ONE SIZE DOES NOT FIT ALL: THE CASE FOR TAILORING PRINT MATERIALS[1]

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ABSTRACT

Printed health education materials frequently consist of mass-produced brochures, booklets, or pamphlets designed for a general population audience. Although this one-size-fits-all approach might be appropriate under certain circumstances and even produce small changes at relatively modest costs, it cannot address the unique needs, interests, and concerns of different individuals. With the advent and dissemination of new communication technologies, our ability to collect information from individuals and provide feedback tailored to the specific information collected is not only possible, but practical. The purpose of this article is to: (a) distinguish between tailored print communication and other common communication-based approaches to health education and behavior change; (b) present a theoretical and public health rationale for tailoring health information; and (c) describe the steps involved in creating and delivering tailored print communication programs. Studies suggest computer tailoring is a promising strategy for health education and behavior change. Practitioners and researchers should understand the approach and consider the possibilities it presents for enhancing their work in disease prevention.

INTRODUCTION

"To generalize is to be an idiot."—William Blake (1).

Blake's comment referred to mediocre artists whose broad strokes he felt failed to capture the subtleties and finer detail of nature. He argued that detail and precision were the hallmarks of a skilled artist. Whether Blake was right or wrong about art, his comment—albeit overstated—illustrates one reason for the recent emergence of tailored health communication. That is, health education materials commonly consist of a single, generalized body of information in the form of brochures, booklets, or pamphlets designed for the general population or for some demographic subgroup. Although these mass-produced materials are relatively inexpensive to create and often provide valuable information, their one-size-fits-all approach cannot address the

"finer details" that vary from person to person and uniquely affect each individual's health-related decisions and behaviors.

With the advent and dissemination of new communication technologies, our ability to collect information from individuals and provide feedback tailored to the specific information collected is not only possible, but practical. Throughout the 1990s, computer-tailored health education and behavior change programs have been developed and tested by researchers at several universities, health care organizations, and government agencies. The results of these efforts, together with an increasing mastery of the technological aspects of tailoring, suggest the time is right to promote a greater understanding of tailored health communication. The purpose of this article is threefold: (a) to distinguish between tailored print communication and other common communication-based approaches to health education and behavior change; (b) to present a theoretical and public health rationale for tailoring; and (c) to describe the steps involved in creating and delivering tailored print communication interventions. Because computer tailoring appears to be an effective intervention strategy (2), health educators and researchers should understand the approach and consider the possibilities it presents for enhancing their work in disease prevention.

WHAT IS TAILORING?

The distinctions between tailored, targeted, personalized, and other forms of health communication are important ones, yet the terms have sometimes been used interchangeably in the research literature (3–8). Because there appear to be differences in development costs and processes and in the relative effectiveness of these approaches (2), there is a need to standardize our terminology. Conceptually, the infinite gradations that are possible could be viewed as a continuum—with the two extremes being completely generic and perfectly tailored materials. For practical purposes, it may be most useful to consider two main levels: targeted generic materials and tailored communication. We define targeted generic materials as those intended to reach some specific subgroup of the general population, usually based on one or more demographic characteristics shared by its members. In contrast, tailored materials are intended to reach one specific person, are based on characteristics that are unique to that person, are related to the outcome of interest, and have been derived from an individual assessment (9).

Generic and Targeted Generic Communication

The least expensive way to reach large audiences is to use generic materials. Well-designed generic materials will include as much information as possible within a single communication, yet

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keep it easy to read and comprehend. These materials generally aspire to be all things to all people, providing one comprehensive set of information about some specific content area. In using generic educational materials, it is not necessarily assumed that all people have the same informational needs, but rather that individuals can and will sift through the parts of these materials that do not apply to them to find and consume that material which does. In certain contexts (e.g. when large populations share common information deficits), such materials can be very helpful. The Public Health Service's 1987 mailing of the booklet *Understanding AIDS* to 107 million U.S. households illustrates that tremendous educational opportunities can be created by using generic materials. But the main strength of generic materials—their breadth of coverage of general information—is also their greatest weakness. These materials are typically created for general populations and therefore do not really consider specific characteristics of prospective consumers (10). Consider the case of a woman with a strong family history of breast cancer who wants to make an informed decision about genetic testing for the BRCA1 and BRCA2 mutations. If she has no children and is not planning to have any, she should not have to plow through verbiage on "Your Test Results and Your Children." Targeted or tailored materials can not only relieve her of that burden, but also address in much greater detail those factors about which she has expressed concern.

