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A META-ANALYTIC EXAMINATION OF DECISIONAL BALANCE

ACROSS STAGE TRANSITIONS:

A CROSS-SECTIONAL ANALYSIS AND CROSS-SEQUENTIAL

CROSS-VALIDATION

BY

KARA L. HALL

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE

REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

PSYCHOLOGY

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2004

Abstract

Interventions to decrease unhealthy behaviors and to increase healthy behaviors are crucial for health promotion and disease prevention. Computerized tailored interventions provide a promising approach for creating positive health behavior change. The Transtheoretical Model (TTM) delineates a way to conceptualize behavior change, provides the foundation for developing assessments of an individual's readiness to change, and is utilized in tailoring interventions for actualizing behavior change. To produce optimally tailored interventions: (1) theory that guides interventions needs to be comprehensively tested; and (2) empirical data that drive the tailored interventions needs to be systematically generated. This program of research tests theoretical assumptions of the model and begins to outline necessary tailoring data, and does so in three main phases: (1) comparison of effect size procedures; (2) cross-sectional meta-analytic investigation of the Stages of Change and Decisional Balance; and (3) a cross-sequential cross-validation study of the cross-sectional study.

In meta-analyses, essential information for calculating effect size is often missing in published studies. Such missing data precludes the inclusion of studies in the meta-analysis thereby introducing bias to the review. Methods to utilize as much data as possible are invaluable to meta-analytic work. A comparison of effect size procedures was conducted in order to identify a bias correction for studies otherwise unusable. The study included 38 studies, with a total of 46 datasets for each of the Decisional Balance measures. Hedge's g provided a 10% larger effect size than a standard score method of effect size estimation for both the Pros and Cons measures.

A single correction equation was developed to allow the use of standard score estimation in future meta-analytic work with these constructs.

The second phase of this program of research utilized meta-analytic procedures with longitudinal data to examine 146 datasets across 55 behaviors spanning 18 countries and including 85,272 participants. This study identified a 2-factor structure for the Pros and Cons in 96% of the studies, with a crossover occurring before the Action Stage in the majority of studies. Overall magnitudes of effect were larger in the earlier Stages for Pros and in the later Stages for Cons. Heterogeneity of effect size distribution was found and moderators assessed. Generalizability of these constructs were supported, especially across behaviors and populations. Moderators of effect were found to be differentially related across particular Stage transitions but in no readily apparent pattern.

Thirdly, longitudinal changes in Decisional Balance across the Stages of Change were assessed across the Stage transitions using a cross-sequential approach. Overall magnitudes of effect were somewhat larger for the longitudinal data. Similar magnitudes of effects for cross-sectional adjacent stage transitions and longitudinal stage movements in the early stages were found between cross-sectional and cross-sequential profile for the two behaviors examined.

Overall, the use of preexisting studies can lead to groundbreaking empirical data for the development of more comprehensive and more precisely tailored health prevention and disease prevention interventions and further research will continue to delineate important patterns of relationships between these variables.

Acknowledgements

There are certainly so many folks to thank for making this project possible. I would like to start by thanking my mother for her love and support through this long endeavor. Her patience and her great cooking kept me going.

I would like to thank all the researchers around the world for the data that made this work possible, especially to those who took the time to provide me with data that was otherwise unavailable. In particular I would like to thank Stefan Keller for his extensive contributions. From across the country, Scott C. Roesch went above and beyond to answer my questions as time ran short – I owe him many thanks. With certainty, the breadth of this project would not have been possible without the help of undergraduate research assistants, most notably Aimee Martel.

During the past 6 years, Dom Valentino has given me endless unwavering unconditional support -- always there full of kindness and sincerity. I am so grateful to have such an amazing person in my life. A special thanks to Jim Campbell for being there at the right time, offering up the right help at the right moment. Thanks to my friends and colleagues for those things big and small that make a difference, especially to Leanne Mauriello, Andrea Paiva, Paul Krebs, Bettina Hoepner, Milena Anachakova, Colleen Redding, and Kathy Meier -- I thank them for being there.

Thanks to my dissertation committee for helping me through the project. Thanks to Bryan Blissmer for sticking with me through all the milestones and the countless pages that came with them. I thank Mark Robbins

for, among many things, keeping the laughing going day after day after day after long day. Jim Prochaska offered me an intellectual forum in which to thrive, I am grateful to him for that – and I look forward to continuing my intellectual growth with all the great minds at the Cancer Prevention Research Center.

This project and so many of my achievements could not have been possible without Joe Rossi. His dedication and mentorship has been a great gift. I thank him for the countless emails, lunches, and of course sushi that were essential components to this intense process. My sincerest gratitude goes to him for all his efforts and his generosity.

Dedication

To my husband Seth – with all my love.

I look forward to sharing the rest of our lives together.

Preface

This dissertation document combines the standard format and the manuscript format in order to most comprehensively cover the relevant material while minimizing redundancy across studies. The document begins with an introductory chapter (Chapter 1) that sets the stage for the program of research as a whole. Chapters 2, 3, and 4 provide theoretical, methodological and practical background information. Chapters 5, 6, and 7 are written in manuscript format and detail the three main phases of the program of research. This program of research was conducted in 3 main phases: (1) comparison of effect size procedures (Chapter 5); (2) cross-sectional meta-analytic investigation of the Stages of Change and Decisional Balance (Chapter 6); and (3) a cross-sequential cross-validation of the cross-sectional study (Chapter 7).

The first phase, *Determining Effect Size for Meta-Analysis: A Comparison of Alternative Procedures*, provides an important methodological building block for the subsequent meta-analytic study. The *T*-score is a standardized metric frequently used in the body of literature explored in this program of research. This metric, similar to a *z*-score, has a mean of fifty and a standard deviation of ten. Unfortunately, *T*-scores means when reported are often unaccompanied by the specific standard deviation of the study groups. Since standard deviations are an essential element for effect size calculation, the potential for the loss of a large portion of data is present. This study examined alternative ways to calculate effect sizes based on available data and

compares effects size methods with other procedures and develops adjustment for bias in the resulting effect size calculation.

In the second phase, *A Meta-Analytic Examination of Decisional Balance across Stage Transitions: Cross-sectional Analysis*, nearly 150 studies are combined to assess theoretical prescriptions of two primary constructs central to a commonly used behavior change model. The Transtheoretical Model of behavior change has been used around the world and across more than 50 behaviors to help elucidate the behavior change process and provide a framework for interventions for guiding that change process. This study examines a variety of relationships among the two behavior change factors, most notably the magnitude of effect for the relationship between the Decisional Balance measures and adjacent Stage of Change transitions.

The third phase, *A Cross-sequential Analysis and Cross-Validation of Decisional Balance across Stage Transitions*, provides an investigation of the primary relationships examined in phase two but does so with longitudinal datasets. Instead of examining the magnitude of the relationship of Decisional Balance across adjacent Stage transitions, Decisional Balance will be examined for group of individuals actually moving from one Stage to another. The results of the longitudinal data will then be compared to those of the cross-sectional data.

Overall, the main aims of this program of research are to: 1) quantitatively investigate the relationship of Decisional Balance and Stages of Change by identifying the magnitudes of effect for Decisional Balance in

relation to the transition between each adjacent Stage of Change; 2) more clearly delineate the patterns of change across and within behaviors; and 3) provide information that will help inform intervention development in order to create more efficient and effective health behavior change.

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CHAPTER ONE

OVERVIEW

Introduction

Interventions to decrease unhealthy behaviors (e.g., smoking and sun exposure) and to increase healthy behaviors (e.g., exercise and mammography screening) are crucial for health promotion and disease prevention. Tailored interventions provide a promising approach for creating positive health behavior change. In order to produce optimal tailored interventions: (1) the theory that guides interventions must be comprehensively tested; and (2) empirical data designed to drive the tailored interventions must be systematically gathered and analyzed.

Many theories have been developed to explain and to assist in behavior change. One theory, the Transtheoretical Model (TTM), has drawn from some of the most powerful processes and principles of change from across multiple theories of behavior and behavior change to form one comprehensive model. The model delineates a way to conceptualize behavior change, provides the foundation for developing assessments of an individual's readiness to change, and is utilized in tailoring interventions for actualizing behavior change. Since the development of the TTM, hundreds of health promotion and disease prevention studies around the world have used the model, yet many theoretical assumptions of the relationships between TTM constructs have not been thoroughly tested.

To date there has been no comprehensive examination of TTM constructs across behaviors. The common measures utilized in hundreds of studies, across the

many different content areas, research designs and populations, provide a unique opportunity for comparative and integrative analyses of important behavior change factors. Unique meta-analytic techniques will be used to analyze and compare cross-sectional and longitudinal datasets between and within multiple behaviors on two behavior change factors across five Stages of Change. This quantitative review aims to: (1) comprehensively identify if and when theoretical prescriptions of the TTM are maintained or if modifications of the model need to be made; and (2) update and expand the data that drives intervention development of tailored behavior change systems. Overall, this study will help bridge the gap in knowledge between theoretical prescriptions and intervention applications to create more efficient and effective population-based health promotion and disease prevention interventions – ultimately reducing the incidence of disease, such as cancer.

Health Promotion and Disease Prevention

The development of many diseases is often rooted in unhealthy behaviors. For instance, many behaviors that can lead to cancer, such as smoking and alcohol abuse, are preventable and many behaviors that reduce the risk of cancer, such as exercise and healthy diet, are readily attainable. Unfortunately, it is often difficult for individuals to change well-established but unhealthy behaviors, even when the need to do so is apparent and acknowledged by the individual, thus emphasizing the need for behavior change interventions.

Computerized Tailored Intervention Systems

Computerized systems that deliver population-based health promotion and disease prevention interventions have proven particularly effective when systems provide tailored feedback to each participant. The combination of advances in both the behavioral sciences and in computer technology has enabled the development of expert system interventions that guide and motivate individuals to change. Expert systems are broadly defined as computer programs that mimic the reasoning and problem solving of a human 'expert'. Early programs implemented the advice of an individual without the inclusion of empirical data (Negotia, 1985). In contrast, empirically based systems generate interventions driven more by science than opinion. Expert systems start with basic principles and theoretical decision rules and are then enriched with heuristics and empirical data.

Current expert systems provide tailored print feedback or interactive and immediate tailored feedback to each individual (Redding et al., 1999; Velicer et al., 1993; Velicer & Prochaska, 1999). Feedback includes both *normative* feedback, which compares the individual to other successful and unsuccessful individuals, as well as *ipsative* feedback, which compares the individual to his or her own previous responses.

Importance of Well-Tested Theory for Interventions (TTM)

To ensure maximum effectiveness of tailored interventions for behavior change, the theory that guides interventions must be comprehensively tested. Since many theoretical assumptions of the TTM have not been thoroughly tested, developing interventions based primarily on theory rather than empirical data may

prove problematic. This program of research will explore theoretical prescriptions and determine what, if any, modifications are appropriate to enhance this behavior change model.

Empirical Data for Optimally Tailoring Interventions

To date, no study has produced a set of empirical data to drive complex behavior change intervention systems; the paucity of available data results in interventions primarily guided by the theoretical principles alone. This study provides an empirical review of several TTM variables across a wide range of behaviors. Traditionally, the empirical basis for expert systems has been based on small-sample pilot data. In order to approach truly optimal tailoring, data that currently drive expert systems need updating. Additionally, a more precise understanding of where, when and on what to tailor need to be generated. An optimal tailoring approach can reduce demands on participants and costs to providers while increasing intervention effectiveness. Optimal tailoring can be achieved in part by systematically and quantitatively analyzing key relationships between various populations and behaviors across hundreds of available studies, both cross-sectionally and longitudinally.

Several studies have shown differences in intervention outcomes for adolescence vs. adults (Spencer et al., 2002; Weinstock et al., 2002), and males vs. females (Laforge et al., 2003; Weinstock et al., 2002) that suggest tailoring on particular demographics may be warranted. For example, in reexamining the work of Spencer et al. (2002), it was found that two of the three negative studies using partial or full tailoring involved adolescent smokers, while all but one of the positive results

were with adult smokers. Laforge et al. (2003) found differential effects for males and females in a tailored expert system intervention to reduce binge drinking in a college population. Weinstock et al. (2002) found differential outcomes for both gender and age in a randomized controlled trial of a tailored expert system intervention to reduce unprotected sun exposure. Meta-analytic procedures provide a unique opportunity to assess these variables across multiple data sets and behaviors.

Integrative Techniques

This program of research will utilize established meta-analytic procedures and employ new and innovative meta-analytic techniques and integrative analyses across more than one hundred and fifty cross-sectional and longitudinal data sets. The overall goal of this program of research is to produce a preliminary set of cumulative data specifically designed to guide the creation of “next generation” optimally tailored expert system interventions for behavior change.

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CHAPTER TWO

THE TRANSTHEORETICAL MODEL OF BEHAVIOR CHANGE

The Transtheoretical Model

Many different theories are utilized in behavior change interventions and serve as the basis for tailored interventions. One theory, the Transtheoretical Model (TTM) of behavior change, is particularly suited to provide the framework for individualized interventions using expert system approaches. The TTM involves three dimensions: the temporal dimension, the independent variable dimension, and the intermediate variable dimension (Velicer et al., 2000). The central organizing construct of the TTM characterizes behavior change over time through five distinct Stages of change: Precontemplation, Contemplation, Preparation, Action, and Maintenance. The independent variable dimension of the TTM identifies behavior change strategies through ten primary Processes of Change that are grouped into two higher order factors – the behavioral and experiential Processes. Two intermediate indicators of when the Stage of Change will occur are Decisional Balance (weighing of Pros and Cons) and Self-efficacy (Situational Confidence or Temptation).

Stages of Change

In health psychology, the concept of change occurring in a series of stages has been examined in efforts to understand the temporal aspects of change in human nature or behavior. An example of the stage concept can be seen in Horn's (1976; Horn & Waingrow, 1966) work with smoking behavior and cessation. Horn developed a four stage process of change investigating smoking behavior, which

consisted of 1) contemplation of change; 2) the decision to change; 3) short-term change; and 4) long-term change. Although arising independently and in a different context, the Stages of change as conceptualized by the TTM are similar to Horn's stages. Over the years, through its own evolution, the TTM ultimately identified five Stages (DiClemente, Prochaska, Fairhurst, Velicer, Velasquez, et al., 1991).

Historically, Prochaska and DiClemente (1982) identified the five Stages (Precontemplation, Contemplation, Action, Maintenance, and Relapse). Around that same time, (1983) developed the URICA (University of Rhode Island Change Assessment) Stage of change assessment instrument identifying five Stages (Precontemplation, Contemplation, Decision Making, Action, and Maintenance). Due to what appeared at the time to be lack of empirical support, Decision Making was dropped (McConaughy, 1989) and four Stages became the primary focus of subsequent study. In 1991 the Preparation Stage, similar to the Decision Making Stage, was reinstituted into the Stage of Change construct and in general has remained a part of the model (DiClemente et. al., 1991).

The algorithms for the five Stages of Change are specific for each behavior, but usually follow these general Stage concepts. Participants are considered to be in the Precontemplation Stage if they report an undesired status, that is, the presence of a problem behavior or the lack of a healthy one, and express no intention of changing in the next six months. Participants are considered the Contemplation Stage if they intend to change in the next six months. Participants in the Preparation Stage plan to change in the next month and have begun to engage in target behaviors, but have not yet met particular criteria. Participants reach the Action Stage once they have met the

given behavioral criteria. Lastly, if the participant has met the specified behavioral criteria for more than six months, they have reached the Maintenance Stage.

Processes

The TTM also includes a series of independent variables, the Processes of Change (Prochaska, Velicer, DiClemente, & Fava, 1988). The Processes represent strategies for changing one's behavior. The Processes of Change instruments that measure this construct assess affective, cognitive, evaluative, experiential, and behavioral activities as one moves through the Stages of Change. The Processes have been found to have a correlated higher order factor structure and measure change Processes that represent two primary dimensions, experiential and behavioral (Prochaska et al., 1988). In general, the experiential Processes include consciousness raising, dramatic relief, environmental reevaluation, self-reevaluation, and social liberation. The behavioral Processes include stimulus control, counter conditioning, reinforcement management, self-liberation, and helping relationships. Experiential Processes generally are considered to be more salient in the earlier Stages of Change whereas the behavioral Processes are considered to be more salient in the later Stages.

Self-efficacy/Temptations

Situational Self-efficacy (or Situational Confidence) and Temptations are variations of Bandura's self-efficacy construct (Bandura, 1977; 1982; DiClemente, 1986; Velicer, DiClemente, Rossi & Prochaska, 1990) and describe one's perceived confidence or temptation to engage in a behavior in particular challenging situations.

Most typically, when measuring Self-efficacy, a general Self-efficacy scale is reported. If subscales are found or reported, they most commonly are: Positive/Social and Negative Affect. Additional examples of subscales representing different types of situations include Emotional Situations, Skill Applications, Relapse Recovery (Dijkstra & deVries, 2000), Excuse Making, Resistance from Others (Rossi et al., 2000) and Habit/Addictive (Velicer et al., 1990). For Temptations, in addition to the most common subscales - Positive/Social and Negative Affect, other examples include Curiosity (Pallonen et al., 1998) and Habit/Addictive (Velicer et al., 1990).

Decisional Balance

The TTM originated by integrating theories of psychotherapy as well as incorporating constructs from alternative models. One of the most important and reliable TTM constructs, Decisional Balance, was inspired by Janis and Mann's (1977) conflict model of decision-making. Janis (1959) proposed a descriptive schema called a "balance sheet" of incentives. The four main categories of consideration for decisional conflicts are: a) utilitarian gains and losses for self; b) utilitarian gains and losses for significant others; c) self-approval or –disapproval; d) approval or disapproval by significant others. These four comparative categories of potential positive and negative incentives involve both instrumental effects of utilitarian objectives and nonutilitarian considerations such as issues of self-esteem and value-based determinations.

