

## Theory-comparison and multiple-behavior research: common themes advancing health behavior research

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### Abstract

Research that seeks to compare and contrast theories of behavior change and assess the utility of a particular theoretical model for changing two or more health-related behaviors is critical to advancing health behavior research. Theory-comparison can help us learn more about the processes by which people change and maintain health behaviors than does study of any single theory alone and thus has the potential to better guide the development of intervention. Multiple-behavior interventions promise to have much greater impact on public health than single-behavior interventions. However, theory-comparison and multiple-behavior research presents several emerging challenges. These include finding new ways to enhance recruitment and retention, especially among diverse populations; improving treatment fidelity; developing common metrics across behaviors that can be used to advance the measurement and assessment of behavioral change; and expanding the reach and translation of intervention approaches that have demonstrated efficacy. This paper discusses the rationale for

conducting theory-comparison and multiple-behavior research and presents several common themes that have emerged from the work of the National Institutes of Health Behavior Change Consortium (BCC). The activities of each BCC workgroup and the potential contribution of each to these common themes to advance health behavior research are also described.

### Introduction

The Behavior Change Consortium (BCC), sponsored by the National Institutes of Health (NIH), the American Heart Association and the Robert Wood Johnson Foundation, was initiated to support a new generation of research on innovative approaches to disease prevention through behavior change (Ory *et al.*, 2002a). The goal of this initiative has been to stimulate the investigation of innovative strategies designed to initiate and maintain changes in health behaviors.

In addition to demonstrating the efficacy of a single theory or single behavior change program, the intervention studies of the BCC also provide a unique opportunity to compare theories of behavior change and assess the utility of a particular theoretical model for changing two or more health-related behaviors. The collective work of the BCC is oriented toward identifying common theoretical and methodologic themes of interest to advancing health behavior research. This paper discusses the rationale for conducting theory-comparison and multiple-behavior research, and presents several common themes that have emerged from the work of the BCC and its workgroups.

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### Rationale for theory-comparison research

Research on theory-based intervention in changing health behavior has increased dramatically (Smedley and Syme, 2000). Most of the research has focused on studying the explanatory and predictive validity of individual theories, including the Health Belief Model (Rosenstock, 1966; Becker, 1974), Self-Determination Theory (Deci and Ryan, 1980), Social Cognitive Theory (Bandura, 1977), Theory of Reasoned Action/Planned Behavior (Ajzen and Fishbein, 1980; Ajzen and Madden, 1986) and the Transtheoretical Model (Prochaska *et al.*, 1992), among others. Indeed, these theories have formed the familiar dialectic of the theoretical perspective that has dominated the field of research in health behavior (Allegre and Roizen, 1998).

These theories can be categorized as belief-attitude theories, competence-based theories, control-based theories and decision-making theories [e.g. (Biddle and Nigg, 2000)]. The emphasis of most of these theories is on understanding the cognitive psychology of the individual, either alone or within the context of the individual's social environment, and from the point of view of several key constructs (i.e. motivation, intentions and behavior). Such theories reflect a long-standing preoccupation with psychological and social-psychological factors that have been shown to be critically necessary although not sufficient 'determinants' of health behavior (Sallis and Owen, 1999).

Broader approaches to understanding health behavior have emerged and are increasingly pursued in health promotion and health behavior change research. These include ecological models [e.g. (McLeroy *et al.*, 1988; Green and Kreuter, 1999)] and community models of intervention [e.g. (Minkler and Wallerstein, 1997)], where individual psychology comprises but one element of the broader social and environmental context in which health behavior is determined. For example, large-scale studies of population-wide cardiovascular risk reduction conducted at Minnesota (Luepker

*et al.*, 1995), Stanford (Farquhar *et al.*, 1990) and Pawtucket (Carleton *et al.*, 1995), supported by the National Heart, Lung and Blood Institute, were among the first generation of studies to synthesize these broader theoretical perspectives in the design of community intervention programs. While such perspectives have demonstrated differential utility in explaining modest percentages of variance across different behaviors and populations, they have proved useful in providing a more general understanding of the process of health behavior change at both individual and community levels.

Intervention approaches have since been expanded to include advocating for policy changes. Policy approaches have been applied to several studies of health behavior change, including those directed at smoking cessation, increasing physical activity, and improving diet and nutrition (International Longevity Center, 1999); however, research with ecologic and community models of health behavior has sought to study the theories singly, not in comparison.