Targeted generic materials are developed for some specific population. The use of targeted materials is based upon principles of "market segmentation," which aim to find a specific group of consumers for a particular product or service (11). For the development of health education materials, this means the content and presentation of targeted information is guided by an understanding of the unique needs and concerns of the population's members. This approach might lead to creating educational materials such as a self-help smoking cessation manual especially for African–Americans (12) or breast and cervical cancer screening materials for midlife and older women (13). This is an incremental advance over the generic one-size-fits-all approach, and there is some evidence that such materials can contribute to individual behavior change (3–8,14). While there is a sound public health rationale for using this approach—namely that certain health problems disproportionately affect certain populations—its appropriateness as a mass communication strategy is unclear. Implicit in the use of targeted health messages is the assumption that sufficient homogeneity exists among members of a demographically-defined population to justify using one common approach to communicate with all its members. In fact, this assumption is largely unfounded for some populations (15).

Still other materials are "personalized," using a person's name to draw attention to an otherwise generic message (16,17). This is a commonly-used direct mail approach (e.g. "Matthew W. Kreuter, you may have already won $2,500,000!"). Superficially personalized materials are frequently used in such mass mailings so that even a low percentage of return might generate a profit (18). Although both targeted and personalized communications do base their messages on factors that are unique to individuals (e.g. age, race, name), these factors alone provide little information about the many cognitive and behavioral mediating mechanisms hypothesized to influence individuals' health-related decision-making and actions. Without this information it is difficult to create truly individualized strategies to address complex life-style behaviors. For example, which would be more useful to health educators developing a dietary change program—knowing the age, race, and sex of program participants or knowing about each individual's

specific dietary habits, cooking skills, and eating patterns? Tailoring health education materials allows you to build upon the strengths of both sources of information, without being confined by limitations of demographic data alone.

Tailored Communication

Although most tailored communication programs to date have used printed materials to reach their intended audiences, tailored messages can also be delivered via telephone, audio, video, the Internet, or other electronic media. In keeping with the known evidence on effects of tailoring (2), this paper will focus on tailored print communication. We previously defined tailoring as any combination of strategies and information *intended to reach one specific person,* based on characteristics that are unique to that person, related to the outcome of interest, and *derived from an individual assessment.* The italicized portion of this definition highlights the two features that distinguish tailored communication from other commonly used approaches: (a) it is assessment-based and (b) its messages are individual-focused. In general, as the level of assessment increases so does the degree of individualization possible in the communication content. For example, because superficially personalized materials are based on only a single data point (i.e. a person's name), the content of such materials is less individualized. The more information available about the intended recipient of the communication, the better able one is to create messages and materials individualized to his or her specific needs (see Figure 1). Importantly, some will erroneously assume that tailored interventions that are more intensive, complex, or costly will therefore be more efficacious. However, an optimal dose model for tailoring has not been established. Some components of tailoring may actually be inversely related to reach or penetration into a given population. Thus, there are complex trade-offs between reach, efficacy, and cost-effectiveness (19).

In contrast to generic, targeted, or superficially personalized materials, tailored materials address only those factors known to be important to an individual recipient. For example, most smoking cessation materials address the benefits of quitting in some way or another. These benefits may include improved health, reduced disease risk, saving money, gaining control over your life, and improved physical appearance. But not every smoker will value each of these benefits. For some, the sole motive for quitting may be a financial one. For others, improved appearance may be the motive. And even for those motivated by health benefits, there will be some who want to quit because they have been diagnosed with a smoking-related condition, others who want to prevent such illness, and still others who want to quit to protect the health of nonsmokers in their family. If it is indeed important to address the benefits of cessation in quitting materials, it makes sense to frame these benefits in the terms most salient to an individual smoker. Tailored materials can do this.

