no part of their content was generic. Tailored materials were generated using a database created in Claris Filemaker Pro 3.0 (FileMaker, Santa Clara, CA) and a message generator created in Adobe Pagemaker 6.5 (Adobe Systems, San Jose, CA).

Non-tailored materials consisted of either a pre-printed American Heart Association (AHA) booklet on weight loss or the exact content from that booklet presented in a format similar to that of the tailored materials (i.e. not a pre-printed booklet). For the purpose of this study, the two non-tailored groups are combined into one and all statistical analyses include a covariate controlling for this variation in formatting. The AHA booklet is a recent (1997) publication, *Managing Your Weight*, that contains general information, recommendations and tips for realistic weight loss, increased physical activity and healthy eating (American Heart Association, 1997). The tailored materials and formatted non-tailored materials both included four (8.5×11 in.) pages of text. The AHA booklet included 20 (4×8.5 in.) pages of text. A measure of time spent reading the materials divided by word count was included as a covariate in all analyses. Participants were not told which type of weight loss material they would receive, nor were the materials described to participants at any time.

Table I. *Content and format of tailored and non-tailored weight loss materials*

Attributes of weight loss materials	Tailored	Non-tailored
Content		
addressed realistic weight loss	yes	yes
addressed benefits of weight loss	yes	yes
addressed healthy eating for weight loss	yes	yes
addressed physical activity for weight loss	yes	yes
addressed getting social support for weight loss	yes	yes
provided sources for obtaining further information	yes	yes
was tailored to participant's survey responses	yes	no
Format		
used multi-color printing	yes	yes
included participant's name on the cover	yes	no

The content and design features of the tailored and non-tailored weight loss materials are shown in Table I.

'Goodness-of-fit' measure

To determine how well or poorly the non-tailored materials addressed the weight loss needs of each individual participant, we created a 'goodness-of-fit' variable. We reviewed the content of the non-tailored materials and identified distinct topic areas that were addressed (e.g. developing an eating plan, realistic weight loss, the role of physical activity). We then examined the questions and response choices in Q2 (the tailoring assessment) to determine which specific participant answers would indicate a need for the type of information provided in the non-tailored materials. For example, a question on Q2 asks participants if it would help them to have a detailed eating plan. A 'yes' response to this question would indicate that a message on developing an eating plan is appropriate for this person and thus the non-tailored materials would be a good fit for this person on this particular topic. In all, we found 17 different topic areas that were addressed in the non-tailored materials and also assessed in Q2. For

each individual participant, the total number of 'good fits' was divided by 17 (i.e. the number of *possible* good fits, or matches) and multiplied by 100 to yield a percentile goodness-of-fit score ranging from 0 to 100%. A tercile split was used to classify these percentage scores as either poor fitting (0–53% matching), moderate fitting (54–71%) or good fitting (≥72%). For participants who received tailored materials, it was assumed that weight loss materials fit their needs 100%. Thus four levels of goodness-of-fit are compared in all analyses—tailored materials, and good-fitting, moderate-fitting and poor-fitting non-tailored materials.

Coding cognitive responses

Cognitive responses to the weight loss materials were collected in Q4, transcribed and coded by two reviewers who were blind to study group assignment. Each thought listed by participants was coded on four dimensions: personal connections, self-efficacy, self-assessment and behavioral intention (Fishbein and Azjen, 1975). These dimensions were selected based on previous research (Petty *et al.*, 1981), theoretical constructs of the Elaboration Likelihood Model (Petty and Cacioppo, 1979) and the recognition that in addition to conventional coding schemes, 'a variety of other dimensions may be important' [(Cacioppo, 1981), p. 44]. Participants self-coded their responses on a fifth dimension, polarity. The most reliable finding in cognitive response research is the relationship between polarity of responses and yielding to a persuasive appeal (Cacioppo *et al.*, 1981; Petty *et al.*, 1994). The *polarity* of cognitions is typically classified as: (1) favorable, supporting the product or issue; (2) unfavorable, opposing the product or issue; or (3) neutral, neither favoring nor opposing the product or issue. Because reviewers' ratings of polarity are very similar to participants' ratings, the latter are commonly used in research (Petty, *et al.*, 1976; Cacioppo *et al.*, 1981). In this study, participants classified each idea or thought as positive, negative or neutral.