Comparing and contrasting theories can be fruitful for several reasons. First, as Maddux has suggested, it is counterproductive to hold statistical horse races to see what theory brings about more behavior change and discard the 'loser' (Maddux, 1993). Theory-comparison research may help behavioral and social scientists engaged in health behavior research to avoid Marsh's concept of the 'jingle-jangle' fallacy (Marsh, 1994). Theory comparison can inform if the same constructs are being addressed but labeled differently (jingle) or if the theories operationalize the same construct differently (jangle). Moreover, studying multiple theories simultaneously allows for empirically driven integration of theories and may lead to the construction of a more complete or holistic theory of health behavior change than currently exists.

Second, theory comparison can help us learn more about the behavior change process than does study of any theory in isolation and thus better guide intervention development. While one theory may contribute to our understanding of how best to motivate an individual to adopt a new health behavior, another theory may contribute to our

understanding of how an individual maintains that behavior change over time. In addition, moderators (e.g. minority status and age) may differentially influence the effectiveness of theories. Moreover, while a particular theory may be appropriate if the disease of interest is proximal, a different theory may prove useful to elicit the desired behavior if the disease to which it is relevant is temporally removed.

Finally, comparing and contrasting theories may help us to understand that some behavior change and the observed variance in change cannot be explained at all by existing theories, perhaps necessitating the development of entirely new theories, and the identification of new variables and novel measurement strategies.

Regardless of the aims, theory-based research will improve our understanding of the health behavior change process. Theory-based research allows for: (1) an understanding of the mechanism of behavior change involved, (2) an understanding of the underlying reasoning of why the mechanism worked or failed, (3) identification of what mediators of behavior an intervention should target and (4) the design of evaluations that can determine why an intervention was (or was not) successful (i.e. process to outcome analyses).

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### **Rationale for multiple-behavior research**

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Smoking, high-fat diet and physical inactivity are three behaviors underlying the most preventable causes of disease and death in the US (National Center for Health Statistics, 1997) and are three of the top five priorities of *Healthy People 2010* (US Department of Health and Human Services, 2000). In 1997, an international panel of cancer experts concluded that as many as 30–40% of all cancer cases worldwide could be avoided if people ate a healthy diet, avoided obesity and got enough exercise (Hellmich, 1997). Although multiple risk factors are associated with a heightened risk of morbidity and mortality, the majority of health promotion interventions address risk factors as categorically separate entities, with the exception

of obesity and diabetes interventions. Yet we know that health behaviors often cluster. For example, in a sample of 1559 manufacturing workers, 46% of smokers had two other risk factors (diet and inactivity) compared to 28% of non-smokers (Emmons *et al.*, 1994). Further, the rate of heart attack increases from 46 per 1000 persons at risk with one risk factor (smoking) to 95 per 1000 persons at risk for a combination of three risk factors [smoking, hypertension and hyperlipidemia (American Heart Association, 1997)]. Thus, a potentially more effective paradigm may be to target multiple behaviors by developing intervention approaches that integrate what we have learned from modular approaches in order to focus on behavior-change issues common or generic to several risk behaviors. The critical questions of interest are: Is it valuable to work on multiple behaviors simultaneously or should one behavior be addressed at a time? What are the key behavioral constructs and processes common to these problem behaviors? How do multiple behaviors interact to increase or decrease health risks?

There is growing evidence that multiple-behavior interventions have the potential for much greater impact on public health than single-behavior interventions. The risk of cardiovascular disease can be lowered by 50–70% when people quit smoking and by 45% by maintaining a physically active lifestyle (Manson *et al.*, 1993). If intervening on a single behavior can yield such significant improvements in public health, the natural extension of such a corollary is that intervening on multiple behaviors has the potential to greatly increase the impact of the intervention on public health across different diseases. Furthermore, changing multiple health behaviors should result in more favorable benefits measured in terms of quality of life outcomes and health care utilization. Given the growing interest in developing effective theory to both understand and intervene on multiple health behaviors, surprisingly little is known about what is the most effective way to intervene on multiple behaviors (Smedley and Syme, 2000; Emmons, 2001).