The tailoring approach of conducting individual assessments and providing individualized feedback is not new, nor is its use unique to health educators. It is commonly employed by successful real estate agents, physicians, teachers, brokers, and salespersons, all of whom identify a client's needs through observation and inquiry and use that information to customize solutions. In health education and medicine, individual counseling for behavior modification such as improved nutrition, increased physical activity, and smoking cessation is also based on this approach. In many ways, the interpersonal contact, interactivity, and immediacy of feedback that can be provided in one-on-one counseling makes this approach more desirable than a computer-tailored print communication
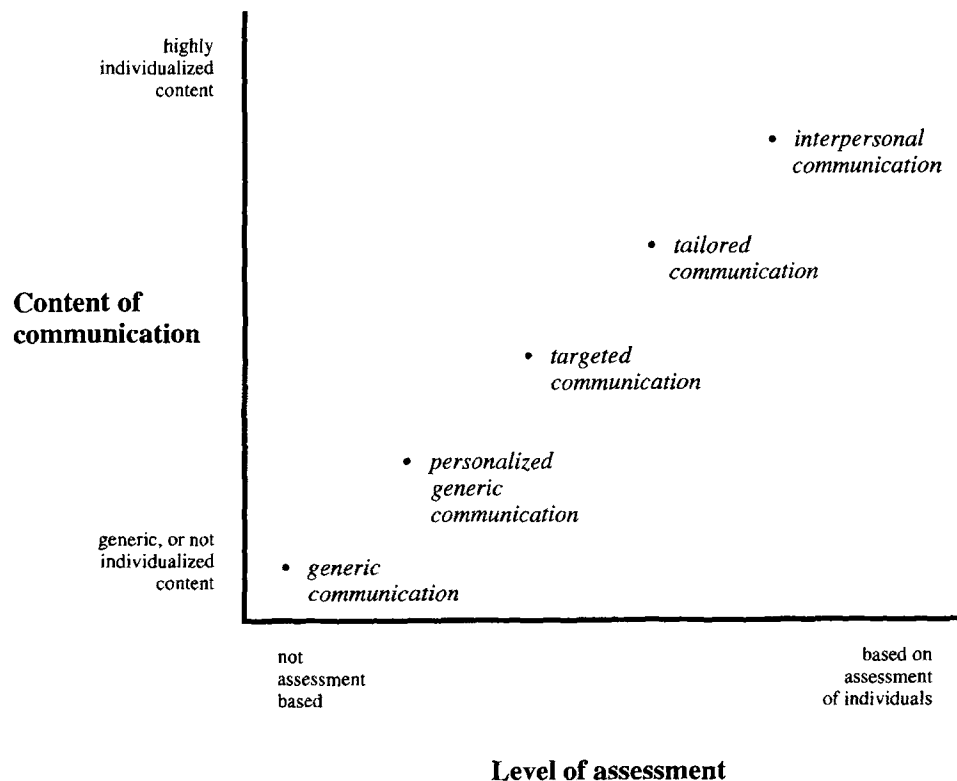
highly
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Content of
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Level of assessment

FIGURE 1:   **Classification of five approaches to health communication by level of assessment and nature of content.**

program. But the impact of counseling on the health of populations can be limited by cost and by the relatively limited number of individuals who can be reached by a small cadre of trained professionals. A skilled counselor can do everything a tailored message program can do except be available at all times to simultaneously serve multiple and diverse members of mass populations.

WHY TAILOR PRINT COMMUNICATION MATERIALS?