The development of the TTM Decisional Balance measure (Velicer, DiClemente, Prochaska, & Brandenburg, 1985) was based on the 8 factors (4 gains

and 4 losses) of Janis and Mann (1977). The researchers constructed the scale to study the decision-making process across the Stages for smoking cessation. Instead of achieving an 8 factor-structure as anticipated, principal components analysis identified two orthogonal components. These two components were called the Pros and Cons of Smoking.

Stage of Change and Decisional Balance

The Stages of Change and Decisional Balance will be the focus of the subsequent studies in this program of study, therefore special emphasis is given to these constructs.

Stages: The Central Organizing Construct

The Stages of Change are considered the central organizing construct because many of the theoretical assumptions and construct relationships are framed around this temporal process of change. Therefore, the role of the Stages of Change in the context of the Transtheoretical Model is important theoretically and practically.

A variety of theoretical prescriptions of the model center on the relationships between the Stages of Change and the intermediate (Self-efficacy and Decisional Balance) and independent variables (Processes of Change) that serve as guides for the development of health behavior change interventions. The TTM is particularly suited to provide the framework for individualized tailored interventions. The Stage of Change construct delineates the first hierarchical tier in the tailoring process. At each time point, an individual's "readiness to change" or Stage of Change is assessed. Feedback is then provided on an individual's Stage and all subsequent

feedback is framed within the context of that Stage. The independent dimension includes the ten Processes of Change, which delineate strategies to bring about behavioral change. The intermediate dimension includes Decisional Balance, which represents the weighting of the Pros and Cons, and Self-efficacy, which incorporates confidence and temptation to engage in particular behaviors across challenging situations. These two dimensions form the second tier of the algorithms that drive expert systems. Thus, individuals receive normative feedback on each independent and intermediate dimension with respect to others in the same Stage of Change and ipsative feedback based on how they previously performed on these measures.

Measuring Stage of Change

The Stages of Change can be measured in a variety of ways. These measures can be divided into two broad categories: continuous and discrete. Most typically, though not exclusively, continuous measures utilize clustering procedures to create Stage profiles. These approaches usually include more lengthy questionnaires than the discrete or algorithm procedures and include “clusters” of statements that represent different Stages that are subsequently analyzed based on profiles using cluster analysis. Discrete Stage measures appear to be more frequently used by researchers, since they are more prominent in the literature. These procedures are guided by decision rules and typically examine behavioral intentions as well as actions regarding behavior change.

Discrete Stage Approaches

Discrete Stage measures are designed to unambiguously classify individuals into one of the defined Stages. The algorithms for the five Stages of Change are

specific for each targeted behavior. In general they adhere to the following Stage concepts, though particular aspects of the staging (e.g., time frame, behavioral criteria) vary among studies. Participants are considered to be in the *Precontemplation* Stage if they report an undesired status, that is, the presence of a problem behavior or the lack of a healthy one, and express no intention of changing in the next six months. The *Contemplation* Stage indicates that the participant intends to change in the next six months. Participants in the *Preparation* Stage plan to change in the next month and have begun to engage in target behaviors, but have not yet met particular criteria. For well studied behaviors these criteria are set according to gold standards in their given field. The *Action* Stage is attained once the participant reaches the given behavioral criteria. Lastly, if the participant has met the specified behavioral criteria for more than six months, they have reached the *Maintenance* Stage.

The stage concepts guide the staging algorithms but typically vary in time frame, behavior criteria, action criteria, and response format. Staging also can vary in clarity of behavioral operationalization, in complexity of target behavior and in consistency in stage description.

Time Frame. Most, but not all, Stage algorithms include a time frame. The most typical time frames used in staging algorithms are: Precontemplation = no intention in the next 6 months; Contemplation = seriously considering in the next 6 months; Preparation = considering in the next 30 days; Action = changed behavior within the past 6 months; Maintenance = changed behavior for more than 6 months. The use of the time frame across studies is inconsistent, however, and variations

include: (1) time frame is not used at all (e.g., Never having had a prior mammogram nor having high intentions to have one; Lauver, et al., 2003); (2) time frame is only used in some Stages (e.g., Wyse, 1995); (3) staging includes additional time frame criteria (e.g., Smokers who planned to quit in the next 30 days and had made an attempt to quit in the past 12 months; Etter et al., 1997); (4) staging includes alternative placements of time frame (e.g., Action = Reported regular vigorous exercise for at least one month; Armstrong, 1993); (5) staging includes “unstandard” time frames (e.g., Intending to use CPAP in the next two weeks; Stepnowsky, 2002; and no screening mammogram 2-4 years ago, with one in the past 2 years, intends to have mammogram in future; Chamot et al., 2001). Further exploration is needed for such issues as impact of wording of time frame (one month versus 30 days), possible patterns of the use of time frame, relevance of particular time frames with respect to particular behavior (e.g., 2 weeks = CPAP and 2 years = mammography).

Critics of the TTM consider the use of time frames (e.g., 6 months) “arbitrary” (Bandura, 1997; Sutton, 1996; Weinstein et al., 1998) and indicate that this is a contradiction to the idea that Stages differ based on qualitatively different attributes (Bandura, 1997; Weinstein et al., 1998). It is also thought that altering the time frame may alter the Stage distribution (Weinstein et al., 1998).

Behavioral Criteria. In some staging algorithms, Contemplation and Preparation are differentiated by the time frame criteria (seriously considering changing in the next six months versus the next month). In order to create a greater distinction between these two Stages a behavioral criterion is sometimes used. If a behavioral criterion is used, it is typically included in the Preparation Stage.

Behavioral criteria demonstrate an attempt by the individual to take action. For instance, in a recent study, Keller et al. (2000) defined the Preparation Stage with the typical intention statement, time frame and then set behavioral criteria. The Preparation statement reads: I intend to change my behavior in the next 30 days and in the last 6 months, have made steps to actively deal with the topic of good body posture, like reading a book or watching a TV program about it.

Action Criteria. “Action criteria” typically indicates the particular behavioral criteria necessary for a participant to reach the Action Stage. This seemingly simple criterion can be the source of much debate when developing or evaluating Stage measures. When a behavior is clear, discrete, and agreed upon by a given field then setting a behavior criterion can be simple, for instance “quitting smoking”. An action criteria of “reduction of cigarettes smoked” complicates the measurement of the behavior and behavior change. There is not a clear consensus among professionals or in the field how much reducing the amount of cigarettes per day is helpful to an individual. Choosing this criterion could minimize the value of the overall study outcomes or could introduce ethical concerns if in fact this strategy proves unhelpful or more harmful (e.g., as in the example menthol and light cigarettes). Additional complications arise concerning the need for tracking or recall for participants. For instance, it is much easier to remember if one did or did not smoke versus an individual remembering precisely the number of cigarettes smoked over the course of a day, a week or a month.

Utilizing gold standards in the field is often a good approach for setting an action criterion. But not all behaviors have established gold standards, for instance

areas such as diet (healthy eating) / weight loss face much debate regarding the best strategies. For example, in the area of weight loss, it is unclear what the best strategy is – should one eat a low fat diet or the Atkins diet? In the area of nutrition, should individuals eat 5, 7, 9, or 11 fruits and vegetable a day? Another example, treatment for sleep apnea – it is unclear what treatment is best, how often should the treatment be given or how long should the treatment last?

Response Format. Perhaps one of the most variable aspects of staging (aside from behavior) is the response format of the algorithms. Response formats include various combinations of characteristics such as: (1) length of definition; (2) number of questions; (3) true/false questions; (4) yes/no questions; (5) total number of items; and (6) single item vs. multiple item format. The multitude of combinations introduces a significant concern for comparability of measures. Studies have shown that different response formats can differentially impact Stage distributions; for example, algorithms using longer, more complete definitions of exercise produced larger number of participants in the earlier Stages, whereas Likert scale format resulted in lower percentage of participants in Precontemplation and Maintenance than fixed format. Additionally, in one study (Reed et al., 1997), the algorithm that provided a long definition and measured vigorous exercise using a 5-choice format revealed a pattern that most closely matched the theoretical prescription of the Pros and Cons across Stages as well as for the pattern for hours of exercise across Stages (i.e., hours increasing across Stages). In some cases similar results were found between response formats. For example, effect size comparisons found both long definitions measuring vigorous exercise using a 5-choice and true/false format

equally effective across Pros, Cons, confidence, and hours of exercise. And lastly, true/false and choice formats were found to be comparable.

Continuous Stage Approaches

A variety of continuous measures have been developed to assess Stages of Change. The primary continuous Stage measures are considered clustering approaches (e.g., URICA, Socrates). These staging procedures do not offer consistent methods and staging (as described below) and therefore will not be included in the dissertation project analyses.

The most common continuous measure is the URICA (University of Rhode Island Change Assessment). The URICA scale is considered a more subtle approach to staging than the discrete Stage measures. This subtle approach has made it particularly appealing for clinical contexts. The URICA includes a lengthy set of statements that try to tap into the Stage of Change of an individual rather than relying on the individual to identify their readiness to change. The original scale consists of 32 items, 8 items for each of the four identified Stages at the time (Precontemplation, Contemplation, Action, and Maintenance). The URICA measure is thought to accurately measure Stage but unfortunately the many drawbacks of this approach have raised questions regarding the comparability of the URICA to the Stage algorithm approaches.

Stages Variations. The URICA (and similar procedures) often does not yield “traditional” Stage categories. Sometimes, the URICA approach Stages participants into four categories (Precontemplation, Contemplation, Action, and Maintenance). Other times the URICA (and similar approaches) includes alternative categories

called "non-reflective action", "taking steps", "recognition" "ambivalent", "uninvolved/discouraged" or "participation". The numbers of categories or clusters also vary, including 5- (DiClemente & Hughes, 1990), 8- (McConaughy et al., 1983) and 18-cluster solutions (McConaughy et al., 1989) found in some studies.

Scale Construction Problems. A review by Littell and Girvin (2002) summarizes a variety of problems seen in cluster-type staging. Examples of scale construction issues include: (1) items in each scale are scored in the same direction increasing the likelihood of response sets; (2) many double barreled items are included in the scales; (3) the scales use many double negative items; (4) some items are awkwardly worded (e.g., "I'm not following through with what I had already changed as well as I had hoped, and I'm here to prevent a relapse of a problem"; Jefferson, 1991); (5) uncommonly used phrases are included in items; (6) overlap among items cause possible inflation of internal consistency measure; and (7) generalizability is potentially limited since the scales were normed on middle-class, Caucasian participants.

Scoring issues. The cluster-type measures utilize a variety of methods for "scoring" or identifying Stages. The most simplistic method involves identifying the highest raw score or standardized score of a given scale and classifying an individual into a stage based on that scale. One complication of this method is that more than one scale can be tied. Strategies include: (1) placing the participant in the more advanced stage; (2) identifying ties as a new stage; or (3) a combination of approaches (Heather, Rollnick & Bell, 1993). These strategies are rather arbitrary and clearly result in different stage distributions (Littell & Girvin, 2002).

Prochaska and DiClemente (1998) indicate that regardless of an individual's Stage of Change, participants may experience attitudes described across the stage designated items, therefore more complex cluster approaches are likely to be the best method for interpreting the continuous instruments. Though currently, there is no definitive answer as to which of these procedures is best.

Stage of Change: Continuous or Discrete?

In the current studies only discrete measures of Stage of Change will be used. This will eliminate the methodological issues discussed above regarding the continuous clustering measures of Stage of Change as well as increase consistency across Stages as much as possible. Additionally, although there has been an on-going debate regarding the theoretical conceptualization for stage as continuous versus discrete, regardless of the outcome of this debate and regardless of when or if stage is measured on a continuous scale, practically speaking discrete stages are needed in order to tailor interventions.

Decisional Balance: Pros and Cons of Change

Following the original study by Velicer et al. (1985), the use of the construct began to expand, encompassing an array of behaviors such as exercise, condom use, and mammography screening. This early work culminated in a paper by Prochaska et al. (1994), which looked at patterns in Decisional Balance across Stages in 12 behaviors. This integrative study investigated: 1) the generalizability of the TTM for Stage and Decisional Balance across behaviors; 2) the generalizability of the TTM for a variety of populations; 3) the number of components in Decisional Balance and

their respective internal consistencies; 4) patterns of Pros and Cons across Stages; and 5) the Stage of crossover between standardized Pros and Cons scores. More recently, a meta-analysis examining 37 behaviors utilizing 81 datasets including nearly 40,000 participants was conducted re-examining these relationships and exploring additional ones (Hall & Rossi, 2004).

Generalizability

Prochaska et al. (1994) and Hall & Rossi (2004) found clear support for the generalizability of the Stages of Change, the Pros and Cons, and the integration between them. The researchers additionally found that these constructs generalized across a variety of populations and behaviors.

Structure of Decisional Balance

Consistent with the two-factor structure identified by Velicer et al. (1985), Prochaska et al. (1994) and Hall & Rossi (2004) respectively found 92% and 94% of the studies reported a two-component solution for Decisional Balance with average internal consistency coefficients ranging from .72 to .95 and from .64 to .95 for Pros and Cons, respectively.

Functional Aspects of Decisional Balance

Decisional Balance Crossovers. In Kurt Lewin's (1948) expectancy theory, it is postulated that behavior changes as a function of the increases and decreases in motivation to contemplate gains and losses. The TTM builds on this notion by suggesting a clear directionality to the function as well as a characteristic way of examining it. This function is based on the relationship of when and how much the Pros increase and the Cons decrease (Prochaska et al., 1994) and is examined by

identifying a graphical crossover of the Pros and Cons as they change relative to each other. It is believed that interaction of the Pros and Cons may increase or decrease the likelihood of a cognitive conflict between the benefits and disadvantages of a particular behavior. One possible interaction occurs when a person believes there are greater personal gains and less disadvantages associated with a behavior. It is hypothesized that at this time, the Pros increase and the Cons decrease, making it more likely that an individual will change their behavior. The crossover indicates an equal weighting in a person's cognitive framing of the gains and losses of engaging in a particular behavior. This equal weighting can create a state of ambivalence towards change.

This crossover therefore is a theoretically important marker for the success of the functional relationship between the Stages and Decisional Balance. Prochaska et al. (1994) and Hall & Rossi (2004) found that the Decisional Balance crossovers occurred during the Contemplation Stage for 58% and 53% of the studies, respectively. Based on the timing of the crossover, the researchers suggest that progress from Precontemplation to Contemplation involves an increase in Pros whereas progress from Contemplation to Action involves a decrease in Cons.

Patterns across Stage. Several additional patterns in the relationship between Stage of Change and Decisional Balance were found in the two studies (Hall & Rossi, 2004, Prochaska et al, 1994). For example, the Cons of Changing were higher than the Pros of Changing in the Precontemplation Stage for all datasets in both studies. Prochaska found the opposite true for 11 out of 12 behaviors in the Action Stage.

Decisional balance (Pros and Cons) serves as an intermediate indicator of when change will occur and has generally been thought to be especially salient in the earlier Stages of Change (Redding et al., 1999; Velicer et al., 2000). Velicer et al. (2000) also illustrated that the relationship between the Stages and Decisional Balance for an unhealthy behavior is different than for a healthy behavior. Specifically, the pattern for an unhealthy behavior was such that the Cons decreased across the Stages whereas the Pros displayed a curvilinear pattern, which paralleled the decline of the Cons in the later Stages. In contrast, the healthy behavior showed more of an X configuration, with the Pros continuing to increase across the Stages whereas the Cons decrease across the Stages.

Strong and Weak Principles.

Across twelve studies (Prochaska, 1994), mathematical relationships were found between the Pros and Cons of Changing and progress across the early Stages into Action (Prochaska, 1994). The Strong Principle of Change states that $PC \rightarrow A \cong 1 SD \uparrow PROS$: progress from Precontemplation to Action involves approximately one standard deviation increase in the Pros of Changing. The Weak Principle of Change states that $PC \rightarrow A \cong 0.5 SD \downarrow CONS$: progress from Precontemplation to Action involves approximately 0.5 SD decrease in the Cons of Changing.

In re-examination of the Strong and Weak Principles, the magnitude of the maximum increase in the Pros of change was again found to be greater than the maximum decrease in the Cons of change from Precontemplation to Action across 37 different health behaviors (Hall & Rossi, 2004). Consistent with Prochaska's

(1994) Strong principle, the average effect size for the Pros was approximately one standard deviation ($d = 1.05$, $SD = 0.45$), almost identical to Prochaska's (1994) original finding ($d = 1.06$, $SD = 0.26$). Hall and Rossi's (2004) findings also revealed that Prochaska's Weak Principle may not be so weak. That is, the average effect size for Cons was stronger ($d = 0.62$, $SD = 0.38$) than was found in the previous study ($d = 0.45$, $SD = 0.22$) by Prochaska (1994), though clearly the Cons remains weak relative to the Pros. Practical implications of these principles are that the Pros of Changing must increase twice as much as the Cons must decrease, suggesting that an intervention place twice as much emphasis on raising the benefits as on reducing the costs or barriers.

Stage Transitions

The Strong and Weak Principles are useful for understanding the amount of work generally needed to move from Precontemplation to Action. Although theoretically the principles have been important in conceptualizing and understanding the relationship between Decisional Balance and Stages of Change, these principles are essentially action-oriented when applied to interventions. That is, by examining characteristics of the transition only from Precontemplation to Action, and using these to tailor interventions, one is potentially neglecting three Stages: Contemplation, Preparation and Maintenance. In addition, adjacent Stage transitions should be examined. Adjacent Stage transitions include Precontemplation to Contemplation (PC-C), Contemplation to Preparation (C-PR), Preparation to Action (PR-A), and Action to Maintenance (A-M). Therefore more practically, the

examination of each Stage transition can help identify the most effective strategy for tailoring behavior change interventions.