For example, regular physical activity aids in decreasing both physiological and psychological responses to stress and helps reduce depression, which often accompanies smoking cessation (Hughes, 1984; Holmes and Roth, 1988). Preliminary studies have demonstrated the utility of physical activity in enhancing quit rates and decreasing the likelihood of relapse following smoking cessation (Marcus *et al.*, 1991, 1995). Physical activity also results in increased caloric expenditure, which may lessen the post-smoking cessation weight gain that often leads to relapse (Hall *et al.*, 1989; Klesges *et al.*, 1991). There is also some evidence that adopting physical activity leads to dietary changes (Kano and Tucker, 1993). For example, physical activity is not only inversely related to fat intake, it seems to act as a mild appetite suppressant, at least for the first few hours following exercise training (Wilmore and Costill, 1994). Finally, in a study of the cognitive-behavioral mediators of changing multiple behaviors in smokers, King *et al.* found significant relationships in decisional balance and self-efficacy between smoking and physical activity (King *et al.*, 1996). This study provided preliminary cross-sectional data on how change in one risk behavior (smoking) may relate to change in another (physical inactivity).

Despite such intriguing evidence, it is currently unknown whether treating more behaviors is more or less effective than treating fewer behaviors and, if so, why. Treating multiple behaviors may have a positive effect due to the multiple exposures to the principles of behavior change. Conversely, treating multiple behaviors may be less effective due to the increased response burden produced by trying to change several behaviors at once. Moreover, there may be a maximum number or hierarchy of order of behaviors that individuals can better cope with trying to change at any given time and with different incentives. Understanding the best ways to change multiple risk behaviors and what motivates those changes is essential for designing effective intervention programs at both the individual and population levels.

The impact of an intervention is partly determined by the percent of the target population

recruited and the efficacy of the intervention, i.e.  $\text{intervention impact} = \text{recruitment} \times \text{efficacy}$  (Abrams *et al.*, 1994). Recently, another dimension of intervention impact, *retention*, has been added to this equation, i.e.  $\text{intervention impact} = \text{recruitment} \times \text{retention} \times \text{efficacy}$  (Marcus *et al.*, 2000). This equation could be expanded to assess the impact of multiple-behavior interventions, i.e.  $\text{intervention impact} = \text{recruitment} \times \text{retention} \times \text{mean efficacy} \times \text{number of behaviors}$  (the mean efficacy may be each behavior's effect size multiplied by a coefficient derived from the contribution to all cause mortality, which is then averaged for behaviors addressed). In addition to evaluating a summary estimate of behavioral change, projected reductions in morbidity and mortality will inform public health impact and decision making (Woolf, 1999).

Developing integrated intervention approaches that can take advantage of the data pointing to the synergy that exists between multiple health behaviors and what is known about the impact of intervention, however, will require a better understanding of what behaviors are the most difficult to change and maintain, why and how these behaviors can be best used as examples. In addition, further research is required to better understand the relationship of dose to response (Steckler *et al.*, 1995), i.e. whether intervention dosing based on one theory is equivalent to intervention dosing based on another theory and, related, if intervention dosing based on one behavior is equivalent to dosing of a different behavior.

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### **Common themes in theory-comparison and multiple-behavior research of the NIH's BCC**

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The BCC has endeavored to support cross-site collaborations that are designed to begin answering such questions by supporting theory-comparison and multiple-behavior research. BCC workgroups are engaged in activities on several common themes in theory-comparison and multiple-behavior research (Figure 1). These include recruitment

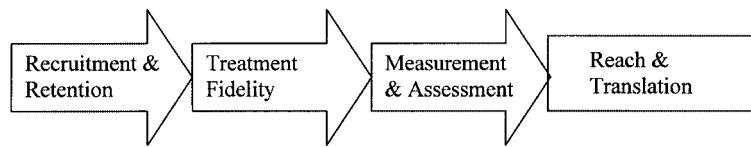


Fig. 1. Common themes in theory-comparison and multiple-behavior research.

and retention, treatment fidelity, measurement and assessment, and reach and translation.

### Recruitment and retention

A critical issue in advancing the next generation of health behavior research is conducting representative recruitment and implementing strategic retention plans, especially among underserved populations. While there is a basic understanding that meeting recruitment goals is critical for the scientific integrity of the proposed research, until recently this has been seen as an administrative problem rather than as an area of scientific inquiry (Ory *et al.*, 2002b). Similarly, there is a lack of information on the factors associated with preventing attrition, particularly among underserved populations. There is an urgent need for systematic, empirical research that compares the effectiveness of different approaches to recruitment and retention; that examines the factors and conditions that maximize recruitment and retention; and that assesses various methods most sensitive to the needs of ethnic and racial minorities. Such studies need to consider the recruitment and retention complexities in the context of an increasingly urban, multi-ethnic and multi-racial society (Levkoff *et al.*, 2000).