According to Petty and Cacioppo's (20) elaboration likelihood model, people are more likely to actively and thoughtfully process information if they perceive it to be personally relevant. The model is based on the premise that under many conditions, people are active information processors—considering messages carefully, relating them to other information they have encountered, and comparing them to their own past experiences (21,22). Studies have shown that messages processed in this way (i.e. "elaborated" upon) tend to be retained for a longer period of time and are more likely to lead to permanent change (23,24). The rationale for using tailored communication follows from this theory and can be summarized as a five-part logic sequence: (a) by tailoring materials, superfluous information is eliminated; (b) the information that remains is more personally relevant to the recipient; (c) people pay more attention to information they perceive to be personally relevant; (d) information that is attended to is more likely to have an effect than that which is not (25); and (e) when attended to, information that addresses the unique needs of a person will be useful in helping them become and stay motivated, acquire new skills, and enact and sustain desired life-style changes.

We would expect, therefore, that tailored health communication materials might elicit the following responses by the receiver when compared with untailored communication: (a) greater attention, (b) greater comprehension, (c) greater likelihood of discus-

sion of the content with others, (d) greater change in cognitive–behavioral mediating constructs addressed by the content, and (e) greater likelihood of behavior change. Several well-designed randomized studies have reported findings consistent with these expectations. For example, compared to untailored messages, tailored messages are more likely to be read and remembered (26–29); saved (26); discussed with others (26,29); and be perceived by readers as interesting (26,28,29), personally relevant (26,29), and having been written especially for them (2,26). These outcomes are, of course, central to most public health education efforts.

For reaching behavioral outcomes, tailored communication programs draw heavily upon established and tested theories of health-related behavior change to guide message development. For example, Prochaska and DiClemente's transtheoretical or Stages of Change Model (30) describes a process of behavior change in which people move through five distinct stages of readiness to adopt and maintain health-related behaviors. According to the model, different intervention strategies and "processes of change" (31) are indicated for people in different stages. The Health Belief Model (32) proposes that people are most likely to take preventive action when they perceive themselves to be susceptible to some adverse outcome, believe that outcome would be severe for them, and see more reasons to make the change (i.e. benefits) than impediments to making the change (i.e. barriers). By identifying the specific risks, barriers, and benefits an individual perceives, tailored messages can address those factors directly. Self-efficacy—the beliefs a person holds about his or her ability to enact a particular behavior—is another strong predictor of behavior change (33). This part of Bandura's (34) social cognitive theory proposes that when people believe they are able to take some action and believe that action will lead to desirable outcomes, they are more likely to do so. Tailored health communication programs

can identify specific situations in which a person's self-efficacy is low and provide the appropriate skills training needed to help enhance it. Other important theories used in tailored communication programs explain specific behavioral phenomena such as relapse (35), goal-setting (36), causal attributions for behavioral success or failure (37), and behavioral intention (38).

In addition to the theoretical rationale for tailoring, there is also a strong public health rationale for using this approach. Public health is interested in population-based prevention (39), believes that programs and services should be designed to meet the unique needs of the populations affected (40), recognizes the value of interactive and individualized learning experiences in changing behavior (41), and is generally cost-conscious (42). Until recently and without the assistance of computers, few public health activities could bring together all four of these desirable characteristics within a single program. But computer-tailored health communication holds the promise of doing that. As such, it should be viewed as a tool of the public health educator to be incorporated into comprehensive programs of health promotion, disease prevention, and disease management. The traditional public health approach of using mass media to disseminate health information could eventually be supplanted with what may be termed "micromass media" (13) or "mass customization" (44,45)—allowing the fine-tuning of message content to individuals' needs, but on the scale of mass communication.

IS IT REALLY NECESSARY TO TAILOR PRINT PREVENTION MESSAGES?

Consider the following application of theory in tailoring. A simple tailored communication program designed to promote physical activity might include eight messages that each address a different barrier to exercise, six different goal-setting messages, messages promoting 10 different types of exercise a person might prefer, seven different messages about risk and susceptibility to cancer and heart disease, and six different messages addressing the benefits of exercise. By asking an individual to answer questions about each of these five topics, we could determine which specific message or messages from each group would be most appropriate for that person. Note that from these five questions we could create at least 20,160 different combinations of the 37 total messages (i.e. unique permutations of 8 + 6 + 10 + 7 + 6 messages, assuming only one message from each section is selected). Pine (45) has likened this phenomenon to a child playing with Lego® building blocks. Although there are a discrete number of blocks to play with, an almost infinite number of objects can be created because all blocks have been designed to fit together regardless of size, shape, or color. In this example, if tailoring truly applies to physical activity, only one of these 20,160 combinations would be right for any given participant. In reality, most tailored message programs are far more complex than this example and can easily generate hundreds of millions of different possible messages for even a short printed communication.