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CHAPTER THREE

INTEGRATIVE APPROACH TO THEORY TESTING

Introduction

In Sante Fe, New Mexico May of 2002, the National Cancer Institute's Division of Cancer Control and Population Sciences Behavioral Research Program brought together a group of esteemed researchers for a workshop entitled, "Toward Better Theories of Health Behavior". The workshop was designed to help move the field forward by identifying and discussing gaps in health communication and health behaviors theory with the primary goal of "accelerating progress in the testing, validation, and development, and revision of health behavior theories" (National Cancer Institute: Division of Cancer Control and Population Sciences, 2002). This program of research directly answers to this important goal by testing several theoretical assumptions from a health behavior theory using innovative and unique methods in order to make recommendations for revising or rejecting parts of the theory. Furthermore, at this workshop, Weinstein indicated that "all current theories of health behavior have significant limitations" and that, "progress in improving theories that explain or encourage health behavior has been slow" (National Cancer Institute: Division of Cancer Control and Population Sciences, 2002). This program of research seeks to speed that process. Weinstein continues by explaining, "The scientific progress, in which theories are tested, weaknesses exposed, inadequate theories rejected, and better theories arise to take their place has not been taking place." This program of research intends to advance this scientific progress.

Integrative Approaches

There are a variety of approaches that can be employed to test theory. In fact, most empirical studies attempt to test some theory at least in part. Powerful approaches to assess theoretical models involve integrative approaches. These are approaches which attempt to combine the data of previously conducted studies, such as combining longitudinal secondary data or employing meta-analytic strategies.

Meta-Analysis for Theory Testing

One particularly effective integrative tool is meta-analysis. Researchers encourage the use of meta-analysis for informing theory (Cook et al., 1992) as well as testing and advancing theory. This is in part because meta-analyses have the power to test large sets of explanatory mechanisms by more broadly examining moderators (Marsh et al., 2001) than traditional qualitative reviews as well as individual empirical studies. Therefore, meta-analyses have the potential to more comprehensively examine aspects of theories that are oftentimes not testable due to practical constraints. Researchers have begun utilizing traditional meta-analytic techniques as a basis of theory testing (e.g., Marsh et al., 2001).

Meta-analyses can be used for theory testing in varying degrees. A simple meta-analysis combines the results of previous studies, examining a single question - the same question, asked by previous researchers. This type of meta-analysis is considered the lowest level and provides the least theoretical advance. That is, the simple meta-analysis can be an essential tool for clarifying inconsistencies in the literature, but typically introduces no new ideas and offers little additional information to the field. A more sophisticated method of employing meta-analysis

for theory testing is to build on the aforementioned method by aggregating the effect sizes from the literature and subsequently assessing homogeneity. If heterogeneity is discovered, searches for moderators become possible. (It is possible to establish a priori moderator tests precluding the need for heterogeneity to be found). The introduction of moderator analyses enables the possibility of generating new theoretical evidence. Lastly, the most important method of conducting meta-analysis for theory testing involves testing theoretical relationships or concepts not previously conducted in primary-level studies. This creative use of previously conducted studies offers the highest potential for theoretical advance. This dissertation seeks to conduct this highest level meta-analysis.

Additionally, meta-analysis can be used to clarify conflicting results due to particular failings of null hypothesis testing, especially with single studies. The use of effect sizes can provide important information about effects that hypothesis testing does not offer, namely, the magnitude of an effect. Confidence intervals can provide a means to test statistical significance in meta-analysis and increase precision with each study added to a meta-analysis. Moreover, meta-analysis has typically been used as a method to simply combine results of studies based on null hypothesis testing. More sophisticated uses of meta-analysis can go beyond the simplicity of null hypothesis testing to identify results not previously reported in the literature, explore moderators of effect that may not be able to be examined in a single study, and even provide a tool for advancing theory. This program of research aims to provide results that overcome many of these hypothesis testing failings by synthesizing data from nearly 150 studies utilizing effect sizes and confidence

intervals. Additionally, this meta-analysis aims to go beyond the simplicity of hypothesis testing exploring new relationships in the data and exploring moderators with the goal of advancing theory.

Importance of Comprehensive and Systematic Review Strategies

Although seemingly obvious, careful implementation of integration strategies is essential to the success of qualitative and quantitative reviews. Comprehensive and systematic review strategies have not often been found in previous reviews examining the TTM. For instance, hundreds of studies related to behavior change, and more specifically health-related behaviors have been conducted using the TTM, yet no study has integrated this vast body of literature. A small number of studies have attempted to review the TTM literature, but these studies have either: (1) limited their review to one behavior (e.g., Horowitz, 2003; Horwath, 1999; Marshall & Biddle, 2001; Spencer, Pagell, Hellion & Abrams, 2002); (2) qualitatively compiled studies (e.g., Horowitz, 2003; Horwath, 1999; Spencer et al., 2002; Riemsma et al., 2003); or (3) failed to systematically or comprehensively gather and analyze all available data (Riemsma et al., 2003; Spencer et al., 2002).

Many meaningful relationships are lost in reviews that limit analysis to one behavior. Efforts in health promotion and disease prevention can best be served by understanding the similarities and differences in behavior change factors across behaviors. The advent of recent efforts to focus on multiple behavior change, where constellations of related (or unrelated) behaviors are treated simultaneously, make understanding the inter- and intra-relationships of behavior change factors increasingly critical for developing effective interventions.

Most literature reviews examining the TTM have focused on overall intervention effects or study design and methodology rather than quantitatively examining process-to-outcome relationships that can aid in improving intervention development. Additionally, the role of sample size and power has not always been fully appreciated as a factor in these reviews. Sample size is often a source of discrepancy in the results of outcome studies, especially as the effect size for most such interventions tends to be fairly small, particularly for population- or community-based interventions. A meta-analytic review of the literature is especially well suited to evaluate the role of sample size, effect size, and power in the generation of discrepant study outcomes (Rossi, 1990, 1997).

Inadequate review strategies can produce misleading results. For example, TTM tailoring is usually incorporated into interventions in one of three ways: 1) *stage only* – providing feedback specific to only an individual’s SOC; 2) *partial tailoring* - providing individual feedback on SOC, Decisional Balance, and/or Self-efficacy; and 3) *full tailoring* - providing individual feedback on all TTM constructs, including SOC, Decisional Balance, Self-efficacy, and processes of change. In a qualitative review of smoking, Spencer et al. (2002) identified 22 studies evaluating TTM tailored or stage-matched interventions. The researchers concluded that the body of literature on staged-matched interventions was “acceptable” but not “conclusive.” Upon closer examination, it appears that the authors did not perform the review in a careful systematic way. New and informative patterns were revealed by simply re-grouping the studies by the type of tailoring: 13 of the studies used *stage only* tailoring, 4 of which had positive results (Canga et al., 2000; Leed-Kelly,

Russell, Bobo, 1996; Valanis et al., 2001; Wang, 1994), five of which had negative results (Lancaster et al., 1999; Lenox et al., 1998; Quinlan & McCaul, 2000; Steptoe et al., 2001; Velicer et al., 1999), and 4 of which were unclear (Bernstein & Stoduto, 1999; Goldberg et al., 1994; Pallonen et al., 1994; Rohren et al., 1994). In contrast, the five *partial tailoring* studies produced positive results on a 3 to 2 ratio. The three positive studies were Coleman-Wallace et al. (1999), Dijkstra et al. (1998, 1999) and the two negative studies were Dijkstra et al. (1998) and Pallonen et al. (1998). Lastly, the five studies using *full TTM tailoring* produced positive results on a 4 to 1 ratio. The four positive studies were Prochaska et al. (1993, 2001a, 2001b), Velicer et al. (1999) and the negative study was Aveyard et al. (1999). In sum, *partial tailoring* studies were 2 times more likely and *full tailoring* studies were 2.7 times more likely to find significant treatment effects than *stage only* intervention studies.

Additionally, in Spencer et al.'s (2002) review, length of follow-up was not accounted for when comparing studies. The five partial tailoring studies were limited to shorter-term effects with follow-ups ranging from only 10 weeks to 6 months, while the five full tailoring studies demonstrated more sustained effects with follow-ups ranging from 18 to 24 months. Also, none of the partial tailoring studies involved population cessation, while four of the full tailoring studies were population-based. Hence, it appears the more demanding studies (e.g., full tailoring, long follow-ups and population-based) produced the highest rates of significant results and had the highest impacts on smoking. This example suggests that the variations in treatment effectiveness are possibly due to systematic differences in study and intervention designs. More specifically, variation in use, application, and

measurement of the TTM may significantly contribute to the discrepancies in assessment of the overall effectiveness of TTM-based tailoring. In a meta-analytic review, these factors would be coded and analyzed to preclude such vague, contradictory, and misleading results. It is clear that more care and rigor is needed when compiling such rich data and that systematic analysis is critical to discovering such essential findings regarding key factors of successful interventions.

The use of existing datasets for secondary data analysis is often thought of as a simple procedure, but this is not necessarily the case. For instance, both Spencer et al. (2002) and Riemsma et al. (2003) performed a “comprehensive” review of smoking studies utilizing the TTM. Spencer et al. (2002) identified 22 stage-matched intervention studies and Riemsma et al. (2003) identified 23 such studies over similar time frames. Amazingly, only 7 of the studies were the same. Inadequate or selective data collection inherently leads to bias. Therefore, it is clear that sufficient time and resources need to be devoted to systematic data collection in order to attain a minimally biased and maximally complete set of datasets for a meta-analytic review.

Integrative and Meta-analytic Approaches to Testing the TTM

In addition to reviews by Spencer et al. (2002) and Riemsma et al. (2003) a variety of studies have used integrative approaches to examine the TTM; some of these are highlighted below.

Predicting Behavior Change

A powerful question that drives psychology is: can we predict behavior? And if so, how can we predict behavior? The Transtheoretical Model explains that

individuals move through a series of Stages as an individual prepares to and eventually succeeds in changing a given behavior. In this way the model can predict behavior. Two ways to explore these predictions are to examine relationship of the constructs to stage movements and stage effects.

Stage Movement. In the context of the Transtheoretical Model, the concept that primarily is being predicted is stage movement. That is, can the model help predict the movement of individuals from one stage to the next? As described above, the model also predicts that particular constructs serve as indicators for change and play a part in predicting stage movement. For instance, one may ask - do the processes of change predict movement from Action to Maintenance? More specifically, since experiential processes have been shown to be more salient in the earlier Stages and the behavioral processes more salient in the later Stages, we might refine that question to - do the behavioral processes predict stage movement from Action to Maintenance? These predictive questions have been at the heart of recent debates. Overall, the model's ability to make these predictions has been demonstrated cross-sectionally, cross-sequentially, and longitudinally. Although it is beyond the scope of this essay to review the body of literature on the predictive nature of the model one particular integrative method, examining stage effects, will be highlighted. In sum, it is clear that the Stages of Change play the key role in understanding this key aspect of the model.

Stage Effects. Examining stage effects is another means to explore the predictive nature of the model, and more importantly the role of stage in the context of the model. Stage effects involve the prediction of a person's behavior over time

depending on which stage the individual is in at baseline. More specifically, a person further along in the Stages is predicted to be more likely to move to Action or Maintenance than a person in the earlier Stages. Overall, stage effects across behaviors such as sun, smoking, and diet have been supported (Krebs, 2003; Prochaska et al., 2003). This suggests that persons in Precontemplation were less likely to take Action than those in Contemplation, who were, in turn, less likely to take Action than those in Preparation. An important implication of these findings is that moving forward one stage can increase the adoption of the target behavior. For instance, recent research has demonstrated that stage movement from Precontemplation to Contemplation increased the chances that smokers quit by 75% (Prochaska et al., 2003). Again, we see the importance of the Stages of Change in the context of the model.

Moderators of Stage Distributions

In a preliminary review of the literature a variety of moderators of stage distributions have been found. Examples include study characteristics and sample characteristics as well as behavior specific variables. More specifically, these moderators have included variables such as behavior, age, gender, setting, income, education, race, ethnicity, country, recruitment method, response format and activity criteria. For sake of brevity, several of the main moderating variables will be discussed in more detail below.

Behavior. Overall, stage distribution is typically examined across behaviors in the context of other potentially moderating variables and therefore will be touched

upon in most other sections. The only review identified in this preliminary examination of stage distributions that specifically compared stage distributions across behaviors was a study conducted by Nigg, Burbank, Padula, Dufresne, Rossi, Veleicer, LaForge, & Prochaska (1999). This study examined Stage distributions across ten health behaviors in older adults (and many findings will be highlighted in the age section). In the broadest scope, the researchers discovered that highest percentages of individuals across the age groups were in either the Precontemplation or Maintenance Stages across all behaviors. This finding indicates that for all behaviors getting people to think about change may be the most important place to start in population-based interventions.

When examining across behaviors we can assess trends in readiness to change, adoption/cessation of a behavior, and maintenance and then use these trends can help determine where the greatest emphasis should be placed for health interventions. One example might be utilizing stage distribution information to determine which order behaviors will be intervened upon in a multiple behavior intervention. An intervention targeting a large population may want to begin with a behavior where the most individuals are ready to change. Successful change in one behavior may increase participant confidence and potentially lead to greater success for subsequent behaviors. If this idea is valid, accomplishing this may best be done by tailoring the order of behaviors at the individual level. But individual tailoring to this extent may not be possible or practical. For instance, many multi-level multi-behavioral interventions include group wide (e.g., school or workplace) intervention

activities or campaigns for a given behavior. In this case, it likely would be best to simultaneously work on the same behavior at the group level and individual level.

Age. In a meta-analytic study examining exercise, Marshall and Biddle (2001), found that the youngest group (<25) had the lowest percentage of individuals in Precontemplation and the highest proportion in Preparation. In contrast, the oldest group (55+) had the highest proportion in extreme Stages, Precontemplation and Maintenance. Velicer, Fava, Prochaska, Abrams, Emmons, and Pierce (1995) found stable patterns in stage distributions across three samples of smokers for three of four age categories. The age categories consisted of 18-24 years, 24-44 years, 45-64 years, and 64+ years. Of these, the oldest category, 64+ years, was consistently different from the other three categories.

Nigg et al. (1999) looked specifically at stage distributions in various older samples. Differential distributions were identified for these age groups and especially in comparison to distributions in younger adults. Some interesting patterns were identified across behaviors for age, for instance the prevalence of maintaining a low-fat and high fiber diet increased as age increased whereas for exercise distributions increasingly stratified to the extremes as age increased (consistent with findings by Marshall & Biddle, 2001). Overall, of the 10 behaviors all but two showed higher prevalence of individuals maintaining behaviors in one of the two oldest age groups (65-74 and 75+). This may be due to the fact that individuals who maintain healthy behaviors in fact live longer. Therefore, it seems this level of specificity is important for guiding age-related interventions, especially with regards to the elder end of the spectrum. For instance, an intervention developed for an assisted living facility

would best be informed with data specific to this age group rather than with data from the general population.

Study Characteristics. Marshall and Biddle (2001) conducted a study examining stage distributions for exercise in a variety of different samples. Their results indicate that stage distributions were influenced by factors such as sampling method, with random / nonrandom recruitment, and active / passive recruitment strategies. More specifically, passive recruitment and nonrandom sampling strategies resulted in a higher percentage of participants in the later Stages where as active recruitment and random sampling strategies resulted in higher percentages of participants in the earlier Stages. Likert scale format for staging resulted in lower percentage of participants in Precontemplation and Maintenance than fixed format. Ultimately, it is important to be able to know how a particular study design impacts stage distributions to enable researchers to more accurately interpret findings of a particular study or more adequately design a new study.

Gaps. Overall, more studies examining stage distributions are warranted. Specifically, a comprehensive review examining multiple moderators across a variety of behaviors would be appropriate. A variety of limitations in previously conducted studies have left gaps in the exploration of stage distributions. For example, these studies have either: (1) limited their review to one behavior (e.g., Marshall & Biddle, 2001; Velicer et al. 1995); one age group (Nigg et al., 1999) or one specific staging algorithm (Nigg et al., 1999; Velicer et al., 1995); (2) did not include all Stages (Velicer et al., 1995); (3) were unable to explore the influence of study design (Nigg et al, 1999; Rossi, 1992; Velicer et al., 1995); (4) examined only

US samples (Nigg et al., 1999; Velicer et al., 1995); and (5) failed account for multiple operationism (Marshall & Biddle, 2001).

Strong and Weak Principles

Hall and Rossi (2004a) re-examined Prochaska's (1994) Strong and Weak Principles for Decisional Balance by updating the number of studies and expanding the types of analyses conducted. Hall and Rossi (2004a) investigated the crossover profile patterns and effect sizes for Decisional Balance across the Stages of Change for 37 different health behaviors in 81 independent datasets including nearly 40,000 participants. Behaviors such as exercise, smoking, and condom use were represented by more than 10 datasets each, enabling preliminary exploration of each of these behaviors in more detail.