To evaluate the effectiveness of multiple-theory and multiple-behavior interventions in an unbiased and scientific manner, mechanisms to ensure that the maximum number of representative study participants are recruited and retained throughout the investigation need to be developed and refined. Recruitment and retention are paramount to ensure generalizability of results and may affect statistical power and an investigation's effect size (Altman *et al.*, 2001); however, recruitment and retention remains a challenge to investigators (Wragg *et al.*, 2000). These challenges may be magnified in theory-comparison and multiple-behavior research

where the number of assessments and the dose of the intervention increases, requiring more time from the participants, potentially influencing completion and adherence rates.

The BCC recruitment and retention workgroup is endeavoring to provide an open forum for the discussion of recruitment and retention issues, including representative recruitment, retention plan development, ongoing problem solving of compliance barriers, and evaluation of general and population-specific recruitment and retention techniques. In addition, this workgroup disseminates the most up-to-date recruitment and retention strategies, materials, resources and evaluation methods. This is in an effort to strengthen the validity and generalizability among BCC-funded research projects that study highly diverse groups with variable medical conditions and social environments, and to advance knowledge of recruitment and attrition biases in the social and behavioral sciences.

### Treatment fidelity

To further ensure both internal and external validity of intervention research, treatment fidelity must be maximized. Treatment fidelity involves both *treatment integrity* (the degree to which a treatment condition is implemented as intended) and *treatment differentiation* (whether the treatment conditions differ from one another as intended) (Moncher and Prinz, 1991). Verification of treatment fidelity is integral to both the interpretation and generalization of research findings. Treatment fidelity can inform whether a 'type 3' error is made, concluding that the intervention is ineffective, when in fact it was never implemented.

Elements underlying treatment fidelity, include:

- (1) Design: Is the study consistent with the underlying theory?

- (2) Training: Has the provider acquired and maintained the requisite skill?
- (3) Delivery: Was the intervention delivered as intended?
- (4) Receipt: Did the participant understand the intervention?
- (5) Enactment: To what extent are the behaviors, skills, and/or cognitive strategies implemented by participants in real life settings?

The BCC has established a treatment fidelity workgroup whose overall aim is to advance the definition and measurement of treatment fidelity and adherence in order to facilitate the interpretation of findings and increase our understanding of the relationship of treatment intensity and dosage to treatment outcome. The workgroup also provides BCC investigators with the information and resources needed to ensure that interventions are delivered as intended, and that the dose delivered and the dose received are measured in a quantifiable manner for use in treatment validity, treatment outcome and treatment cost-effectiveness analyses. Based on existing models of treatment fidelity (Moncher and Prinz, 1991; Lichstein *et al.*, 1994), this workgroup is developing and will disseminate best practice guidelines to enhance treatment fidelity in behavioral interventions.

### Measurement and assessment across multiple behaviors

Conducting multiple-behavior research requires identification and organization of common measurements and assessment criteria across constructs and behaviors. There are three key issues when identifying similarities in constructs and measures between behaviors to standardize assessment. First, the *equivalence* of change in different behaviors has not been investigated. For example, is the equivalence of a one-cigarette reduction or an increase in a serving of vegetables the same as being physically active for 30 min in reducing morbidity and mortality? Does a dichotomous or a continuous conceptualization hold greater utility in prediction? It is also important to consider *effect size* within this topic of inquiry. For example, BCC intervention studies include a comparison condition

so effect sizes can be calculated for each study to express a standardized treatment difference. This will allow for an interpretation of the differential magnitude of behavioral change effects for the different theories and when interventions are applied to different behaviors. Of course, because effect sizes are expressed in standard deviation units, they can and do vary with different populations, and with different inclusionary/exclusionary criteria, so this must be accounted for in comparative analyses. Another notion of equivalence is as an input and assessment of the resources needed to effect a behavioral change. With this interpretation the issue is the meaningful quantification of the resources across behaviors.

Second, instead of metric comparisons, an evaluative perspective could be adopted to identify a consensus definition of a 'successful' outcome or criteria in each behavioral domain. For example, for smoking 7-day abstinence rates (Fiore *et al.*, 2000), for diet interventions using a '5-a-day' behavioral criteria (Potter *et al.*, 2000) and for physical activity using the recommendations published by CDCP/ACSM (Pate *et al.*, 1995) may be adopted.

The third key issue when identifying similarities in constructs and measures between theories is *documenting and measuring progress* in the treatment population. Do we focus on and measure progress towards achievement of individual behavioral goals or do we focus on a single criterion success? In either case, interpretation of progress needs to include the clinical and the public health significance of behavioral changes.