According to the Elaboration Likelihood Model, individuals will be more motivated to process information and will process it more carefully and thoroughly when they perceive it to be personally relevant (Petty *et al.*, 1979). For this reason, participants thoughts were rated as 'high', 'moderate' or 'low' on *personal connections* (the extent to which thoughts show a link between the weight loss materials and the person's lifestyle, attitudes, social norms or behavior, e.g. 'It might help to have an exercise buddy'). Thoughts were also examined for the presence or absence of *self-assessment* statements (the extent to which thoughts show that the participant considered his or her own habits, lifestyle, behavior, attitudes, or relationships, e.g. 'I really need to change my eating habits') and rated for *self-efficacy* (thoughts 'strongly related to self-efficacy' or 'not related'). *Behavioral intention* (thoughts indicated 'behavioral intent', 'need to engage in behavior' or 'no behavioral intent') was also coded.

Two research project staff members were trained to code the cognitive responses using a sample of 20% of participant responses. Both coders rated all thoughts on all dimensions. Discrepancies in coding were resolved through discussion. Overall inter-rater reliability was 86% (82% for connections to personal life, 88% for self-efficacy, 90% for behavioral intention and 86% for self-assessment). Thirteen thoughts (out of 1506, <1%) were not rated for polarity by the participant and were given a consensus rating by the two coders.

Statistical analyses

A series of one-way ANOVAs was conducted, using the four level goodness-of-fit grouping as the independent variable. Group means were compared on participants' ratings of the materials on selected criteria (e.g. attractiveness, usefulness, personal relevance) and on their cognitive responses to the materials (e.g. total thoughts listed, personal connection thoughts, behavioral intention thoughts). Where necessary, response scales were reverse coded such that for all participant ratings of the materials, a higher mean indicates a more favorable response. Because the formatting for the two types of non-tailored materials was slightly different [to test effects of appearance in a previ-

Table II. *Ratings of weight loss materials, by group*

Extent to which participants reported...	*F* statistic; *P* value	Tailored materials ($n = 72$)	Good fitting non-tailored ($n = 41$)	Mod. fitting non-tailored ($n = 44$)	Poor fitting non-tailored ($n = 44$)
The materials caught their attention	$F(3,196) = 6.24$; $P < 0.001$	6.22 [b]	5.94 [b,c]	5.42[a,c,]	5.10[a]
The materials were attractive	$F(3,196) = 5.14$; $P = 0.002$	6.13[b]	5.81[b,c]	5.45[a,c]	5.10[a]
The materials were informative	$F(3,196) = 3.86$; $P = 0.01$	5.85[a]	6.45[b]	5.74[a]	5.68[a]
The materials were easy to understand	$F(3,196) = 2.27$; $P = 0.08$	6.82[b]	6.72[b]	6.73 [b]	6.43[a]
The materials were encouraging	$F(3,196) = 2.19$; $P = 0.09$	5.68[b]	5.79[b]	5.29[a,b]	5.04[a]
The materials were useful	$F(3,196) = 4.35$; $P = 0.005$	5.13[a]	5.95[b]	4.72[a]	4.73[a]
The materials applied to their life	$F(3,192) = 1.75$; $P = 0.16$	6.05	6.24	5.65	5.76
They liked the materials	$F(3,196) = 4.90$; $P = 0.003$	5.87[b]	6.19[b]	5.37[a]	5.29[a]
...information in the materials was trustworthy	$F(3,196) = 2.99$; $P = 0.03$	6.46[b]	6.58[b]	6.23[a,b]	6.04[a]
...information in the materials was new (i.e. not familiar)	$F(3,196) = 1.10$; $P = 0.35$	2.82	2.26	2.37	2.22
They would have read materials if received at home	$F(3,196) = 1.51$; $P = 0.21$	5.92	6.17	5.67	5.40
They would read materials again in the future	$F(3,194) = 4.74$; $P = 0.003$	6.31[b]	6.14[b]	5.80[b]	5.12[a]
They would show the materials to others	$F(3,196) = 2.28$; $P = 0.08$	5.24[b]	5.34[b]	5.05[b,c]	4.22[a,c]
They would make behavioral changes based on materials	$F(3,196) = 3.64$; $P = 0.014$	5.34[b,c]	5.72[b]	4.84[a,c]	4.75[a]

Means with different subscripts are significantly different (Tukey HSD, $P < 0.05$).

ously reported study (Kreuter *et al*., 1999a)] a covariate was included in all analyses to adjust for any potential differences due solely to formatting. In ANOVAs for cognitive response outcomes, weight loss stage of readiness and time reading the material (time reading/word count) were also included as covariates to adjust for any differences between the groups on these variables. Tukey HSD ($P < 0.05$) *post hoc* tests were used to follow-up significant analyses of variance.