Patterns consistent with those reported by Prochaska et al. (1994) were found for Pros and Cons; for instance, in all studies the Cons of Changing outweighed the Pros of Changing during the Precontemplation stage. The "crossover" pattern of the Pros and Cons occurs when the standardized Decisional Balance scores are graphed by stage. Conceptually, the crossover point is thought to represent the ambivalence individuals feel when they begin to seriously consider changing their behavior. Prochaska et al. (1994) and Hall and Rossi (2004a) found that the Decisional Balance crossovers occurred during the Contemplation stage for 58% and 53% of the studies, respectively. However, although often thought of as a simple function, Hall and Rossi (2004a) discovered complexities in the crossover patterns. For example, 16% of the datasets revealed multiple crossovers of the Pros and Cons, suggesting

further examinations are needed. One methodological consideration of the crossover function is that many of the studies found very unequal numbers of participants across the Stages of Change. Unequal sample size distributions affect the standardized score estimates of the Pros and Cons and tends to distort the crossover profile pattern, typically by “pulling” the crossover point towards either Precontemplation or Maintenance, since it is usually one of these two Stages that contains disproportionately greater numbers of participants. Recent work by Hall and Rossi (2004b) has begun the development of strategies to standardize these unequal sample size distributions which will allow a “truer” pattern to be revealed, enabling more accurate testing of theory and shedding more light on the meaning of the crossovers and what influences them.

In re-examining the strong and weak principles (Prochaska, 1994), the magnitude of the maximum increase in the Pros of Change was again found to be greater than the maximum decrease in the Cons of Change from Precontemplation to Action (Hall & Rossi, 2004a). Consistent with Prochaska’s (1994) strong principle, the average effect size for the pros was approximately one standard deviation ($d = 1.05$, $SD = 0.45$), almost identical to Prochaska’s (1994) original finding ($d = 1.06$, $SD = 0.26$). But our findings also revealed that Prochaska’s weak principle may not be so weak. That is, the average effect size for cons was stronger ($d = 0.62$, $SD = 0.38$) than was found in the previous study ($d = 0.45$, $SD = 0.22$) by Prochaska (1994), though clearly the cons remains weak relative to the pros.

Heterogeneity of the distribution of effect size across all datasets was found, which signifies the presence of modifiers of effect size. Preliminary exploration of

the moderators was conducted, beginning with behavior. Behaviors represented by more than 10 datasets were compared; four behaviors met this criterion (smoking, exercise, diet, condom use). Significant differences between behaviors were found for both Pros and Cons of change. The magnitude of effect for pros of exercise was significantly greater than for smoking, condom use, and diet. The effect size for cons of smoking was significantly greater than for diet and condom use. Examination of heterogeneity within each behavior was also significant, therefore additional moderators were explored.

Studies were characterized as either focusing on the cessation or acquisition of a behavior. Analyses revealed that cessation and acquisition behaviors did not differ significantly. One explanation could be that, conceptually, the distinction between cessation and acquisition may not be as straightforward as it initially appears. For instance, with a behavior like exercise, the emphasis may be on increasing or encouraging a person to exercise regularly, but this also means the person ultimately must decrease their sedentary behavior. Therefore, although measures of Decisional Balance and other TTM constructs may focus on the acquisition of a particular behavior, achieving acquisition may involve the cessation of other behaviors as well. More elaborate coding methodology may be necessary in order to differentiate more accurately the cessation and acquisition characteristics of the behaviors.

“Framing” Decisional Balance in the context of healthy versus an unhealthy behavior also showed no significant relationship to effect size (e.g., pros of quitting smoking versus the pros of smoking). The number of items in the Decisional Balance

scale was also unrelated to effect size. Effect size was related to gender for cons but not pros. One implication of this finding is that expert system scoring algorithms might need to be different for men and women, at least for the Cons of Change.

Experimenter bias was also examined as a potential moderator of effect size. All 81 datasets were divided into three groups: studies performed by investigators at the Cancer Prevention Research Center (CPRC) at the University of Rhode Island (the originators of the Stages of Change and Decisional Balance measures); studies performed by CPRC trained researchers but conducted outside the center; and studies conducted by researchers with no formal CPRC affiliation. Bias was assessed by examining effect sizes rather than significance levels (p -values). This method provides a more sensitive context within which to investigate bias since, unlike significance tests, these indices are independent of sample size. So far as we know, this was the first time experimenter bias has been evaluated in this way. Analyses showed that there were no significant differences in effect sizes between the three groups. These findings suggest that the effect size results are not biased towards the researchers who originally developed the Decisional Balance measure and that the measures can be modified and applied by a variety of researchers with equal effectiveness.

The main limitation of this study was that all of the datasets were cross-sectional. We can not assume the same relationships will necessarily occur when examining the movement of participants from Precontemplation to Action with longitudinal data, therefore it is important these results be replicated using longitudinal data. Additionally longitudinal data allows for more elaborate

exploration of moderators and subsamples, which can increase the richness of the results. The analyses of potential moderators in this study were conducted using correlational and univariate statistics. More sensitive tools such as random effects modeling need to be utilized to advance such research.

Only 4 of the 37 behaviors had sufficient numbers of datasets to perform sub-analyses by behaviors. More comprehensive data collection and updated searches of published and unpublished research will increase these numbers, greatly enhancing the depth of the results. Since average effect size significantly varied by behavior, it is important to look carefully at the effect sizes for individual behaviors rather than just across all behaviors as more studies are conducted and identified for each behavior.

Self-efficacy Across the Stages

Both Self-efficacy and the Stages of Change serve as important aspects of the design and evaluation of clinic-based and population-based health promotion interventions. Rossi and Redding (2001) examined the relationship between Self-efficacy and the Stages in 28 independent studies across 14 behaviors (total N = 21,244), including cancer-related behaviors such as smoking cessation and prevention, exercise adoption, dietary fat reduction, fruit and vegetable consumption, sun exposure, cocaine use, binge drinking, weight control, contraceptive use, high-risk sex and condom use.

The functional relationship between Self-efficacy and the Stages of Change varied across behaviors but typically was monotonically increasing and linear across

Stages. Studies that assessed both situational confidence and temptations displayed a consistent profile across Stages with a characteristic “crossover” towards the Action stage.

The magnitude of effect was examined in a similar fashion as the strong and weak principles for Decisional Balance (described above). The magnitude of the maximum increase from Precontemplation to Maintenance was strong and fairly consistent across behaviors, about 1.5 standard deviations, suggesting that Stage of Change accounts for about 36% of the variance in Self-efficacy.

This preliminary study again demonstrates the use of effect sizes to quantify theoretical relationships. Unfortunately this study is insufficiently powered and limited in scope.

Longitudinal Analyses of the TTM

Rossi (2001) conducted a very preliminary study of stage transition effect sizes for the processes of change in a single longitudinal dataset. In general, sample sizes in population-based health promotion research are often so large that statistical power can be quite high even for fairly small effect sizes. Consequently, all or most statistical tests may be significant. This can lead to difficulty in distinguishing between important effects and trivial ones. The distinction often cannot be made simply on the basis of the magnitude of effect sizes but must be grounded in theory. For example, the transtheoretical model posits that behavior change occurs in a series of Stages and includes a number of independent and intervening variables underlying the change process. The model makes explicit predictions about which variables are

most important across each stage transition. For the transition from Precontemplation to Contemplation, the experiential processes of change are expected to be more salient. For the transition from Contemplation to Preparation, the behavioral processes of change are expected to be more important. These transitions were examined using data from a smoking cessation study (DiClemente et al., 1991; Prochaska et al., 1993). Because the sample size for this study was large ($N = 1466$), nearly all statistical tests across stage transitions were significant. However, calculation of contrast effect sizes for each stage transition showed a clear pattern that was consistent with transtheoretical model predictions: for the early stage transition, effect sizes were larger for experiential than for behavioral processes; for the later stage transition, effect sizes were larger for behavioral than for experiential processes. The utility of effect sizes for the analysis of population-based research is evident, especially as compared to standard significance testing approaches. The use of such procedures within the context of theory-based research promises to be of even greater utility in the development of more quantitative models of health behavior change.

Stage Transitions

The strong and weak principles are useful for understanding the amount of work generally needed to move from Precontemplation to Action. Therefore, although the strong and weak principles have been important in conceptualizing and understanding the relationship between Decisional Balance and Stages of Change, these two principles have an action-oriented influence when applied to interventions.

That is, by virtue of examining characteristics of the transition from Precontemplation to Action and using these to tailor interventions, one is gathering information which potentially neglects three Stages: Contemplation, Preparation and Maintenance. If the ultimate goal is to advance the quantitative resources for development of stage matched tailored interventions in order to move people from Precontemplation to Contemplation to Preparation to Action and then finally to Maintenance, more specific transitions should be examined. It then becomes imperative to examine the magnitude of effect for each stage transition in order to explore the possibility of more complex impact patterns. For instance, some behaviors maintain a classic crossover profile, but that does not necessarily mean that their patterns of effect are straightforward; the patterns of effect may be curvilinear rather than linear. In order to identify curvilinear patterns in the relationship between Decisional Balance and Stages of Change one would need to examine the magnitude of adjacent stage transitions.

Stage transition analyses could identify the most effective strategy for tailoring behavior change interventions. For example, for a given behavior if the effect size from Precontemplation to Contemplation for pros is large but very small for cons, in this instance pros could be intervened on whereas cons could be eliminated for precontemplators in an intervention. From Contemplation to Preparation, if both the Pros and Cons effect sizes were large, both might be emphasized at this transition in an intervention. Following this strategy across each stage transition would create the most efficacious and efficient application of the measure, maximizing the impact and minimizing the resource expenditure.

Ultimately, careful and systematic investigation of the changes in these measures across stage transitions by behavior can provide even more detailed evidence for exactly how to use these measures most efficiently in future stage-matched interventions.

Integrative Analyses: Current Project

The current project was conducted in three main phases: (1) comparison of effect size procedures and development of correction formulas through the use of meta-analytic data; (2) comprehensive cross-sectional meta-analytic investigation of stage and Decisional Balance; (3) exploratory integrative analysis of longitudinal investigation Stage and Decisional Balance and cross-sectional and longitudinal comparison of stage and Decisional Balance. Each phase utilized integrative techniques building on each other to create a comprehensive program of studies aimed at testing and advancing theory and informing intervention development.

The first phase is a preliminary study to help inform and facilitate a more comprehensive exploration of the Stages of Change and Decisional Balance in phases two and three. The second and third phases will each contribute a set of results, which will uniquely contribute to the aims of the project. Additionally, phase three integrates the results of the cross-sectional and longitudinal studies by comparing similarities and differences between the two. That is, in phase three, the longitudinal data will serve as a cross-validation of the cross-sectional data among common relationships between the two types of data.

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CHAPTER FOUR

META-ANALYTIC APPROACH

Brief History

Methods of combining data were being developed as early as 1904 when Karl Pearson combined average correlations across five independent samples (Cooper & Hedges, 1994), and furthermore into the 1930's (Fisher, 1932; Pearson 1933), but these integration techniques were rarely applied (Cooper, 1989). In 1976, Gene Glass coined the term "meta-analysis". Together with the increasing need for integrating research findings, Glass's fitting term seemed to finally launch this methodology into the field. Since then, meta-analytic techniques have continued to grow more complex and have slowly been expanding to meet the needs of the growing applications across the social and medical sciences.

Failings of the Null

In the behavioral and social sciences, empirical questions have been explored and theories guiding those questions have been tested primarily using null hypothesis procedures. As the field progresses, it is becoming clearer that this indirect procedure is an inadequate tool for efficiently answering research questions or for testing, modifying or rejecting theories. The focus on rejection of the lack of a relationship among variables as a means to clarify a research question not only obfuscates the objective, but also can ultimately be misleading.

The failure to reject the null hypothesis can occur for a variety of reasons, for example, insufficient power due to small sample sizes. Additionally, sample sizes

can be so large that statistical power essentially becomes “too high”, which can lead to all or most statistical tests being statistically significant and thereby make it difficult to distinguish between important effects and trivial ones. Furthermore, null hypothesis testing can only provide ordinal or directional characterization of a relationship between variables not the magnitude of particular relationships.

The Role of Meta-analysis in the Significance Testing Debate

Meta-analytic techniques can be used to help overcome some of the limitations of null hypothesis testing as well as to move beyond null hypothesis testing. Meta-analysis can help resolve conflicting results, reduce variability in results, and increase the precision of reported results. Meta-analysis can best achieve this by synthesizing studies using point estimates and confidence intervals.

Meta-analysis can be used to synthesize the results of a body of conflicting studies and avoid some of the pitfalls of relying on traditional hypothesis testing. For example, low power can result for a variety of reasons such as not considering issues of power when planning a study, low retention during the course of a study and insufficient resources to achieve adequate power. Low power typically will create conflicting results within a body of literature due to statistical probability in null hypothesis testing. In fact, the effect size of two studies can be equal even when their level of significance may differ (i.e., one significant, the other not) due to variations in sample size. Meta-analyses can combine the results of multiple studies to overcome issues of low power. By placing confidence intervals around effect sizes the overall significance of a body of research can be determined and thereby clarify discrepant results found among individual studies.

Additionally, meta-analysis can be seen as overcoming failings of traditional hypothesis testing by increasing the precision of results by accounting for sampling error and other sources of variance. Meta-analytic techniques, by controlling for sampling error, can reduce variability in results. Likewise, corrections for study artifacts such as measurement error can be implemented using meta-analytic techniques. Various methods for modeling these types of error (i.e., fixed, random, and mixed effects modeling) can further increase precision in meta-analyses.

In sum, meta-analysis can be used to clarify conflicting results due to particular failings of null hypothesis testing, especially with single studies. The use of effect sizes can provide important information about effects that hypothesis testing does not offer, namely, the magnitude of an effect. Confidence intervals can provide a means to test statistical significance in meta-analysis and increase precision with each study added to a meta-analysis. Moreover, meta-analysis has typically been used as a method to simply combine results of studies based on null hypothesis testing. More sophisticated uses of meta-analysis can go beyond the simplicity of the null hypothesis testing to identify results not previously reported in the literature, explore moderators of effect that may not be able to be examined in a single study, and even provide a tool for advancing theory.

When to Use Meta-Analytic Techniques

Many literature reviews can and should consider the inclusion of quantitatively synthesizing results so long as they meet certain basic criteria. First, the review must include empirical studies. And secondly, these studies must include at least in part quantitative data. Beyond these minimum requirements, several

additional issues should be considered. First, the research question(s) driving the research synthesis should be clearly defined. The question should be narrow enough to provide meaningful results from the literature, but broad enough to advance theory. A question too broadly defined risks creating the “apples and oranges” problem, in other words, summarizing studies that are not really dealing with the same constructs or relationships (Lipsey & Wilson, 2001). One must use keen judgment to differentiate an “apples and oranges” study from a study aptly examining “fruit”. In addition to these considerations of the research question, ultimately, data must be available in order to transform data or summary statistics into comparable statistical forms for the successful integration of research findings.

Although Rosenthal (1995) stated that “The level of quantitative skill and training required to use basic meta-analytic procedures is so modest that researchers capable of readily learning the small number of calculations required to answer standard meta-analytic questions”, this idea is quickly changing. Increased attention to meta-analysis and in meta-analytic techniques has led to many advances and refinements. These strategies are more statistically demanding and these statistically demanding techniques are becoming more and more standard in practice. This does mean that more sophisticated and user-friendly software is being developed to aid the conduct of meta-analyses, though clearly this does not eliminate the need to be able to conceptually understand many complex issues.

Literature searches

The advent of computerized reference databases has made searching for available studies, more “up-to-date” and much easier in many respects, but it does have its caveats. For instance, the seeming ease of searching computerized reference databases may provide researchers with a false security regarding their success in collecting available studies. Researchers should be aware that there are currently many available reference databases (e.g., some health related databases: MEDLINE, PsychInfo, Cancerlit, Cinahl, Health and Wellness Resource Center, Pubmed). It is important for researchers to determine which of these are relevant to their particular review and since some databases are more inclusive than others, researchers should not rely on just one or two. Each field of study has a handful of primary databases (e.g., MEDLINE, PsychINFO) that are typically used. Unfortunately, the quality of these databases can vary from institution to institution. That is, a literature search conducted on a reference database at one institution can yield different results than at another institution since institutions can purchase different versions or levels of a particular database. Therefore, discrepancies will exist in the level of inclusiveness yielded by searches. Despite these cautions, the use of reference databases is an essential tool for literature reviews.

At the outset of the computerized search, keywords that represent the area of interest should be identified and entered into the database. These keywords may need to be modified as the search progresses in order to include important keywords that were overlooked or unknown to the reviewer at the onset. Documentation of

keywords, reference databases, and other search strategies should be kept during the conduct of the meta-analysis.

In addition to computerized reference databases, search strategies include (1) manual searches of relevant (and typically the most prominent) journals; (2) careful examination of reference lists from review articles and acquired articles; (3) conference programs and proceeding; and (4) contacting authors and experts. Thorough use of each of these procedures is important to minimize bias in the data collection phase.

Identifying the Studies

Several strategies can be used for determining which studies will be included in the meta-analysis. Usually preliminary screening of studies occurs at the literature search level. Oftentimes abstracts are used to give a gross assessment of applicability of the study to the meta-analytic review. Any study that is considered potentially relevant is then collected and should be carefully reviewed to further assess if each study meets the complete inclusionary criteria.

Inclusionary criteria should be explicit and directly related to the overall study objectives. Researchers should consider criteria such as: (1) Does the study include particular research participant groups (based on demographics or other characteristics) relevant to the research questions? (2) Are the key variables present? (3) Is there adequate information regarding the variables to calculate the needed effects? (4) Does the study use a design (e.g., RCT) that is acceptable to examine the question at hand? And (5) Are there particular time frames that the studies are

limited to? These types of issues should be considered in terms of the specific research question for the meta-analytic study. Decisions regarding the precise research question should be made as early in the processes as possible to avoid the need to redo the literature search.

Coding and Database Production

Software.

Coding of study results, constructs, characteristics, treatment, samples and design are the essence of meta-analysis. To most efficiently and effectively create a database, several software options should be considered, including software for reference management, database production, meta-analysis computation and graphical display.