Resolving measurement issues in theory-comparison and multiple-behavior research can aid in advancing our capability to understand relative contributions and trade-offs, and provide evaluation criteria to apply to any health behavior. This presents the opportunity for comparing interventions to establish whether different treatments are more or less effective across health behaviors. However, with using a common metric across behaviors, the issue of similarity of criteria may need to be addressed. For example, is being physically active for 30 min or more on most days

of the week on the same 'difficulty level' as quitting smoking, or eating five servings of fruits and vegetables a day?

Using the same metric across behaviors also facilitates the identification of gateway behaviors. A gateway behavior can be thought of as a behavior that, when intervened upon, has a positive influence on other behavior changes. Generally stated, it may be that only a few behaviors are related to general health of a specific population. There is preliminary evidence that points toward this possibility as a large number of behaviors are somewhat related (Nigg *et al.*, 1999). Examining the effect of single behavior change interventions on other health behavior changes is a first step to further develop knowledge regarding potential gateway behaviors.

The BCC workgroup on transbehavioral outcomes assessment is working to further the science of health behavior change and maintenance through cross-project collaboration by working on these kinds of issues. The workgroup has been working to explore the development of transbehavioral indices or assessment methods (such as a behavior change index) to be used in behavior change research regardless of behavior being addressed.

### **Reach and translation**

Despite considerable advances and increasing evidence supporting health behavior interventions, few programs that have been demonstrated efficacious have been adopted in practice settings. Among the major reasons for the failure to adopt effective programs include the concern about the ability to generalize from non-representative efficacy studies, barriers to adoption under constraints of limited time and resources, and difficulties with consistency of implementation.

In general, the next generation of health behavior research needs to more closely consider issues of external validity. The studies involved in the BCC and other recent intervention research [e.g. (Glasgow *et al.*, 1996; Nigg *et al.*, 1997; Brug *et al.*, 1998)] have paid greater attention to the representativeness of individual participants than have previous studies. Work such as this

provides an important step in the effort to advance our understanding of health behavior change, and how this can be translated into behavioral and environmental changes that facilitate improvements in individual and population health. The representativeness of the settings in which multiple-theory and multiple-behavior research takes place, and the intervention agents conducting the treatment are equally important as the representativeness of individual participants, but have received less attention (Glasgow *et al.*, 1999, 2002).

Recommendations for ways in which to increase adoption by target organizations (e.g. worksites, health care settings and schools) and the likelihood that intervention activities will be maintained after the formal evaluation is completed, include: (1) involving such organizations in intervention design beginning at the earliest stages of program planning, (2) collaborative partnerships by investigators to disseminate successful programs to target organizations, (3) reducing barriers to participation requirements and exclusion criteria for organizations, and (4) paying attention to issues of feasibility and breadth of appeal when designing interventions and contact schedules. The increased understanding through multiple-theory investigations, and the increased impact and applicability of multiple-behavior programs, should facilitate translation efforts as organizations today are less interested in having to adopt a separate health promotion program for every separate target behavior or risk factor.

With funding from the Robert Wood Johnson Foundation, the BCC workgroup on reach and translation is attempting to systematically address reach and translation issues through a two-part project that is designed to develop, implement and evaluate a framework to measure intervention impact in its broadest sense (that takes into account issues of internal and external validity). This work is based on the earlier work of Glasgow *et al.* (Glasgow *et al.*, 1999) who have suggested that multilevel interventions are evaluated based on their settings, goals and purpose. The RE-AIM framework for assessing such intervention includes the dimensions of reach, efficacy, adop-

tion, implementation and maintenance. The reach and translation work group is further refining the RE-AIM framework, has surveyed the various BCC projects about how they are addressing these various issues and is serving as a coordinating resource for projects having the goal of translating their results into practice.

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### Conclusion

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The mission of the BCC is to further the science of health behavior change by supporting individual projects and through cross-project collaboration that can shed further light on the processes by which people make and maintain changes in behaviors that can promote health or prevent disease in different populations and in different settings. By stimulating a wide range of cross-project collaborations, the BCC supports unique efforts for theory-comparison and multiple-behavior research that can better integrate empirical theory in our efforts to change human health behavior. Conducting theory-comparison and multiple-behavior research presents several emerging challenges but needs to be recognized as a priority research area. This includes finding new ways to enhance recruitment and retention, especially among diverse populations; improving treatment fidelity; developing common metrics across behaviors that can be used to advance the measurement and assessment of behavioral change; and expanding the reach and translation of effective intervention approaches. Such work promises to provide a stronger basis for advancing our knowledge of the processes by which people change and maintain health behaviors and how we can best facilitate those processes.

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