To examine behavioral effects of the weight loss materials, measures of intention to change physical activity, and diet at baseline and immediately after reading the materials were compared across study groups to actual behavior change reported at a 1 month follow-up. These analyses used a (3)×4 mixed model analysis with time as the repeated measures variable and goodness-of-fit (i.e. study group) as the between subjects variable. Of primary interest in these analyses was the degree to which the two variables interacted. A significant interaction would indicate that behavioral changes had occurred over time, varying by study group.

Findings

Participants

The majority of participants were women (83%) and white (78%). Twenty-one percent were African-American. The mean age of participants was 47 years (SD = 12.3) and the mean level of education was 14 years. Participants had an average BMI of 36.6. There were no differences in these characteristics across the four study groups. Seventy-two participants were randomly assigned to receive tailored materials and 126 participants were randomly assigned to receive non-tailored materials in either booklet form ($n = 73$) or formatted to look like tailored materials ($n = 53$).

Table III. *Cognitive responses to weight loss materials, by group*

Extent to which participants reported...	*F* statistic; *P* value	Tailored materials ($n = 72$)	Good fitting non-tailored ($n = 41$)	Mod. fitting non-tailored ($n = 44$)	Poor fitting non-tailored ($n = 44$)
Total thoughts	$F(3,189) = 1.58$; $P = 0.20$	8.60	7.41	7.34	6.63
Total positive thoughts	$F(3,189) = 3.24$; $P = 0.02$	5.59[b]	4.84[b]	4.59[a,b]	3.43[a]
Total negative thoughts	$F(3,189) = 0.56$; $P = 0.64$	1.80	1.53	1.95	1.47
Personal connections, high and positive	$F(3,188) = 2.03$; $P = 0.11$	3.04	1.81	1.91	1.62
Personal connections, high and negative	$F(3,188) = 0.58$; $P = 0.63$	1.16	0.79	1.13	0.87
Personal connections, moderate and positive	$F(3,188) = 4.65$; $P = 0.004$	2.07 [c]	1.60[b,c]	0.95[a,b]	0.83[a]
Personal connections, moderate and negative	$F(3,188) = 1.18$; $P = 0.32$	0.44	0.69	0.71	0.42
Self-efficacy, strong and positive	$F(3,189) = 0.271$; $P = 0.85$	0.87	0.93	0.75	0.67
Self-efficacy, strong and negative	$F(3,189) = 1.37$; $P = 0.26$	0.57	0.47	0.72	0.25
Behavioral intention, high and positive	$F(3,189) = 1.26$; $P = 0.29$	0.50	0.22	0.22	0.17
Behavioral intention, high and negative	$F(3,189) = 0.72$; $P = 0.54$	0.04	0.00	0.03	0.00
Behavioral intention, moderate and positive	$F(3,189) = 2.65$; $P = 0.05$	1.86[b]	0.89[a]	0.59[a]	0.87[a]
Behavioral intention, moderate and negative	$F(3,189) = 0.93$; $P = 0.43$	0.18	0.29	0.21	0.08
Self-assessment, positive	$F(3,189) = 3.11$; $P = 0.03$	3.26·[b]	1.82[a]	1.69[a]	1.46[a]
Self-assessment, negative	$F(3,189) = 0.74$; $P = 0.53$	1.20	0.83	1.03	0.71

Means with different subscripts are significantly different (Tukey HSD, $P < 0.05$)

Ratings of weight loss materials

Tailored weight loss materials were rated significantly higher than all three levels of untailored materials on attractiveness, but on no other criteria. The good-fitting non-tailored materials were rated just as highly as tailored materials in terms of catching attention (5.9 versus 6.2, respectively) and being liked (6.2 versus 5.9), and were rated significantly higher than tailored materials on being informative (6.5 versus 5.9) and useful (6.0 versus 5.1). In no cases were the moderate- or poor-fitting non-tailored materials rated higher than the tailored or good-fitting non-tailored materials. Nor were there significant differences between tailored materials, good- and moderate-fitting non-tailored materials in terms of the likelihood that participants would re-read the materials in the future (6.3 versus 6.1 versus 5.8, respectively) or show the materials to others (5.2 versus 5.3 versus 5.1). Tailored materials and good-fitting non-tailored materials were rated as equally likely to lead to behavioral changes, significantly more so than moderate- or poor-fitting non-tailored materials (5.3 versus 5.7 versus 4.8 versus 4.8, respectively). Table II summarizes these data.