Still, being able to generate millions of different message combinations is one thing; needing to do so is another. To assess this need, we analyzed data from a recently completed study of disease prevention in primary care settings (46,47). Among 885 adult patients in southeastern Missouri, we imposed a tailoring algorithm on baseline data collected from all participants—regardless of which of four study groups they had been assigned to—just as if they all would have received the tailored intervention. This particular tailoring program included four distinct modules, each designed to reduce a different behavioral risk factor for

cardiovascular disease. The modules aimed to help people quit smoking, increase physical activity, reduce dietary fat consumption, and learn to read nutrition labels on foods. As an example, tailored messages in the smoking cessation module were based on five variables: stage of readiness to quit smoking (30); level of addiction to nicotine (48); perceived barriers to quitting (32); motives, or outcome expectations, for quitting; and past attempts to quit. Our analyses showed that among 190 smokers, 186 (98%) would have received a different combination of the 1,272 different possible combinations of cessation messages. Of 709 patients who could have received nutrition labels, 98% would have received a set of messages no other participant received. For the modules promoting reduction of dietary fat intake and increased physical activity, rates of uniqueness were 86% and 78%, respectively. These data suggest that patients vary considerably in their status on important predictors of behavior change, thus suggesting the need for more individualized approaches to intervention.

ARE THERE TIMES NOT TO TAILOR MESSAGES?

Some people who have the inclination, resources, or need might choose to have a suit or dress custom made for them. On the other hand, almost none of us would ever consider having a pair of athletic socks tailor made. Why? Because the one or two sizes they are offered in do fit most people reasonably well. Tailoring health messages will be most appropriate when there is both considerable variation across the intended audience on important factors known to influence the outcome of interest and when the outcome itself is more complex (i.e. multiple factors, or variables, are likely to influence the outcome). For example, if there is high demand within a given population for a particular screening but people are not aware of the availability of that service, tailoring may not be necessary. In this case a single and relatively simple deficit exists (i.e. lack of awareness) and is shared by most members of a population. Perhaps obviously, there is little need to tailor a message if it would end up being more or less the same for all members of the intended audience. For this reason, it may be more efficient in some cases to use a combination of tailored and untailored approaches within the same program.

DOES TAILORING WORK?

Although still a relatively new area of research inquiry, early randomized trials testing the effectiveness of tailored messages have shown promising results. Most of these studies have compared computer-generated tailored print materials to generic materials, usual medical care, or both. Findings suggest that for certain populations, computer-tailored materials can be effective in promoting a range of health-related behaviors, including smoking cessation (49,50), reduced dietary fat consumption (26,27), increased fruit and vegetable consumption (29), mammography (28), and physical activity (51,52). Because it is not the purpose of this paper to provide a comprehensive and critical review of the research literature on the effectiveness of computer-tailored interventions, we refer readers to Skinner et al. in this issue (2).

HOW DO YOU CREATE TAILORED MATERIALS?

As with any innovation in the early stages of diffusion (53), tailoring programs to date have been used by just a handful of "pioneers." But given the growing evidence that tailored interventions may be more effective than traditional approaches to health education and health communication, it is important for a wider range of practitioners and researchers to now consider how tailoring might be used to enhance their work. The remainder of

this paper provides an overview of the process of developing and delivering computer-tailored health promotion programs, with the goal of expanding the base of health professionals who can use this approach and thereby the population base that can benefit from it.

There are five general steps involved in creating tailored print materials: (a) analyzing the problem to be addressed and understanding its determinants; (b) developing an assessment tool to measure a person's status on these determinants; (c) creating tailored messages that address individual variation on determinants of the problem; (d) developing a data base to store participants' responses; and (e) developing algorithms and a computer program that link responses from the assessment to specific tailored messages and creating the final health communication materials. Each of these steps is described briefly below.