Firstly, literature searches and bibliographic information form the core of data collection. In order to manage the oftentimes unwieldy number of studies that are gathered during the collection phase, a reference management software program is recommended. Several different programs are available, such as Reference Manager and Refworks, which aid in cataloging each study (that was included or excluded) and save considerable time when referencing the studies during the write-up phase of the meta-analysis.

Next, deciding whether a meta-analytic software package is needed. The size of the meta-analysis, the type of effect sizes, and the type of analyses can impact this decision. A variety of meta-analytic software programs are now available, such as Comprehensive Meta-Analysis, Review Manager, MetaGraphs, SAS Macros,

STATA, ARCUS, DSTAT, Meta-Analyst, Easy MA, Fast Pro, True Epistat, and DESCARTES and macros for SPSS. Each of these software packages or macros has advantages and disadvantages and should be carefully reviewed before purchasing. Types of features to consider include: (1) Does the software package include the appropriate statistical model (e.g., fixed, random, mixed effects models) (2) How is data entered into the program (e.g., forms, spreadsheets)? (3) What effect size measures are available? (4) Can the software perform advanced procedures? (5) What types of graphics, if any, does it offer? (6) Can the graphics be easily imported into another program (e.g., Word or PowerPoint) so they can be shared with other researchers? (7) Does the program have a test of homogeneity? and (8) Is the software flexible enough to allow adaptations of the algorithms? Typically, a given software package will not have all of the features needed. One must assess the particular needs of the individual meta-analysis and base decisions on the most important needs.

A viable option for many researchers may be to develop their own software using a program such as EXCEL. Algorithms for the calculation of effect sizes and bias corrections can be programmed into the spreadsheet. The advantage of this option is that data entry and preliminary computations analyses can be formatted in a way that is most intuitive or useful for the individual researcher. But more importantly, many programs are not sufficiently flexible to allow for specialized calculations not included in the software to be added or algorithms adapted to the specific needs of the researchers. Building your own program can give you that flexibility.

Depending whether you decided to create your own program or which meta-analysis software package you choose will play a part in determining how data entry will take place. For instance, Version 1 of Comprehensive Meta-analysis is created to have data entered directly into the program using a form template. In this case, data should be entered directly into the program at the start of the meta-analysis in order to maximize the features of the program. Other programs allow for data to be entered in spreadsheets, such as EXCEL, and can then be later imported into the software program.

No matter which way the researcher chooses, data entry should be conducted directly into a computerized spreadsheet or form rather than on pencil and paper forms. Using paper and pencil forms that are subsequently keyed into a computer database merely introduces additional error. It is also likely that this would require additional data entry procedures in order to verify the accuracy of the keyed data. This will increase the overall amount of work.

Coding Manuals and Forms.

A coding manual outlines the items that should be extracted from each study, gives detailed definitions of each item, and specifies codes for each item. Coding forms traditionally were paper and pencil and each study was summarized by filling in the form. The contemporary method is to develop a spreadsheet that contains places for each item to be entered.

The coding manual is typically a work in progress. That is, the researcher first carefully considers the data that should be extracted from the studies.

Subsequently, as the coders are trained and as the coding manuals are being used, modifications and refinements will be made. For instance, a researcher may too broadly or too narrowly define a variable in the coding manual. This may result in inconsistent data extraction or an unusually high rate of missing data. The researcher must then reassess the item in question and modify the manual accordingly. Many of the coding manual refinements will occur during the training of the coders.

Training of Coders

Lipsey and Wilson (2001) emphasize that the coding of studies is “one of the most technically demanding aspects of meta-analysis”. Therefore the training of coders should be give careful attention. At the onset of the project several instructional seminars, including readings, lectures, and discussions, should be provided. The extent of the instructional seminars will depend largely on the knowledge and sophistication of the coders. Issues that should be covered include: (1) general and theoretical knowledge about the body of literature; (2) methodological and statistical procedures common in the body of literature and relevant to the research question; and (3) meta-analytic procedures and strategies. Subsequently, coding manuals should be reviewed line-by line and discussions of various aspects of the coding manual discussed. Coders should practice using the manuals until all researchers are comfortable with the coding procedures. Periodic meetings should be conducted to review progress and discuss any difficulties encountered.

Choosing variables to extract and code in a meta-analysis should be done with careful thought and planning. The coded variables provide a description of the set of studies included in the meta-analysis and serve as potential moderating variables for analysis. In general, coding is done at the study level. Oftentimes a given study will offer more than one type of result, relationship, sample, construct, or time point. Each of these can result in more than one effect size that can be included in the meta-analysis. Care needs to be taken to provide study characteristics specific to each effect size included. Variables related to each effect size include characteristics such as, measure or construct, effect size specific sample size, calculation procedures, and scale reliability.

Study characteristics such as date of publication, form of publication (e.g., dissertation, peer-reviewed, conference presentation), sample size, demographics (e.g., age, gender, education), population description and setting should be included. Variables related to methods and procedures such as, sampling procedure, attrition and survey design are also important. Additionally, variables specific to the research question or particular body of literature that may be theoretically relevant should be identified.

Studies are sometimes coded for methodological soundness of the study. This type of coding is particularly relevant for comparisons between groups (e.g. treatment and control) across studies that may be directly impacted by study design. Setting explicit criteria for assessing methodological soundness is essential for avoiding the pitfalls of subjectivity. Using guidelines for methodological soundness

set by the field as much as possible can help increase objectivity. Two independent coders should rate the quality of studies and the coders should be blinded to names of authors and journals if possible.

Effect Sizes and Confidence Intervals

Effect sizes and confidence intervals are the most central elements of meta-analysis. Effect sizes provide valuable measures of magnitude of an effect, where as confidence intervals illustrate the precision of the given parameter estimate.

Effect sizes

Effect sizes are the primary index for reporting results in a meta-analysis. Effect sizes provide an estimate of an effect of an independent variable on a dependent variable (Rosenthal, 1991). This relationship between variables most often in meta-analysis is describing a study outcome or treatment effect, though this is by no means the only relationship examined in meta-analytic studies. Although an effect size can represent the direction or magnitude, the most typical (and rich) effect size measure both direction and magnitude. As the central statistic in meta-analysis, understanding effect sizes and the possible variations of effect sizes that exist prove essential for conceptualizing and starting a meta-analysis. Knowing the precise information needed to calculate effect sizes at the outset enables the researcher to more accurately identify which studies can be included in the meta-analysis. Although authors can be contacted for some missing information, this can prove to be unsuccessful for a variety of reasons and decisions about what type of information will be gathered directly from authors should be carefully selected.

Effect size measures can include the follow broad categories: (1) one-variable relationships (e.g., frequencies, proportions, sums); (2) two-variable relationships (e.g., pre-post contrasts, group contrasts; (3) association between variables (e.g., Pearson product moment correlation coefficients); and (4) multi-variate relationships (e.g., use of SEM, FA).

One-variable relationships

One-variable relationships are the least used measure of effect size and meta-analyses focusing on these relationships are not typical. In general this refers to the pattern of observation across a variable reported as a central tendency distribution (mean, median or mode) or as a distribution of values (frequencies, proportions or sums). An example of a one-variable relationship is the comparison of scores between two types of measures that represent the same construct (Lipsey & Wilson, 2001). These scores would need to be reported or converted in the same metric (e.g., percentiles) and associated standard errors calculated in order to be compared as an effect size.

Two-variable relationships

Two-variable relationships are the most common in meta-analyses. One common type of two-variable relationships is the pre-post contrasts, which involves the comparison of two central tendencies. These comparisons can be made on unstandarized means when the metric is the same for all measures. Otherwise comparisons can be made with standardized means scores.

Another common two-variable relationship is the group contrasts. Group contrasts involve a variable that is measured in two or more groups. Means, standard

deviations, and sample sizes for each group on each variable or proportions based on the characteristic of interest can be used for comparisons. There are a variety of effect size measures that can be used for group comparisons, such as, the unstandardized mean difference, the standardized mean difference, the proportion difference and the odds ratio.

Association Between Variables

The association between any two variables can serve as the basis of the meta-analysis. These bivariate relationships involve the covariation between two variables. The primary effect size in this context is the Pearson product-moment correlation coefficient. In some situations one could include the odds-ratio and the standardized mean difference. The standard Pearson product-moment correlation coefficient is used as an effect size index for two continuous variables. In contrast, a biserial point correlation coefficient is used for dichotomous-continuous variable relationships. Another possibility includes the two-dichotomous variable relationships assessed with the odds-ratio and phi coefficient. The odds-ratio is generally used to describe the comparison between two subgroups whereas the phi coefficient describes the relationship or predictive strength in a group.

When mixing continuous and dichotomous variables one must first decide if the dichotomous variables are inherently dichotomous or artificially dichotomous. If one variable is inherently continuous and the other is artificially dichotomous then product-moment correlation is used but it should be corrected for the artificial dichotomization or a z-transformed r can be used as the effect size index. On the other hand, if one variable is inherently continuous and the other is inherently

dichotomous either a biserial coefficient with a correction for dichotomy or a standardized mean difference with probit, logit or arcsine correction is used.

Multivariate Relationships

Multivariate relationships are the least common relationships examined. The methods for examining multivariate relationships are few and the applications limited. Various types of multivariate relationships, such as multiple regression, structural equation modeling and factor analysis have been discussed in the literature. The most challenging problem with exploring multivariate relationships is the lack of data needed to calculate standard errors. Researchers have begun to explore strategies such as synthesizing correlations statistics and meta-analyzing them by doing multivariate analyses on synthesized matrices. Ultimately, the most feasible approach identified so far is to actually conduct meta-analyses on individual studies that have conducted multivariate analyses and examining the multivariate relationships by combining correlations of reported predictors. The limited proportion of studies that use multivariate statistics to examine particular relationships in a body of literature poses a significant limitation. Additionally, multivariate meta-analyses are limited due to the lack of full correlation matrices reported in studies. Much more research is needed in this area to identify methods for working with available data. And more importantly, standards for reporting needed information such as correlation matrices, should be set by journal editors to help facilitate the use of these advanced procedures, which will no doubt have important impacts on the field.

In sum. There are advantages and disadvantages to each of effect size indices discussed. When conducting a meta-analysis, the relevant indices need to be identified. Potential effect size indices should be examined to determine which is most relevant, which requires information most attainable from the particular body of literature in question, and which will provide the most reliable measure possible.

Confidence Intervals

Confidence intervals illustrate the precision of a parameter estimate. The confidence interval provides an additional dimension to reporting effect sizes by indicating how “confident” one can be of the measure of magnitude obtained. The researcher has the flexibility to choose the level of probability, and this is done by setting the probability percentage for the confidence interval. For instance, a 95% confidence interval indicates that the confidence interval has a 95% probability of containing the population parameter.

The width of the confidence interval is directly related to: (1) the amount of data used to generate a given effect size; (2) the level of confidence interval chosen by the researcher; and (3) the computational model used. The larger the amount of data used the more precise the measure of effect size and therefore the narrower the confidence interval. Inversely, the greater the confidence level chosen by the researcher, the wider the confidence interval will be. Lastly, variance across studies attributed to entirely random influences are modeled with a fixed effects model. This model allows for confidence intervals that can actually reach zero. On the other hand, if the random variance and between-studies variance is assumed then a random

effects model is typically employed. This model tends to produce wider confidence intervals and limits the ability of the confidence intervals to approach zero.

In a traditional meta-analysis, interpretation of confidence intervals can be guided by clinical utility. In the medical field for instance, some research questions may be focused on reduction of mortality. These studies will hold different criteria than a treatment effect for less “critical” outcomes. Such practical issues illustrate the need for flexibility when setting particular confidence interval levels or for which results are considered “significant” or “not significant”. The most important consideration is whether the differences are clinically important, not important or yet unresolved. In general, caution should be used in interpreting point estimates. An emphasis is placed on the use of confidence intervals to increase the meaningfulness of interpretation.

Additionally, in meta-analytic reviews, confidence intervals should be reported for the individual studies as well as for the combined effects. Graphical representations of these confidence intervals provide an important tool for interpretations of the overall effects and the influences of individual studies on the overall effects. These simple but informative schematics, such as Forest Plots, provide the first step in the exploration of moderating variables of the effects.

Issues of Bias

It is sometimes necessary to correct the meta-analysis for bias. This can happen at two levels, either by correcting effect sizes with study-level information or by correcting more globally with meta-analysis level bias corrections. Most typically bias is corrected using study level information. Various types of biases that are

important to consider include, sample size bias, artifact biases (e.g., measurement bias), publication bias, and the ‘file drawer’ problem.

Sample Size Bias

Simple pooling of data occurs when each set of data from a particular study is pooled together without regard to differences in sample size. Therefore, studies which include 10,000 participants provide the same weight in the analysis as a study with 10 participants. To avoid this problem, effect sizes can be corrected for sample size bias by weighting each data point by its respective sample size. The inverse variance weight reflects the precision of the effect size estimate, which varies as a function of sample size. This method is used to weight the contribution of each study effect size so that larger studies are given more weight in the calculation of the overall meta-analysis effect size.

Artifact Adjustments

Artifacts are imperfections that arise when conducting studies. Adjustments can be made to account for study artifacts such as sampling error, variable reliability, restriction for range of variables, dichotomization of continuous variables, and imperfect construct validity. Most often the information needed to make such corrections is not available in published reports and even when the information is available for many studies, likely it is not available for all. Efforts should be made to identify alternative sources of information for conducting bias corrections. For instance, one may turn to manuals for a given measure (if available) in order to identify the overall reliability coefficient. Another way to deal with the lack of

consistent data is by conducting artifact distribution analyses to correct for biases using distributions. This method allows for bias correction at the meta-analysis level rather than at the study level. Ultimately, bias corrections can increase accuracy in some areas but may decrease accuracy in others. For instance, sampling error is larger for effect sizes with individually corrected effect size (e.g., measurement error correction; Hunter & Schmidt, 1990). Additionally, the researcher must decide if he or she is comfortable making interpretations using adjustments or basing interpretations on unadjusted data. If the researcher chooses to correct for bias, comparisons of effect sizes can always be made by reporting effect sizes both with and without the corrections.

Measurement bias

An example of an artifact bias is measurement or scale reliability bias. Effect sizes can be corrected for attenuation due to scale unreliability using Hunter and Schmidt's (1990) correction:

$$\delta_{ES'} = \frac{\delta_{ES}}{\sqrt{r_{yy}}} \quad (1)$$

where, ES = the observed (attenuated) effect size estimate, ES' = the disattenuated effect size estimate, and, r_{yy} = the reliability of the dependent variable measure, which was estimated using the reported value of the scale internal consistency coefficient Alpha.

When data is missing at the study level due to non-publication, it is called the “file drawer” problem and represents a form of publication bias. The most common procedure to estimate the impact of this sampling bias is computing the “fail-safe K” (Orwin, 1983; Rosenthal, 1979). This is an estimate of the number of undiscovered (presumably mostly unpublished) studies that, if known, would in aggregate reduce the overall meta-analysis effect size so that it was not statistically significant. Additional methods of assessing the robustness of the meta-analytic results in efforts to account for unpublished or missing studies include: (1) file drawer estimated by Iyengar and Greenhouse (1988); (2) missing studies estimate method by Gleser and Olkin (1996); and (3) trim and fill (Duval & Tweedie, 2000).

Although the “fail-safe K” has been a widely used procedure, Pham et al. (2001) found that the Iyengar and Greenhouse (1988) method provide a better estimate of missing studies. Pham et al. (2001) also indicate that the trim and fill method provides an adequate estimate of the number of missing studies. Again more research and consensus is warranted.

Publication bias.

Historically there has been a tendency to published studies with statistically positive results as well as larger effects. Including published studies, “grey literature” and/or unpublished studies can result in an attenuated effect size estimate. McAuley, Pham, Tugwell, and Muher (2000) suggest that the inclusion of grey literature can

reduce the effect size estimates by 12-50%. Publication bias is a form of sampling bias at the study-level.

There are a variety of methods for assessing publication bias. A simple procedure for assessing this type of bias is to compare effect sizes between published and unpublished studies. Additionally, studies can be coded to differentiate between different types of sources of study results (e.g., dissertation, conference presentation). Pham, Platt, McAuley, Klassen and Moher (2001) conducted a study examining some additional procedures including (1) funnel plots; (2) the rank correlation test; (3) the graphical test assessing funnel plot asymmetry; and (4) the graphical test assessing funnel plot asymmetry allowing for between-study heterogeneity. Appropriate use of these methods is important for increasing the reliability and accuracy of meta-analytic reviews. For instance, funnel plots can be difficult to interpret and asymmetry found in the funnel plots may be due to the presence of heterogeneity of the studies rather than publication bias (Egger, Davey, Schneider & Minder, 1997; Sterne, Gavaghan, & Egger, 2000) or may be due to both heterogeneity and publication bias (Pham, et al., 2001). Therefore, these tests should be conducted in conjunction with other tests to increase the accuracy of interpretation. One additional solution is to perform a full artifact distribution interim meta-analysis to determine a meta-analysis level correction rather than study-level corrections.

In sum. Ultimately, a meta-analyst must take into account a variety of information before deciding when to correct for bias, how many different bias corrections are needed (if any), or with which methods will then correct the bias.

Researchers need to consider that corrections of certain biases can increase others. For instance, overall sample size (i.e., number of studies) can decrease the sampling error, therefore the researcher may feel more inclined to correct for measurement error in these more “robust” situations. On the other hand, although the sample size may be large, if subgroup analyses are intended, this may in fact increase the sampling error within subgroup analyses and the researcher may then decide against correcting for measurement error. Another example may be that the range of reliability measures is quite small and the measures on the whole quite reliable, in this case the research may chose to not correct for measurement error in order to avoid the draw backs associated with individually correcting effect sizes.