Cognitive responses to weight loss materials

After reading the weight loss materials, participants in the tailoring group generated significantly more positive self-assessment thoughts (3.3 versus 1.8 versus 1.7 versus 1.5) and moderate positive behavioral intentions (1.9 versus 0.9 versus 0.6 versus 0.9) than did those in the three non-tailored groups. Participants in both the tailored and good-fitting non-tailored groups made more moderate positive personal connections to the materials than did members of the moderate- and poor-fitting

non-tailored groups (2.1 and 1.6 versus 1.0 and 0.8), and those in the tailored, good-fitting and moderate fitting groups were all generated significantly more total positive thoughts than did those in the poor-fitting group (5.6 and 4.8 and 4.6 versus 3.4). There were no significant group differences for self-efficacy thoughts. Table III summarizes these data.

Behavioral changes

A significant interaction between time and study group was found for participants' self-reports of choosing low-fat alternatives in their diets [$F(3,172) = 3.22$, $P < 0.05$]. Simple effects tests revealed that among those who received poor-fitting or moderate-fitting non tailored materials, intent to choose low-fat alternatives increased significantly from baseline to immediate follow-up (from 2.9 to 3.3 and 3.1 to 3.8, respectively, on a five-point scale), but actual use of low-fat alternatives at 1 month follow-up did not differ from the baseline measure. In the good-fitting non-tailored group, intent to choose low-fat alternatives also increased from baseline to immediate follow-up (from 3.3 to 4.1) and actual use of low-fat alternatives at 1 month follow-up was significantly higher than baseline (3.7 versus 3.3). The same pattern was found in the tailored group, where intent to choose low-fat alternatives increased from baseline to immediate follow-up (from 2.9 to 3.9) and actual use of low-fat alternatives at 1 month follow-up was significantly higher than baseline (3.3 versus 2.9). Thus all groups reported greater intent to choose low-fat alternatives at immediate follow-up compared to baseline assessment, but only the tailored and good-fitting non-tailored materials reported greater use of low-fat alternatives 1 month later.

The interaction between time and study group for participants' self-reported level of physical activity was marginally significant [$F(3,178) = 2.42$, $P < 0.07$]. Simple effects tests revealed that participants in the good-fitting non-tailored group reported significantly more physical activity at 1 month follow-up compared to baseline (3.7 versus 3.2). This was not the case for the other three groups. No significant interactions between time and goodness-of-fit were found for eating meals low in fat, eating smaller portions or cutting calories.

Discussion

Analyses showed that good-fitting non-tailored materials can perform as well or better than tailored materials for a variety of cognitive, affective and behavioral outcomes. At the same time, moderate- and poor-fitting non-tailored materials were usually inferior to both approaches. One overarching conclusion is that customization is important for materials to be effective. Whether by chance or by planned intervention (i.e. tailoring), materials that were well matched to an individual were better received than those that were not. The fact that tailoring distinguished itself from non-tailored materials more so on cognitive responses than on ratings of the materials is consistent with findings from other tailoring studies and may help explain how tailoring has achieved behavioral outcomes in the past. For example, in previous work, it has been shown that cognitive responses stimulated by tailored messages are significantly associated with subsequent behavioral intention and actual behavior change in a causal fashion (Kreuter *et al.*, 1999a).

These findings suggest two important points relevant to health education and health communication. First, there will be considerable variation in the effectiveness of any single communication approach in any given population. In this study we see that the content from a generic, pre-printed weight loss booklet does a good job addressing the needs of some readers, but a poor job addressing the needs of many others. This variation in goodness-of-fit is associated with significant differences in the effectiveness of the materials. One interpretation of this finding might lead to the recommendation that greater efforts be made to match individuals to mass-produced materials. Given that tailored communication programs are often neither cheap nor easy to build, an approach that matched individuals to generic materials might maximize

the fit of health messages while keeping costs lower. However, this approach would only succeed if we could efficiently and reliably identify ahead of time those people for whom a particular non-tailored communication would be a good fit. Ironically, such a process would involve a form of tailoring—matching existing content to specific individual profiles. For such an approach to be viable today, we would have to assume that enough different non-tailored communications existed to meet all possible individual profiles. This is probably not the case.

Second, findings from the present study show that current tailored print communications may be no more effective than generic materials that are—purely by chance—well matched to a particular person. If this was true in all cases, one might conclude that the effectiveness of tailoring has been overstated. Yet in this study, tailored materials *were* more effective than non-tailored materials for roughly two-thirds of participants who received non-tailored materials. Thus it is more likely the case that the art and science of creating tailored health communication is still evolving. As suggested elsewhere (Kreuter *et al.*, 1999b), on a continuum from totally generic to perfectly tailored health communication, the tailored print materials tested to date probably lie somewhere in the middle. However, as our methods and technology are refined, tailoring could become even more effective.