Step 1: Analyzing the Problem

As with planning any health promotion program, it is essential to understand the determinants of the problem you are seeking to address (40). Consider the metaphor of tailored messages being like custom made, or tailored, clothing. For a clothier, the key measurements will vary depending upon what kind of garment is being made. Sleeve length, shoulder breadth, and chest circumference might be the important variables for making a jacket, while measures of waist and inseam are needed to make a pair of trousers. The same is true for tailoring health education materials: the key "measurements," or determinants, vary depending on the outcome of interest. For example, a tailored program to help participants quit smoking may need to assess their readiness to quit (30), addiction to nicotine (48), and self-efficacy for quitting (33,34). Tailored materials promoting breast cancer screening might focus on a woman's perceived susceptibility to breast cancer, beliefs about mammography, and perceived barriers to getting a mammogram (28). Tailored information designed to enhance informed decision-making about treatment or screening might include feedback about a person's own pros and cons of taking action (54).

Program planning models such as PRECEDE/PROCEED (40) can provide a useful framework from which to analyze health problems in a systematic way. Prominent theories of health-related behavior change, such as the Transtheoretical Model (30), Health Belief Model (32), and Social–Cognitive Theory (i.e. self-efficacy and social learning constructs [33,34] and relapse prevention models [35]) will also suggest important constructs to consider for many behavioral health problems. Finally, reviewing the research literature for correlates of behavior change in cross-sectional studies and for effective health promotion strategies in intervention studies can help generate ideas about other determinants. This process should yield a list of "candidate" factors to be considered as key determinants of the outcome of interest. Because there is likely a point of diminishing returns in how much assessment data can be collected and used productively in tailoring, this list must be narrowed. Tailored interventions will be most efficient and cost-effective when it can be reduced to the fewest number of determinants that predict the greatest amount of change in the outcome of interest.

Step 2: Developing An Assessment Tool

Tailored materials are assessment-based. Although some tailoring data may be obtained from existing data bases like a patient's computerized medical record (54), in most cases a questionnaire or survey must be developed to measure a person's status on the factors identified in Step 1. These surveys may be self-administered, administered by an interviewer, or even administered by an interactive computer program. Whatever the format, their distinguishing characteristic is the close-ended nature of the questions. In order to create all possible tailored messages before the assessment takes place, the response choices to each question must be known. Because of this, a major task in developing the assessment tool is determining which response choices will accompany each assessment question. For the sake of efficiency, it is important to select the fewest number of response choices that will capture the largest percentage of respondents. Importantly, the need for reducing the scope of an assessment is not driven by limitations in the process or capabilities of computer tailoring, but rather by the objective of developing concise surveys that will not be a burden for individuals to complete. If completing a tailoring assessment becomes excessively demanding or time consuming, we might find that people would rather spend their time wading through a nontailored booklet!

As an example, imagine that 100 smokers were surveyed in an open-ended format and they gave 15 different reasons for wanting to quit smoking. If 90 of these smokers gave 1 of 5 reasons and the remaining 10 smokers each give a different reason, you must consider the trade-offs involved in including just those 5 most common answers as response choices versus including all 15 answers as choices. The issue boils down to practicality versus comprehensiveness, and unfortunately we have no empirical data to guide this decision. Regardless of which decision is made, this step in the development process still involves identifying appropriate questions and response choices to include in the tailoring assessment. Many research papers present such data, as do review articles that summarize existing knowledge about changing a particular behavior. In many cases—especially with theoretical variables—questions with established psychometric properties already exist and can be used as is or modified slightly to meet the needs of the tailoring assessment.