Ideally, if bias corrections are needed, researchers of “primary” studies will report all information needed to perform comprehensive meta-analyses. This can enable meta-analysts to individually correct for bias rather than need to rely on interim meta-analyses to correct for artifacts at the meta-analytic level rather than the individual study level. If bias corrections are used it important to know that meta-analytic formulas used for corrected effect sizes typically are different than those used for uncorrected effect sizes.

Homogeneity of Effect Size

In meta-analytic studies, variation among effect sizes sometimes occurs due to random error, though oftentimes this variation becomes statistically larger than one would expect (due to random or sampling error). Tests of homogeneity attempt to identify the difference between variation due to random error and variation due to systematic differences between study design and participant characteristics or other

theoretically relevant variables. Ultimately, assessing heterogeneity of effect size is important because the lack of a homogeneous distribution typically suggests the presence of possible predictors or moderators of the effect size magnitude. A variety of methods for testing homogeneity are available including tests of homogeneity designed to assess variation in treatment effects with odds ratios, percent of variance accounted for measure of effect size, and standardized effect size measures.

Modeling Variance

There are three primary methods of modeling variance: fixed, random and mixed effects modeling. The fixed effects model assumes the only source of variance is subject-level sampling error, whereas the random effects model assumes that the source of variance includes subject-level sampling error and study-level sampling error (i.e., random error). The fixed effects model can also include systematic variance due to identifiable moderating variables. A mixed model assumes all three sources of error, sampling error, random error and systematic error.

In a fixed effects model, it is assumed that the variance in the effect size distribution is only due to subject-level sampling error. So it is assumed that an effect size from an individual study represents the population effect with only random sampling error associated with chance factors. Tests of homogeneity examine the assumption that error is only due to sampling error and thereby serves as an assessment for whether the fixed effects model holds, though as discussed below, evidence of heterogeneity does not necessarily rule out a fixed effects model.

If the fixed effects model does not hold then another model is sought. The random effects model assumes that sampling error is accompanied by other sources

of variability randomly distributed. The sampling error is considered to be from the subject-level whereas the random error is an estimate of between-studies variance. This between-studies error is thought to be analogous to study-level sampling error. Identifying the random effects variance component is the most difficult of the two components and can be assessed using noniterative methods based on method of moments and iterative methods based on maximum likelihood.

If one assumes that the fixed effects model holds but additional error is due to a systematic difference in the coded variables then one can attempt to partition the effect size variance. This can be tested by performing an analog to analysis of variance. This ANOVA will be used to explore variables by partitioning the total variance Q (Total) into Q (Between) and Q (Within). Q (Between) values will be used to test between group differences by using a Chi-square with $df = p-1$, where p = the number of studies.

If the variance is assumed to be due to subject-level sampling error, study-level sampling error (or random error) and some systematic variance then the model would be a mixed effects one. This means that the component of error not accounted by sampling or systematic variance must be incorporated into the effect size analysis by creating a weighting function. In this case, the residual Q (Between) or Q (Within) would still be heterogeneous. Fitting the mixed effects model is similar to the random effects model.

The mixed effects model is used less often than fixed and random effects models due to the complexity of the modeling procedures. Ultimately, fixed effects are more likely to identify systematic variance than the mixed effects model since it

has more power to do so. On the other hand, mixed effects models have more accuracy in terms of type I error. On the whole these models require much more research to understand how best to account for and assess variance, especially in relation to accounting for and calculating the study-level sampling or random error.

Meta-Regression

In addition to ANOVA analogs using fixed and random effects models, one can employ the use of meta-regression to examine the association of effect with study characteristics. Meta-regression is a more sophisticated approach to assessing moderators when heterogeneity is observed (Song, Sheldon, Sutton, Abrams, Jones, 2001). As with other regression analyses care should be taken to assess collinearity by assessing correlations between variables. Overall fit of the meta-regression can be calculated with a Q_R for the regression and a Q_E for the residual error, which are distributed as a chi-square (Lipsey & Wilson, 2001).

Power Analysis

When conducting a meta-analysis that is primarily aimed at resolving conflicting studies in the literature, namely those using null hypothesis testing, meta-analysts should perform power analyses. In this case, using the obtained overall effect size and assuming it is equivalent to the population effect size, the use of Cohen's power tables are appropriate. In other situations, the principal question of power for meta-analysis involves not so much whether or not the overall effect size is statistically significant but rather whether there is sufficient power to determine if the effect size distribution is heterogeneous. Power for the Q test depends on the

ratio of between- to within-study variance (Hedges & Pigott, 2001). Unfortunately, it is difficult to know what this ratio might be a priori. Schmidt (1992) reports a range of 0.33 to 1.0 across a large number of meta-analyses that he examined. Hedges and Pigott (2001) suggest variance ratios of 0.33, 0.67, and 1.00 be considered small, medium, and large degrees of heterogeneity, respectively.

Outliers

Effect size distributions should be examined for extreme high or low scores in order to identify outliers. Outliers should be examined carefully in efforts to identify any potential errors (e.g., transcription errors) on the part of meta-analyst that can be corrected. In some cases summary data in published studies may appear to be causing the outlier and the meta-analyst can attempt to contact authors for verification.

In order to identify the outliers several methods can be employed. For instance, standardized residuals can be used to identify outliers when using models (e.g., the standardized difference from the mean, using fixed or random effects), though the guidelines for cutoffs are most appropriate when the underlying distribution is homogeneous. Another method is to test the suspected outliers by eliminating one effect size at a time and assessing the change in Q (homogeneity statistic). If underlying heterogeneity exists, Forest plots or other subgroup analyses can be employed to assess the outlier within the context of a variety of moderators and to identify the outlier with respect to potential associated clusters of effect sizes. Another method includes identifying effect sizes that are 2 to 3 standard deviations from the mean to be considered for removal or recoding.

Once identified outliers are most typically removed from further analyses. If a researcher does not wish to remove studies from the meta-analysis, a more inclusive approach can be employed. This involves identifying a break in the effect size distribution and coding outliers back to the next largest cluster of effect sizes (Lipsey & Wilson, 2001). The advantage to this method is that it ensures as much data as possible is maintained and allows for the extreme values to be retained but not to distort other effect sizes in the distribution.

Each of these methods requires a degree of researcher judgment or subjectivity when determining which values are outliers and when those outliers should be removed. Furthermore, these methods have typically not been developed specifically for meta-analysis. Huffcutt and Arthur (1995) developed an outlier statistic for meta-analytic data, called SAMD (sample-adjusted meta-analytic deviancy statistic). Unfortunately it requires a high number of computations and is typically not appropriate for coefficients that are individually corrected for bias (e.g., measurement error; though in some instances with additional adjustments these can be accounted for). Additionally, recent research has raised critical questions about its potential utility. In particular, when SAMD was used for removing outliers with correlational data, small correlation outliers are more likely to be removed than larger correlation outliers (Beal, Corey & Dunlap, 2002) which introduces yet another bias problem. It is unclear if this problem persists in the examination of outliers for standardized mean difference scores. To date, recommendations by Beal et al. (2002) to resolve the asymmetric outlier identification have not yet been explored; therefore more research should be done before this procedure is used.

Interpretation Issues

The interpretation of results in a meta-analysis largely depends on the research question that the meta-analysis was designed to examine. Simple meta-analysis will often seek to determine if a body of literature, when combined, produces significant results. Overall assessments of significance allow interpretations that parallel the individual studies on which the meta-analysis was based. More sophisticated meta-analysis will examine moderating variables and explore aspects of theories and interpretations will be couched in underlying theories or new discoveries.

At a more basic level, the index of effect size is the central measure in the meta-analysis. Effect sizes have general rules of thumb for interpretation. Although important, these should merely serve as guidelines and ultimately need to be interpreted within the context of the measured relationships. For instance, Cohen (1977) suggests that effect size magnitudes have range of small ($d = .20$; $r = .10$; $\eta^2 = .010$), medium ($d = .50$; $r = .25$; $\eta^2 = .059$), and large ($d = .80$; $r = .40$; $\eta^2 = .138$). These can also be interpreted as 1%, 6%, and 14% of the variance is accounted for respectively for small, medium, and large effects. In a recent study, Rossi (2003) found that typical effects for public health interventions were closer to 0.5%, 1.0%, and 1.5% of the variance for small, medium, and large effects. These findings are dramatically smaller than rules of thumbs set by Cohen due to differences in the context of their development. Similarly, when analyses are dealing with clinically and practically significant results it is up to the researcher to determine the significance of the findings within its particular context.

Currently, meta-analysis has much growing to do and the field has much to do to embrace and foster that growth. In such an environment, meta-analysts should be particularly thorough in reporting methods used to conduct meta-analyses, in providing data in a variety of forms (e.g., with and without bias corrections or fixed versus random effects modeling), and avoid interpreting results with unfounded confidence (e.g., without sufficient consideration to limitations). These strategies enable other researchers to replicate meta-analytic findings, and help provide the data needed to replicate findings in the face of new, refined, or more advanced techniques while minimizing the risk of unwarranted controversy over a technique that, as it matures, will be more and more important to the field.

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CHAPTER FIVE

DETERMINING EFFECT SIZE FOR META-ANALYSIS: A COMPARISON OF ALTERNATIVE PROCEDURES

Introduction

Effect sizes are the primary index for reporting results in a meta-analysis.

Effect sizes provide an estimate of an effect of an independent variable on a dependent variable (Rosenthal, 1991). This relationship between variables most often in meta-analysis is describing a study outcome or treatment effect, though this is by no means the only relationship examined in meta-analytic studies. As the central statistic in meta-analysis, determining effect size is essential for meta-analysis. Although relatively little information is typically needed to compute the most common measures of effect size, the necessary data are not always reported in research articles. Rosenthal (1994) and others (Lipsey & Wilson, 2001) have provided useful summaries of methods for computing effect sizes under a variety of situations. For example, to compute Cohen's d or Hedges' g it is necessary to know the means, standard deviations (SD), and sample sizes of the groups that are being compared. If some or all of these data are unavailable, one could estimate effect size from t or F test results as long as the degrees of freedom of the test are known.

A different type of problem occurs when reported data appear to support the calculation of effect size but instead lead to inappropriate or misleading results. This might happen when data are reported as standard scores, such as z ($M = 0$, $SD = 1$) or T -scores ($M = 50$, $SD = 10$). For example, a meta-analysis by Prochaska (1994)

included a study by Velicer et al. (1985) that used T -scores to describe the benefits of smoking. The effect size comparing smokers and ex-smokers was determined by subtracting T -scores and dividing by 10, resulting in an effect size of 0.43. This procedure appears correct because it is known that the SD of T -scores equals 10. Therefore, dividing the T -score difference by 10 should result in the standardized difference between the means. However, this procedure is sub-optimal because 10 is the *total* group SD , not the pooled *within-group* SD used to compute Hedges' g or Cohen's d (Rosenthal, 1994). Since Velicer et al. (1985) provided group n 's and SD 's, we were able to compute an effect size based on the pooled within-group SD . This resulted in an effect size of 0.55, nearly 30% larger than the value reported by Prochaska (1994).

In most cases the within-group variance will be less than the total group variance whenever the grouping variable has a non-zero relationship with the dependent variable, since this will reduce within-group variance relative to total variance (i.e., $SS_{\text{error}} = SS_{\text{total}} - SS_{\text{between}}$). Thus, computing effect size by subtracting T -scores should underestimate Cohen's d or Hedges' g . This study examined this possibility using two meta-analyses that were being conducting (Hall & Rossi, 2002, 2004), including only studies that provided enough information to compute effect size using both methods. It was predicted that the method of subtracting T -scores would underestimate the effect size based on the pooled within-group SD .

Conceptual Framework for Effect Size. The effect sizes computed for this study represent the cross-sectional "change" in Pros and Cons scores across the stages from Precontemplation to Action. Prochaska (1994) found that the effect size

for Pros and Cons across the stages from Precontemplation to Action was approximately 1 *SD* for Pros and 0.5 *SD* for Cons. He coined this relationship the Strong and Weak Principles. The Strong and Weak Principles were re-examined in this study using three different methods of effect size calculation that served as the basis of the effect size comparison. Additionally, correction factors to account for differences between the calculation methods for each of the constructs were considered and a final bias correction was developed.

Method

The current study compiles two sets of data from an on-going study examining Transtheoretical Model Decisional Balance measures – both the Pros and Cons of Change.

Procedure

Literature Searches. The datasets for this study were acquired through literature searches on two computerized databases, MEDLINE, and PsycLIT from 1983 (the year of initial study using the TTM by Prochaska & DiClemente) to February 2002. Additional search procedures included personal communications with authors and reviews of reference lists from acquired articles. Datasets for this meta-analysis included published articles, conference presentations, and papers in progress.

Inclusion Criteria. As part of a larger study, datasets involving any type of behavior, which at least in part examined Stages of Change and Decisional Balance were considered for analysis. The primary inclusion criteria for the current study

required that articles must provide: 1) enough information to compute the pooled *SD*; 2) mean *T*-scores for each group (either in the text, in a table, or in a graph depicting *T*-scores across groups).

Analyses

Effect Size Calculations. Three methods of determining effect size were used in the analysis: Hedges' *g*, standard score, and graphical standard score estimation. Hedges' *g* requires means, *SD*'s, and *n*'s for each group (either raw scores or *T*-scores). Hedges' *g* is the difference between the sample means divided by the average pooled sample standard deviation (Rosenthal, 1994).

$$\text{Hedges' } g = \frac{M_1 - M_2}{S_{pooled}} \quad (2)$$

Both the standard score and the graphical standard score method utilize the same equation to compute effect size. This equation simply requires standard *T*-scores ($M = 50$, $SD = 10$) for each group, and is defined as the difference between the sample means divided by the standard deviation.

$$\text{Standard/Graphical Effect Size} = \frac{M_1 - M_2}{10} \quad (3)$$

The only difference between the standard score and the graphical method is that group means for the standard score method was obtained from the text or a table, whereas, the graphical method used scores estimated from a graph.

Estimations of *T*-scores from graphs were made by using a ruler to measure the point against the *y*-axis where the *T*-scores are graphed. The ruler measurements were then used to interpolate *T*-scores between adjacent tic marks on the *y*-axis. The

scores were interpolated to the nearest hundredth. It should be noted that the graph method was used only when Hedges' g could not be calculated and the actual standardized scores were not available.

Effect Size Differences. Paired-samples t -tests were conducted between the T -score and graphical methods for each of the constructs. Additionally, paired-samples t -tests were conducted between the standard score approach and the Hedges' g for each of the constructs.

Effect Size Correlations. Correlations were performed between the effect size methods for each of the constructs.

Regression Analyses. Regression analyses were conducted with the Pros and Cons data. Regression analyses were performed including the variables: sample size, standard score approaches (T -score and graphical standard score estimation), Hedges' g and standard score, to assess the best fit. Mean differences in effect sizes between the Hedges' g and the standard score calculations for each study was assessed.

A second set of analyses were run following the removal of outliers. Differences in scores between the Hedges' g method and scores estimated via the regression formula of 0.5 or greater were considered outliers and were removed from the analyses.

Corrections Formulas. Regression analyses and trendlines for each set of data were compared to identify the best fit for subsequent use as regression correction formulas.

Results

Thirty-eight studies investigating Decisional Balance (Pros and Cons), satisfying all inclusionary criteria were identified. Some studies examined multiple health behaviors; therefore the total number of datasets was 46 for each of the constructs.

Prior to comparing Hedges' g to the standard score method, the comparability of the two different techniques for obtaining the standard score was examined. This comparison was conducted for the subset of studies that provided information on T -scores both in text and in graphs. Paired-samples t -tests were conducted to test the equivalency of these two approaches. There was no significant difference in using reported T -scores versus estimating scores from a graph for Pros, $t(24)=1.201$, Cons, $t(24)=-1.160$, with correlations of 0.965 and 0.981 respectively. Therefore, these two methods were collapsed. T -scores were estimated from graphs only when the actual standardized scores were not available.

The standard score approach was then compared to the Hedges' g method using paired-samples t -tests. As expected, a significant difference was found for Pros, $t(45)=3.896$, $p<.05$, $d=0.193$, Cons, $t(45)=3.807$, $p<.05$, $d=0.105$. Table 1 presents the means, SD 's, and n 's for Hedges' g and standard score effect size's for the two constructs. The correlation between the two effect size methods was nearly the same for the two variables: 0.924 for Pros, 0.944 for Cons.

Table 1

Comparison of Effect Size Calculation Methods for the Pros and Cons of Change

	Hedges' g		Standard Score	
	Pros	Cons	Pros	Cons
Mean	1.17	.64	1.04	.58
SD	.54	.31	.42	.26
N	46	46	46	46

Regression Analyses. The data were first examined including all available data and using regressors: 1) standard score effect sizes; 2) sample sizes of each mean score used to calculate the effect sizes; and 3) calculation type (*T*-score or graphical method). For Pros, the regression was a good fit ($R^2_{adj} = .843$), with an overall significant relationship ($F_{4,40} = 59.998$, $p < .01$). For Cons, the regression was also a good fit ($R^2_{adj} = .905$), with an overall significant relationship ($F_{4,40} = 95.033$, $p < .01$).

Since, sample size is not always available, and for parsimonious efforts the regression were run again including the standard score effect size as the only regressor. This resulted in a good fit for the Pros data ($R^2_{adj} = .851$), with an overall significant relationship ($F_{1,44} = 258.028$, $p < .01$), as well as a good fit for the Cons data ($R^2_{adj} = .888$), with an overall significant relationship ($F_{1,44} = 359.116$, $p < .01$).