As an example, the most commonly used approach to tailoring to date could be termed 'behavioral construct tailoring'. This is the approach that has been used in all previously published research, including our own. Using behavioral construct tailoring, programs draw almost exclusively upon constructs from established theories of health behavior as the basis for tailoring messages. For example, different tailored messages are created for those who are in different stages of readiness to change a given behavior (Prochaska and DiClemente, 1983), those who identify different barriers to changing that behavior (Becker, 1974) or who have different levels of self-efficacy for changing the behavior (Bandura, 1986). Using behavioral construct tailoring, we expect to identify and address the 'right behavioral or psychosocial issues' for each person.

However, each of these specific issues is addressed in a uniform way across all individuals, not taking into account contextual, cultural or personality factors that may directly influence the way a person processes tailored health information or their ability and motivation to make the changes that are recommended. This is roughly the equivalent of a clothing tailor taking a customer's waist, inseam and outseam measurements to make a pair of trousers, but not asking about the preferred style, color or fabric. The resulting pants would fit well, but might never be worn by the customer if the tailor had chosen incorrectly. Enhanced tailored communication could measure and address not only behavioral constructs from a few selected theories of health behavior change, but also factors such as learning style (Kolb, 1984), preferred media (O'Keefe *et al.*, 1998), cultural norms and values, need for cognition, (Cacioppo *et al.*, 1984), and use of emotional versus cognitive appeals (Chaudhuri and Buck, 1995). Ideally, tailored health communication will not only address the right behavioral variables, but do so in a way that recognizes and builds upon important non-behavioral factors that vary from individual to individual. In the approaching second generation of research on tailored health communication, investigators should identify and test new types of tailoring variables which could enhance the relevance and effectiveness of health and behavior change messages.

The predominance of behavioral construct tailoring may also help explain why studies to date, including the one reported here, have not found greater differences between tailored and non-tailored materials. Specifically, as the field of health education has matured, there has been greater recognition and application of behavioral science theories by practitioners, including those who develop health education materials for distribution to the general public. Thus, if non-tailored materials increasingly address important constructs from theories of health behavior change, there will

be less and less of a difference between these materials and materials developed via behavioral construct tailoring. For example, in the UK, US and Australia, the majority of survey respondents cite 'lack of time' as the leading barrier to increasing their level of physical activity (Sallis *et al.*, 1992; Thomas *et al.*, 1992). This fact is well known by all who endeavor to promote physical activity, and is thus addressed in some way in most non-tailored programs and materials. Consequently, tailored materials which address barriers to physical activity may be quite similar to standard materials for a majority of participants (Bull and Jamrozik, 1998). In contrast, variables like preferred type of physical activity may differ considerably from one person to the next within any large group. Non-tailored educational materials will be unable to address all possible types of physical activity in a meaningful way, but tailored interventions are well suited for this task. Thus tailoring on variables that are both important to a given behavioral outcome and have variability within the target population should be especially valuable in helping individuals change (Bull *et al.*, 1998), and an objective of tailored communication programs developed in the future.

This study had several limitations that should be considered when evaluating its results. First, participants were drawn from a convenience sample of overweight adults (mostly White women) who were motivated to lose weight. Their cognitive, affective and behavioral responses to the tailored and non-tailored materials may not be representative of how other adult populations, less motivated populations, or those with different or no health problems would react to printed health education materials. Second, although 1 month follow-up data were collected for several behavioral outcomes, most outcomes reported in the study were pre-behavioral in nature and assessed immediately following exposure to the intervention. While this design feature is important for gathering written cognitive responses, it can be limiting when interpreting data on other outcomes. For example, the strength of association between attitudes and intention measured immediately post-intervention and subsequent behavioral change may be nominal. In this study, changes in behavioral intention from baseline to immediate post-intervention follow-up did not always predict behavioral change at 1 month follow-up. Of noteworthy absence in the study's findings are associations between study group and self-efficacy thoughts. In our coding scheme, only comments that were of very strong and obvious self-efficacy (e.g. 'I can stick to a low-calorie diet') were classified as self-efficacy thoughts. However, many statements were not so clearly written. Thus, though they may have reflected moderate self-efficacy, were instead classified as non-efficacy thoughts. Thus the restrictiveness of our definitions could have masked a potential relationship between tailoring and self-efficacy thoughts. Future studies examining the mechanisms through which tailored communication may derive its effectiveness should be designed to overcome these limitations.

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