Step 3: Creating Tailored Messages

The assessment tool you have created will provide the framework for developing what is called the tailored message "library." The tailored message library is a computer file which consists of all possible message elements (both text and graphics) that could be provided to an individual participant. Development of such a library can be fairly complex, and only the simplest process is described here. In a four-column table, write the first assessment question in column 1 and list all its response choices in column 2, one response choice per row. In the third column write down intervention strategies that would be appropriate for a person who gave each particular response to the assessment question. For example, if the question in column 1 asked smokers, "Have you ever tried to quit smoking?," column 2 would list the options of "Yes" and "No." In column 3, adjacent to the "Yes" answer, strategies might include self-monitoring, recognition of high-risk situations, building coping and problem-solving skills, reattribution training, and stimulus control or avoidance (55). In column 4, briefly describe how each intervention strategy might be communicated via a tailored message or tailored graphic. These brief descriptions in column 4 are called "message concepts" (56) and are the basis for the actual messages to be created. Message concepts that are well-received in pretesting conducted with members of the intended audience should be further developed into full-length tailored messages. The final versions of all full-length messages are put into the message library, and each message element is assigned a name. For example, a message designed to

help smokers deal with a barrier to quitting like concern about weight gain might be named "BARRIER.WEIGHT.GAIN."

Step 4: Developing a Data Base

Once the tailoring assessment has been administered, participants' responses must be recorded in a way that allows them to easily be converted into the appropriate tailored messages. Again, there are multiple options for doing this, but one of the simplest ways is to create a computer data base with at least one data field for each assessment question. As in coding any survey, each question can be assigned a variable name, and each response choice can be assigned a numeric value. For example, if Jane Doe's record in the data base showed a value of "3" in the field named "QUIT.SMOKING.BARRIER," we would know that she had indicated "concern about weight gain" as an obstacle to quitting smoking.

Step 5: Developing Tailoring Algorithms and a Computer Program

It is neither the purpose of this paper nor is it feasible in the space provided to explain all the computer programming aspects of tailoring, so only the most general concepts are presented here. In short, a data base has been created to house participants' answers to the assessment questionnaire and a message library has been created to hold all possible message elements. The task in Step 5 is to formalize the logic, or decision rules, that link these two entities, and write the computer code to automatize that linkage. Here is the simplest solution. Tailoring algorithms can be written in pseudo-code—a series of "if/then" logic statements that join each assessment response with the appropriate tailored messages. Following the example from Steps 3 and 4, an algorithm might read, "if QUIT.SMOKING.BARRIER = 3 then take BARRIER. WEIGHT.GAIN message from the tailored message library and put it in the tailored quit smoking plan." In other words, if Jane Doe said concern about weight gain would keep her from quitting, give her the tailored message addressing weight gain as a barrier to cessation.

Microsoft Word® for Windows or Macintosh is one commonly used and widely available software package capable of processing such code. When such code is combined with the message library in the form of a Word® document (following specific nomenclature and guidelines described in the user's guide), the document will function as a kind of tailored message generator. When this message generator is linked to a data base using the "merge" command in Word®, it will produce tailored output. In the last year, new software programs have been designed to simplify and automate this process. Although we as yet have no direct experience with these programs, several are now commercially available and have recently been reviewed by a leading computer magazine (43,57).

When all tailoring algorithms and/or computer code have been created, they must be tested extensively. Providing the wrong message to a person (a "tailoring misfire") will not only compromise the credibility of the program, but also could harm the message recipient if inappropriate actions are recommended. For example, if recommendations to engage in vigorous exercise were inadvertently sent to a person who has a serious heart condition, the consequences could be severe if the messages were acted upon.

Special Considerations

Although this section has focused on developing tailored print materials, the basic process of creating and delivering tailored communication is the same for other media as well. Only the specific production tools used (e.g. cameras versus computers, psuedocode versus hypertext markup language [HTML]) and costs for development and implementation will vary. This paper should provide the enterprising novice with enough information to begin experimenting with simple print tailoring programs. For such first-time tailored intervention planners, we strongly recommend starting with smaller-scale pilot type projects.

This paper does not address many of the finer details needed to build and operate more complex and comprehensive tailoring programs. These details include designing a feedback template with spatial boundaries for each message, establishing and complying with parameters for message length, using creative methods to present different messages, writing and programming default messages, and pretesting tailored messages and algorithms. These important issues and others are discussed in much greater detail elsewhere (58).