Regression correction equations were developed based on the parsimonious regressions stated above yielding one correction for each construct:

$$\text{Pros correction} = (\text{ES})(1.829) - 0.065 \quad (4)$$

$$\text{Cons correction} = (\text{ES})(1.130) - 0.014 \quad (5)$$

where ES = standard score effect size. Diagnostics were then assessed and difference scores between the Hedges' g effect size and the estimated effect size based on the regressions reported above. Four sets of data showed differences of 0.5 or greater and therefore were considered outliers. These data were removed from the analyses, including one data set for Cons (Marcus et al., 1994, exercise) and three for Pros (King et al., 1996, smoking; Jordon, 2002, bulimia; Grimley et al., 1995, condom use – main).

Regressions were then run on the data with the outliers removed. This resulted in an even better fit for the Pros data ($R^2_{adj} = .946$), with an overall significant relationship ($F_{4,41} = 713.848$, $p < .01$), as well as a very good fit for the Cons data ($R^2_{adj} = .925$), with an overall significant relationship ($F_{4,41} = 527.631$, $p < .01$). Figure 1 and Figure 2 illustrate the relationships between the effect sizes calculated with Hedges' g and Standard Score methods.

Figure 1. Relationship between Hedges' g and Standard Score for Pros of Change with Outliers Removed.

Figure 2. Relationship between Hedges' g and Standard Score for Cons of Change with Outliers Removed.

Lastly, since the relationships for the Pros and Cons between the Hedges' g effect sizes and the standard score effect sizes revealed similar patterns the two sets of data (see Figure 1 and Figure 2) for these constructs were combined (see Figure 3) and regression analyses were performed. This resulted in the best fit ($R^2_{adj} = 95.5\%$), with an overall significant relationship ($F_{4,41} = 1826.575, p < .01$).

Figure 3. Relationship between Hedges' g and Standard Score for Pros and Cons of Change Combined.

Correction Formula. Regression formulas were specifically designed to correct for this bias for the Pros and Cons of change. Using the best fit regression, the combined Pros and Cons data with outliers removed, a regression correction formula was created. Effect sizes based on either the standard score or the graphical standard score methods can subsequently be corrected for bias using the following equation:

where, ES = standard score effect size estimate.

Discussion

Our results showed that Hedges' g consistently provided a larger effect size estimate than the standard score method for both constructs. For Pros and Cons, Hedges' g was approximately 10% greater than the standard score effect size. In fact, not only were there overall differences but the standard score method underestimated effect size for 87% of the data included in the analysis. An implication of this finding is that one might consider using a correction for standard score estimates to better approximate the effect size.

A single correction equation was achieved by combining the data from both constructs that provides a good effect size adjustment. Unfortunately, it is unclear if the same correction will suffice for other constructs. Thus, meta-analysts may need to determine their own correction factor specific to their given measures.

It is clear from the data that the regression line fit small effect sizes better than larger effect sizes; therefore the correction formula is likely to be more accurate for smaller effect sizes. More exploration is needed to understand this relationship.

An important limitation of our study is the use of only two variables. Our preliminary findings suggest that a more extensive examination is warranted in order to identify possible systematic variation in effect size procedures. Simulation studies may provide an effective way to examine more complex patterns and relationships in the data to clarify what factors affect the magnitude of the discrepancy between these two approaches of estimating effect size.

In sum, a reasonably accurate correction factor was achieved by creating a single regression equation for both constructs. Effect sizes based on either the standard score or the graphical standard score methods can subsequently be corrected for bias using the regression equation. In addition to reducing the underestimation in the magnitude of effect sizes based on standard scores, these procedures will also help reduce the number of studies that must be discarded from the study due to insufficient reporting of data on which to compute effect sizes, thus eliminating a potential source of bias.

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CHAPTER SIX

A META-ANALYTIC EXAMINATION OF DECISIONAL BALANCE ACROSS STAGE TRANSITIONS: CROSS-SECTIONAL ANALYSIS

Introduction

Interventions to decrease unhealthy behaviors and to increase healthy behaviors are crucial for health promotion and disease prevention. Tailored interventions provide a promising approach for creating positive health behavior change. To produce optimally tailored interventions: (1) theory that guides interventions needs to be comprehensively tested; and (2) empirical data that drive the tailored interventions needs to be systematically generated.

One important model of behavior change, the Transtheoretical Model (TTM), is particularly suited for serving as a framework for interventions. The TTM delineates a way to conceptualize behavior change, provides the foundation for developing assessments of an individual's readiness to change, and is utilized in tailoring interventions for actualizing behavior change. Since the development of the TTM, hundreds of studies have used the model, yet, to date there has been no comprehensive examination of the TTM across behaviors. Furthermore, many of model's theoretical assumptions have not been thoroughly tested. As a result, developing interventions based primarily on theory rather than on a firmly established empirical database may prove problematic.

The current investigation aimed to: 1) quantitatively investigate the relationship of Decisional Balance and Stages of Change by identifying the

magnitudes of effect for Decisional Balance in relation to the transition between each adjacent Stage of Change; 2) begin to more clearly delineate the patterns of change across and within behaviors; 3) provide information that will help inform intervention development in order to create more efficient and effective health behavior change.

Transtheoretical Model of Behavior Change

The Transtheoretical Model (TTM) of behavior change has been utilized around the world and across a large variety of behaviors. The TTM originated by integrating theories of psychotherapy as well as incorporating constructs from alternative models. The central organizing construct of the TTM characterizes behavior change over time through five distinct Stages of Change: Precontemplation, Contemplation, Preparation, Action, and Maintenance. Two intermediate indicators of when these changes will occur are Decisional Balance (weighing of Pros and Cons) and Self-efficacy (Situational Confidence or Temptation). Additionally, the TTM explains behavior change strategies through ten Processes of Change.

The algorithms for the five Stages of Change are specific for each behavior, but usually follow these general Stage concepts: participants are considered to be in the Precontemplation Stage if they report an undesired status, that is, the presence of a problem behavior or the lack of a healthy one, and express no intention of changing in the next six months; participants are considered the Contemplation Stage if they intend to change in the next six months; participants in the Preparation Stage plan to change in the next month and have begun to engage in target behaviors, but have not

yet met particular criteria; participants reach the Action Stage once they have met the given behavioral criteria. Lastly, if the participant has met the specified behavioral criteria for greater than six months, they have reached the Maintenance Stage.

One of the most important and reliable TTM constructs, Decisional Balance, was inspired by Janis and Mann's (1977) conflict model of decision-making. Janis (1959) proposed a descriptive schema called a "balance sheet" of incentives. The four main categories of consideration for decisional conflicts are: a) *utilitarian gains and losses for self*; b) *utilitarian gains and losses for significant others*; c) *self-approval or –disapproval*; d) *approval or disapproval by significant others*. These four comparative categories of potential positive and negative incentives involve both instrumental effects of utilitarian objectives and nonutilitarian considerations such as issues of self-esteem and value-based determinations.

The development of the TTM Decisional Balance measure (Velicer, DiClemente, Prochaska, and Brandenburg, 1985) was based on the 8 factors (4 gains and 4 losses) of Janis and Mann (1977). The researchers constructed the scale to study the decision-making process across the Stages for smoking cessation. Instead of achieving an 8 factor-structure as anticipated, principal components analysis identified two orthogonal components. These two components were called the Pros and Cons of Smoking.

Following the original study by Velicer, the use of the construct began to expand, encompassing an array of behaviors such as exercise, condom use, and mammography screening. This early work culminated in a paper by Prochaska et al. (1994), which looked at patterns in Decisional Balance across Stages in 12

behaviors. This integrative study investigated: 1) the generalizability of the TTM for Stage and Decisional Balance across behaviors; 2) the generalizability of the TTM for a variety of populations; 3) the number of components in Decisional Balance and their respective internal consistencies; 4) patterns of Pros and Cons across Stages; and 5) the Stage of crossover between standardized Pros and Cons scores. More recently, a meta-analysis examining 37 behaviors utilizing 81 datasets including nearly 40,000 participants was conducted re-examining these relationships and exploring additional ones (Hall & Rossi, 2004).

Generalizability of Stage and Decisional Balance

Prochaska et al. (1994) and Hall & Rossi (2004) found clear support for the generalizability of the Stages of Change, the Pros and Cons, and the integration between them. The researchers additionally found that these constructs generalized across a variety of populations and behaviors.

Structure of Decisional Balance

Consistent with the two-factor structure identified by Velicer et al. (1985), Prochaska et al. (1994) and Hall and Rossi (2004) respectively found 92% and 94% of the studies reported a two-component solution for Decisional Balance with an average internal consistency coefficients ranging from .72 to .95 for Pros and from .64 to .95 for Cons.

In Kurt Lewin's (1948) expectancy theory, it is postulated that behavior changes as a function of the increases and decreases in motivation to contemplate gains and losses. The TTM builds on this notion by suggesting a clear directionality to the function as well as a characteristic way of examining it. The function is based on the relationship of when and how much the Pros increase and the Cons decrease (Prochaska et al., 1994) and is examined by identifying a graphical crossover of the Pros and Cons as they change relative to each other. More specifically, the crossover occurs when the standardized Decisional Balance scores are graphed by Stage. Prochaska et al. (1994) and Hall and Rossi (2004) found that the Decisional Balance crossovers occurred during the Contemplation Stage for 58% and 53% of the studies, respectively. Based on the timing of the crossover, the researchers suggest that progress from Precontemplation to Contemplation involves an increase in Pros whereas progress from Contemplation to Action involves a decrease in Cons.

Several Decisional Balance patterns were found in the two studies (Hall & Rossi, 2004, Prochaska et al, 1994). For example, the Cons of Changing were higher than the Pros of Changing in the Precontemplation Stage for all datasets in both studies. Prochaska found the opposite true for 11 out of 12 behaviors in the Action Stage.

Patterns across Stage

Several additional patterns in the relationship between Stage of Change and Decisional Balance were found in the two studies (Hall & Rossi, 2004, Prochaska et

al, 1994). For example, the Cons of Changing were higher than the Pros of Changing in the Precontemplation Stage for all datasets in both studies. Prochaska found the opposite true for 11 out of 12 behaviors in the Action Stage.

Decisional balance (Pros and Cons) serves as an intermediate indicator of when change will occur and has generally been thought to be especially salient in the earlier Stages of Change (Redding et al., 1999; Velicer et al., 2000). Velicer et al. (2000) also illustrated that the relationship between the Stages and Decisional Balance for an unhealthy behavior is different than for a healthy behavior. That is the pattern for an unhealthy behavior was such that the Cons decreased across the Stages whereas the Pros displayed a curvilinear pattern which paralleled the decline of the Cons in the later Stages. In contrast, the healthy behavior showed more of an X configuration, with the Pros continuing to increase across the Stages whereas the Cons decrease across the Stages.

Strong and Weak Principles

Across twelve studies (Prochaska, 1994), mathematical relationships were found between the Pros and Cons of Changing and progress across the early Stages into Action (Prochaska, 1994). The Strong Principle of Change states that $PC \rightarrow A \cong 1 SD \uparrow PROS$: progress from Precontemplation to Action involves approximately one standard deviation increase in the Pros of Changing. The Weak Principle of Change states that $PC \rightarrow A \cong .5 SD \downarrow CONS$: progress from Precontemplation to Action involves approximately .5 SD decrease in the Cons of Changing.

In re-examination of the strong and weak principles, the magnitude of the maximum increase in the Pros of change was again found to be greater than the maximum decrease in the Cons of change from Precontemplation to Action across 37 difference health behaviors (Hall & Rossi, 2004). Consistent with Prochaska's (1994) strong principle, the average effect size for the Pros was approximately one standard deviation ($d = 1.05$, $SD = .45$), almost identical to Prochaska's (1994) original finding ($d = 1.06$, $SD = .26$). Though, Hall and Rossi's (2004) findings also revealed that Prochaska's weak principle may not be so weak. That is, the average effect size for Cons was stronger ($d = .62$, $SD = .38$) than was found in the previous study ($d = .45$, $SD = .22$) by Prochaska (1994), though clearly the Cons remains weak relative to the Pros. Practical implications of these principles are that the Pros of Changing must increase twice as much as the Cons must decrease, suggesting that an intervention place twice as much emphasis on raising the benefits as on reducing the costs or barriers.

Stage Transitions

The Strong and Weak Principles are useful for understanding the amount of work generally needed to move from Precontemplation to Action. Although theoretically the principles have been important in conceptualizing and understanding the relationship between Decisional Balance and Stages of Change, these principles are essentially action-oriented when applied to interventions. That is, by examining characteristics of the transition only from Precontemplation to Action, and using these to tailor interventions, one is potentially neglecting three Stages:

Contemplation, Preparation and Maintenance. Therefore more practically, the examination of each Stage transition can help identify the most effective strategy for tailoring behavior change interventions.

Research Hypotheses and Predictions

The aims of this study are focused on the two constructs, Stages of Change and Decisional Balance. The research hypotheses and predictions are as follows:

Hypothesis 1. Decisional Balance for behavior change will show dimensional structure.

Prediction 1. Decisional Balance for behavior change is composed of two separate, distinguishable dimensions, the Pros and Cons (Hall & Rossi, 2004; Prochaska et al., 1994).

Prediction 2. The two dimensions, Pros and Cons, are not correlated (Hall & Rossi, 2004).

Hypothesis 2. There is a functional relationship between the Stages of Change and the two Decisional Balance measures, Pros and Cons.

Prediction 1. The majority of the crossovers will occur during the Contemplation Stage as seen in previous studies (Hall & Rossi, 2004; Prochaska et al., 1994)

Hypothesis 3. There is a relationship between the Stage transitions and the two Decisional Balance measures, Pros and Cons.

Prediction 1. The Strong and Weak Principles of Change have shown approximately 1 standard deviation increase in the Pros of Change as one progresses

from Precontemplation to Action, whereas the Weak principle is approximately a $\frac{1}{2}$ standard deviation decrease in the Cons of Change as one progresses from Precontemplation to Action (Hall & Rossi, 2004; Prochaska, 1994). Since the Strong and Weak Principles measure the maximum increase and decrease of the Pros and Cons from Precontemplation to Action, rather than an absolute difference, these two principles are “biased”. That is, the principles result in a potential over-estimation of the cumulative effect size across the three transitions PC-C, C-PR, and PR-A. Therefore it is predicted that $(PC-C) + (C-PR) + (PR-A) < 1 \text{ SD}$ (standard deviation) for Pros and $(PC-C) + (C-PR) + (PR-A) < .62 \text{ SD}$ for Cons.

Prediction 2. The Pros and Cons appear to be most salient in the earlier Stages of Change (Redding et al., 1999; Velicer et al., 2000), therefore it is predicted that the greatest magnitude of effect will be seen in the transition from PC-C for both the Pros and Cons. The transition from PC-C is anticipated to be approximately .5 *SD* with the transitions C-PR and PR-A each approximately .2 *SD*. Finally, since it is believed that the earlier Stages are most salient and since one would anticipate more “work” would be needed to move from pre-Action Stages towards Action than from Action to continuing to maintain that Action, the transition from A-M for Pros and Cons is predicted to have the smallest effect size.

Prediction 3. In an examination of the Strong and Weak Principles (Hall & Rossi, 2004), the distribution of effect sizes were found to be heterogeneous for both Pros and Cons, therefore it is predicted that the distribution of effect sizes for each Stage transition will also be heterogeneous and that there will be several moderators of the effect size distributions.

3a. Although it is clear that the model generalizes to a variety of behaviors, there are many factors within the characteristic of the behaviors and the studies that may contribute to variation (e.g. similarity of measures within some behaviors but not across behaviors). Therefore, as seen in previous studies (Hall & Rossi, 2004), it is anticipated that behavior category will be a moderator variable and that there will be heterogeneity within behaviors, indicating additional moderators.

3b. Studies have shown that patterns of TTM variables vary by age group (Hall & Rossi, 2004, Weinstock et al., 2002), therefore it is predicted that mean age of study participants will be a moderator of effect sizes.

3c. A recent study found significant effect size differences between response formats (Hall & Rossi, 2004) for the Pros and Cons, therefore it is predicted that response format will be a moderating variable.

3d. Publication status has not previously been examined as a potential moderator of effect size distribution. Datasets will be gathered from sources such as dissertation and conference presentations, since these types of publications are “refereed”, although perhaps not as rigorously as peer-reviewed publications, it is anticipated that publication status will not be a moderating variable.

Method

Procedure

Literature Searches

The datasets for this study were identified through literature searches on computerized databases, PUBMED, Cancerlit, Cinahl, Health and Wellness

Resource Center and PsycLIT, starting in 1985 (the year of the initial Decisional Balance study). Keywords to identify appropriate studies included, Transtheoretical Model, Stages of Change Model, Stages of Change, Decisional Balance, decision making, and Pros and Cons. Additional search procedures included personal communications with authors and reviews of reference lists from acquired articles. Datasets include published articles, conference presentations, papers in progress, and raw data.

Inclusion Criteria

Studies involving any behavior, which examined Stages of Change and Decisional Balance, were considered for analysis. Next, the studies needed to include: 1) means, *SD*'s, and *n*'s of the Decisional Balance measures for each given Stage; or 2) mean *T*-scores of the Decisional Balance measures for each given Stage (in either text, table, or graph). In addition, the studies needed to report at least two consecutive (e.g., Precontemplation and Contemplation or Contemplation and Preparation) Stages of Change.