Two specific issues that do deserve special attention here are dealing with missing data and data collected at multiple points in time during a longitudinal trial. In dealing with missing data, the first priority should be recontacting the participant to gather whatever information was not originally provided. If this cannot be done, there are three basic options for creating tailored messages in the absence of data: (a) provide no message; (b) provide an existing tailored message; or (c) provide a more generic default message. Providing no message is the simplest option, but it has several major drawbacks. First, potentially important topics may be left unaddressed altogether. Second, if the feedback template has designated a space for a given message, having no message to put there will leave a large empty area on the final printed materials. Providing an existing tailored message from the message library can help avoid both of these problems, but it is not without risk. For example, the substitute message selected may be inappropriate for the individual. In most cases, providing a generic default message is the best option for dealing with missing data. A default message is one in which the content addresses a specific topic (e.g. barriers to mammography) but does so in a generic way such that it should not be inappropriate for any given recipient.

If data for a tailoring program are being collected at multiple points in time, it is often necessary to link data from each of these assessments and consider changes from one point in time to the next. In such cases (e.g. a weight management program that seeks to track how much weight a participant loses over time), variables from both past and present assessments must be processed simultaneously to generate the appropriate iterative or ipsitive feedback. Missing data are especially troublesome in such programs; thus effective strategies for obtaining complete data are critical.

DISCUSSION

Results of tailoring studies conducted to date show promise but not conclusive results. In the recent Clinical Practice Guidelines on cigarette smoking cessation developed for the Agency for Health Care Policy and Research (AHCPR), Fiore and colleagues (59) refer to tailored materials as a promising avenue for smoking cessation. The Guidelines committee, however, was not ready to fully endorse the strategy, stating that, "Further research should be done on such innovative approaches to self-help (e.g. computerized, personalized interventions)." There are clearly many ways of tailoring materials, many ways to deliver such materials, and many possible responses to such materials (19).

There are also many potentially fruitful settings for tailored messages. The Cancer Information Service (CIS), for example, mails literally hundreds of thousands of print materials to callers each year—none of these materials are tailored to the specific needs of an individual caller. Having moved to an automated call record format, the CIS is in an ideal position to collect information from callers using computer-assisted telephone interviewing (CATI) technology and to develop tailored materials for a broad spectrum of health-related materials. Such a system has the potential for increasing both the effectiveness of the mailings and the efficiency of the call.

Consumer demand for health information is steadily increasing. McGinnis, Deering, and Patrick (60) report that telephone inquiries to the Public Health Service's health information clearing-houses more than doubled in the early 1990s and that mail inquiries grew by 43%. More than two-thirds of consumers have questions about their personal health (61). Yet, a 1994 survey published by the Medical Library Association found that nearly 70% of respondents reported problems in gaining access to relevant health information.

Research using tailored materials. also leads us toward a promising but highly uncertain future of new health media. In the June 1995 issue of the *American Journal of Public Health*, C. Everett Koop states that "cutting-edge technology, especially in communication and information transfer, will enable the greatest advances yet in public health. ... Eventually, personal home telemedicine links could provide every home with access to health information 24 hours a day, 7 days a week, encouraging personal wellness and prevention and leading to better informed decisions about health care. A generation of children raised on video games will probably be more attuned to health messages coming from interactive videos than from lectures by the school nurse" (62). Yet, the growing use of technology for health promotion and disease prevention should not simply be juxtaposed to traditional approaches. Certainly combinations of "high-tech" and "high touch" are possible and may have important synergistic effects.

Within the next decade, it is likely that traditional mass communication channels such as television and print media will evolve into "micro-mass" channels, creating opportunities to disseminate health programs that tailor messages to specific risk factors, stages of change, and health beliefs of users (63). As we better understand this technology and its effects, we should be able to better inform the public about health risks, encourage informed decision-making, and encourage adoption of healthier behaviors and life-styles. We regard our current research and proposed research as a significant, though early, step toward understanding and harnessing the power of more interactive, vivid, and engaging media formats (e.g. interactive television).

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