There are a variety of ways in which researchers assess Stage of Change. Two main categories of Stage assessment are algorithm type staging and clustering type staging. For inclusion in the current study, the Stages must have been assessed by an algorithm or Likert procedure and not cluster procedures (e.g. URICA, Socrates, or cluster analysis approach). Firstly, procedures such as the URICA, often don't yield traditional Stage categories (e.g., they often include categories called "immotive" and "non-reflective action"). Attempts at consistent interpretation of the profiles to ensure consistent interpretation would be a complex procedure and would

require sufficient reporting of profiles to “re-categorize” them and link them to the Stages or order them from "least ready" to "most ready" to change. Additionally, profiles across studies are inconsistent which would mean interpretation would have to be done on a case-by-case basis. Lastly, scoring for cluster approaches, specifically URICA, are complicated and are sometimes improperly or inconsistently scored, therefore raw data and reanalysis would likely be necessary (D.A. Levesque, personal communication, December, 17, 2003).

Training of Coders

Lipsey and Wilson (2001) emphasize that the coding of studies is “one of the most technically demanding aspects of meta-analysis”. Therefore the training of coders should be given careful attention. At the onset of the project several instructional seminars, including readings, lectures, and discussions, were provided. The extent of the instructional seminars depended largely on the knowledge and sophistication of the coders. Issues that were covered included, for example: (1) general and theoretical knowledge about the Transtheoretical Model; (2) methodological and statistical procedures common in the body of literature and relevant to the research question; and (3) meta-analytic procedures and strategies. Subsequently, coding of variables were reviewed and procedures for the coding process discussed. Coders practiced coding variables until researchers were comfortable with the coding procedures. Periodic meetings were conducted to review progress and discussion any difficulties encountered followed. In some cases significant discrepancies occurred between researchers for particular variables. These variables were then redefined and recoded for all studies.

Coding

A coding manual (see Appendix A) was developed during the course of the project to delineate the coding for study design, participant, measurement, publication, and research characteristic variables. Rosenthal (1984) found that the typical rate of recording errors is approximately 1%, though this rate can be as high as 48%. In order to minimize transcription error, data was entered directly into an excel spreadsheet by the researcher and by trained research assistants. To minimize clerical error and reduce subjective bias in coding, all data was checked at least twice. A third researcher reviewed any discrepancies and consensus was reached.

Table 2 provides a summary of the primary variables extracted and coded. The coding manual found in Appendix A provides more detailed descriptions of coded variables. Additionally key variables are expanded upon below.

Table 2

Examples of Data Categories

Data Category	Description/Example
Target Behavior	Specific behavior measured in study
Population description	Brief description of sample
Setting	Place where study was conducted
Sample Size(s)	Number of participants for the overall study, for each dataset, and for each Stage
Sampling Method	Random, convenience, or mixed
Age	Mean age of the participants
Age Group	Adolescents, College, Adults or Mixed
Gender	Percentage of males and females in the study
Country	Country where the study is conducted
Language	Language of participants and/or measures
Stage Descriptions	Descriptions of Stages used in each study
Stage Algorithm Type	e.g., one item staging; multiple item skip pattern
Response Format	e.g., How important or Agree/disagree
Coefficient Alphas	Reported scale reliability values calculated specifically on study data
Correlation Coefficients	Scale and/or latent construct values
Number of Items	Number of items per measure
Decisional Balance Description	e.g., Pros and Cons of Weight Bearing Exercise
Effect Size Calculation Method	e.g., Hedges <i>g</i> , standard score method or graphical standard score method
Publication status	e.g., peer-reviewed publication, dissertation, conference presentation
Healthy vs Unhealthy	e.g., Exercise verse Smoking
Frequency of Behavior	i.e., Daily, Situational, Yearly
Reversal / Direction	Direction of the Pros and Cons in relation to Staging

Target Behaviors

Target behaviors were defined based on the researcher's treatment of the behavior. A particular behavior was considered a target behavior if the researcher used separate Staging or Decisional Balance Measures for the named behavior. For example, the cessation and acquisition of a behavior such as smoking were considered separate behaviors since specific staging measures were developed for

smokers and nonsmokers (e.g., Plummer et al., 2001). Likewise, when researchers developed Decisional Balance measures specifically for particular behaviors, such as for condom use with main partner or condom use with other partners (e.g., Lauby et al., 1998), the given behaviors were considered separate target behaviors.

Data Reversal

In general researchers consistently define the Pros and Cons. In some cases, the Pros and Cons are inversely defined, that is, the measures focus on the positive aspects of an unhealthy rather than of a healthy behavior (e.g., Borland & Segan, 2000; Rossi et al., 2001; Velicer et al., 1985). For example, a study may examine the Pros of smoking (Velicer et al., 1985) rather than the Pros of quitting smoking (Keller et al., 1999). In this type of study, the Pros and Cons will be reversed for analytic purposes.

Acquisition versus Cessation

Behavior change can happen in two main ways, acquiring new behaviors (e.g., begin to exercise regularly) or ending an existing behavior (e.g., quit smoking). Behaviors were coded accordingly.

Analysis

Five main aspects of the Stage of Change and Decisional Balance measures were examined across behaviors and within behaviors (when there were five or more datasets of a particular behaviors): (1) the measurement structure of Decisional Balance; (2) the nature of the functional relationship between the Stages and Decisional Balance; (3) the magnitude of the effect of Decisional Balance across

Stage transitions; (4) the homogeneity of the effect size distributions; and (5) moderators of effect.

Structure

It was predicted that the majority of the studies identified in the meta-analysis would identify or utilize a two-factor structure for Decisional Balance. The dimensional structure of Decisional Balance was determined by identifying results of analyses such as principal components analyses (PCA), or structural equation modeling. The factor structures of the studies are described descriptively. Additionally, it was predicted that the two dimensions, Pros and Cons, would not be correlated. The strength of association between the Pros and Cons measures was extracted when either the scale or construct correlation coefficient was reported in the studies.

The internal consistency of the Decisional Balance measures was also examined; for those studies that provided alpha coefficients, the alphas were averaged and their range reported.

Function

The functional relationship between the Stages and Decisional Balance were explored by examining the given graphs or constructing new graphs with Stage plotted on the x-axis and the mean *T*-scores plotted on the y-axis. It was predicted that the majority of the crossovers would occur during the Contemplation and Preparation Stage. The functional relationships in Decisional Balance were examined descriptively and tabulations of crossovers conducted.

Magnitude

Effect size magnitude was investigated for each Stage transition: 1) Precontemplation to Contemplation; 2) Contemplation to Preparation; 3) Preparation to Action; 4) Action to Maintenance. Stage transition effect size were calculated using Hedges' g , standard score, or graphical standard score estimation.

Calculation Method

The preferred and most accurate method of estimating effect size is the Hedges' g method. Hedges' g requires means, SD 's, and n 's for each group (either raw scores or T -scores), and is defined as the difference between the sample means divided by the average pooled sample standard deviation (Rosenthal, 1994).

$$\text{Hedges' } g = \frac{M_1 - M_2}{S_{\text{pooled}}} \quad (7)$$

If sufficient data were not available to compute Hedges' g , one of the standard score methods was used to compute effect size. Both the standard score and the graphical standard score methods require the standard (T) scores ($M = 50$, $SD = 10$) for each group, and were calculated by subtracting the sample means and dividing by the standard deviation. The only difference between the standard score and the graphical method was that the sample means for the standard score method were obtained from the text or a table, whereas, the graphical method used scores estimated from a graph.

Graphical Estimation Procedure

Estimations of T -scores from graphs were made by using a ruler to measure the point against the y -axis where the T -scores are graphed. The ruler measurements

were then used to interpolate T -scores between adjacent tic marks on the y-axis. Chapter Five illustrated that the T -scores method and T -scores estimated from a graph for Pros and Cons measures were very highly correlated and no significant differences were found between the two methods, thereby demonstrating that the graphical method provides a good estimation of T -scores. It should be noted that the graphical method was used only when Hedges' g could not be calculated and the actual standardized scores were not available in text or table.

Calculation Method Adjustment

When data are reported as standard scores, such as z ($M = 0$, $SD = 1$) or T -scores ($M = 50$, $SD = 10$), effect sizes are determined by subtracting T -scores and dividing by 10. This procedure appears correct because it is known that the SD of T -scores equals 10. Therefore, dividing the T -score difference by 10 should result in the standardized difference between the means. However, this procedure is sub-optimal because 10 is the total group SD , not the pooled within-group SD used to compute Hedges' g or Cohen's d (Rosenthal, 1994). In most cases the within-group variance will be less than the total group variance (i.e., whenever the grouping variable has a non-zero relationship with the dependent variable), since this will reduce within-group variance relative to total variance (i.e., $SS_{error} = SS_{total} - SS_{between}$), computing effect size by subtracting T -scores underestimates Hedges' g . As described in Chapter 5, regression equations specifically designed to correct for this bias in the Pros and Cons of Change were developed. Therefore, effect sizes based on either the standard score or the graphical standard score methods were subsequently corrected for bias using the following equation:

$$\text{Pros and Cons Correction} = (ES)(1.151) - 0.044 \quad (8)$$

where, ES = standard score effect size estimate.

Additional analyses were conducted to verify the effectiveness of this bias correction, including analog ANOVA's. In the event that calculation method appears to moderate the effect size distribution, all cross-sectional data analyses including effect size calculations would be conducted separately for the effect size methods. Based on previous work (Hall & Rossi, 2004), it was anticipated that 70% of the effect sizes would be calculated using Hedges' g , whereas 30% would be calculated using standard scores.

Sample Size Bias. Simple pooling of data occurs when each set of data from a particular study is pooled together without regard to differences in sample size. Therefore, studies that include 10,000 participants provide the same weight in the analysis as a study with 10 participants. To avoid this problem, all effect sizes were corrected for sample size bias by weighting each data point by its respective sample size (see Equations 9-11). Another concern regarding sample size is that Hedges' g has been shown to be upwardly biased with small sample sizes, especially those less than 20 (Hedges, 1981). Although the overall n 's for the datasets were quite large, since the effect size for the Stage transitions were based on the sample size of a given Stage, these n 's could be reasonably small. Therefore, the obtained effect size was corrected for sample size bias. This calculation was computed using Hedges' formula:

$$ES' = \left[1 - \left(\frac{3}{4N - 9} \right) \right] ES \quad (9)$$

$$SE = \sqrt{\frac{n_1 + n_2}{n_1 n_2} + \frac{(ES')^2}{2(n_1 + n_2)}} \quad (10)$$

$$\omega = \frac{1}{SE^2} = \frac{2n_1 n_2 (n_1 + n_2)}{2(n_1 + n_2)^2 + n_1 n_2 (ES')^2} \quad (11)$$

where, ES = the observed (uncorrected) effect size estimate, ES' = the corrected effect size estimate, N = the total sample size, SE = the standard error of the corrected effect size estimate, n_1 and n_2 = the sample sizes of the two groups (adjacent Stages) being compared, and ω = the inverse variance weight. The inverse variance weight reflects the precision of the effect size estimate, which varies as a function of sample size. This method was used to weight the contribution of each study effect size so that larger studies were given more weight in the calculation of the overall meta-analysis effect size (Hedges & Olkin, 1985; Lipsey & Wilson, 2001).

Confidence Intervals

Confidence intervals illustrate the precision of a parameter estimate. The confidence interval provides an additional dimension to reporting effect sizes by indicating how “confident” one can be in the measure of magnitude obtained. The researcher has the flexibility to choose the level of probability, and this is done by setting the probability percentage for the confidence interval. For instance, a 95% confidence interval indicates that the confidence interval has a 95% probability of containing the population parameter.

The width of the confidence interval is directly related to: (1) the amount of data used to generate a given effect size; (2) the level of confidence interval chosen

by the researcher; and (3) the computational model used (Borenstein & Rothstein, 1999). The larger the amount of data used the more precise the measure of effect size and therefore the narrower the confidence interval. Inversely, the greater the confidence level chosen by the researcher, the wider the confidence interval will be. Lastly, variance across studies attributed to entirely random influences are modeled with a fixed effects model. This model allows for confidence intervals that can actually reach zero. On the other hand, if the random variance and between-studies variance is assumed then a random effects model is typically employed. This model tends to produce wider confidence intervals and limits the ability of the confidence intervals to approach zero (i.e., no confidence interval but rather a point “estimate”).

Ninety-five percent confidence intervals were calculated around the mean effect sizes. This indicates that the confidence interval has a 95% probability of containing the population parameter. Based on the standard error for the mean and a critical value from the z -distribution the confidence intervals were calculated as follows:

$$SE_{ES} = \sqrt{\frac{1}{\sum \omega_i}} \quad (12)$$

$$ES_L = ES - z_{(1-\alpha)}(SE_{ES}) \quad (13)$$

$$ES_U = ES + z_{(1-\alpha)}(SE_{ES}) \quad (14)$$

where SE_{ES} is the standard error of the effect size mean, ω_i is the inverse weight associated with the effect size i with $i = 1$ to k effect sizes included in the mean and ES is the mean effect size, $z_{(1-\alpha)}$ is the critical value for the z -distribution (1.96 for $\alpha = .05$). Confidence intervals were reported for combined effect sizes.

In meta-analytic studies, variation among effect sizes sometimes occurs due to random error, though oftentimes this variation becomes statistically larger than one would expect (due to random or sampling error). Tests of homogeneity attempt to identify the difference between variation due to random error and variation due to systematic differences between study design and participant characteristics. Ultimately, assessing heterogeneity of effect size is important because the lack of a homogeneous distribution suggests the presence of possible predictors or moderators of the effect size magnitude.

A variety of methods of heterogeneity are available, though the majority are designed for assessing variation in treatment effects with odds ratios and percent of variance accounted for measure of effect size. Since this study utilized standardized effect size measures, the test of homogeneity employed in this study was based on the Q statistic.

The Q statistic is distributed as a chi-square with $k-1$ degrees of freedom (k = number of effect sizes) (Lipsey & Wilson, 2000). The homogeneity analysis will be calculated using the equation:

$$Q = (\sum \omega_i ES_i^2) - \frac{(\sum \omega_i ES_i)^2}{\sum \omega_i} \quad (15)$$

where ES_i is the individual effect size for $i = 1$ to k (the number of effect sizes), and ω_i is the individual weight for ES_i calculated using Equation 11 defined above.

The Q statistic is most accurate for sample sizes greater than 10 (Hedges & Olkin, 1985) or 20 (Takkouche, Cadarso-Suarez & Spiegelman, 1999) and increases

in accuracy as sample size increases. Low power can result in statistical tests that fail to detect heterogeneity. Since many of the sub-groups included less than 20 (e.g., many of the behavior categories have less than 20), a priori subgroup analyses were established to ensure primary theoretically-based hypotheses were thoroughly tested. Firstly, subgroup analyses between behavior categories with greater than 5 studies were conducted as well as additional behavioral subgroup analyses on each of these behavior categories (i.e., smoking cessation vs. smoking acquisition). Additionally, regardless of identified heterogeneity, subgroup analyses were performed for categorical moderators. Additionally, other methods of assessing heterogeneity were also employed. In particular, graphical methods for testing heterogeneity were used. Forest plots displaying point estimates and confidence intervals for individual studies and summary estimates were created. Excel macros to create forest plots were developed. Forest plots were examined for systematic patterns in study or construct characteristics.

Tests of homogeneity of the distribution of effect size were conducted on all effect sizes for each transition for both the Pros and the Cons. Fixed effects and Random effects models were tested (as described below). Additionally, tests of homogeneity were conducted on all subgroup and moderator analyses.

Due to the variability in the dimensions of each study, it was anticipated that the effect sizes would be heterogeneous. Upon the discovery of heterogeneity, the follow-up tests were conducted initially for calculation method and then subsequently for the remaining potential moderator variables.

Two methods of modeling variance, fixed and random effects modeling, were used in this study. The fixed effects model assumes the only source of variance is subject-level sampling error, whereas the random effects model assumes that the source of variance includes subject-level sampling error and study-level sampling error (i.e., random error). The fixed effects model can also include systematic variance due to identifiable moderating variables.

Although a third model, the mixed effects model, exists – the mixed model is not employed in this study. Theoretically, a mixed model assumes all three sources of error, sampling error, random error and systematic error. The mixed effects model is typically used less often than fixed and random effects models due to the complexity of the modeling procedures and lack of consensus in the field regarding these procedures.

In a fixed effects model, it is assumed that the variance in the effect size distribution is only due to subject-level sampling error. So it is assumed that an effect size from an individual study represents the population effect with only random sampling error associated with chance factors. Tests of homogeneity examine the assumption that error is only due to sampling error and thereby serve as an assessment for whether the fixed effects model holds, though as discussed below, evidence of heterogeneity does not necessarily rule out a fixed effects model.

If one assumes that the fixed effects model holds but additional error is due to a systematic difference in the coded variables then one can attempt to partition the effect size variance. This assumption can be tested by performing an analog to

analysis of variance. This analog ANOVA was used to explore variables by partitioning the total variance Q (Total) into Q (Between) and Q (Within). Q (Between) values were used to test between group differences by using a Chi-square with $df = p-1$.

The meta-analytic analog to the analysis of variance for the fixed effects model is calculated as follows (Lipsey & Wilson, 2001):

$$Q_B = (\sum \omega_j \overline{ES}_j^2) - \frac{(\sum \omega_j \overline{ES}_j)^2}{\sum \omega_j} \quad (16)$$

where Q_B is the between groups, $\overline{ES}_j$ is the weighted mean effect size for each group, ω_j is the sum of the weights within each group, and j is the number of groups.

$$Q_W = \sum \omega_i (ES_i - \overline{ES}_j)^2 \quad (17)$$

where Q_W is the pooled Q within groups, ES_i is the individual effect size, $\overline{ES}_j$ is the weighted mean effect size for each group, ω_j is the sum of the weights within each group, i is the number of effect sizes, and j is the number of groups.

If the fixed effects model does not hold then another model is sought. The random effects model assumes that sampling error is accompanied by other sources of variability randomly distributed. The sampling error is considered to be from the subject-level whereas the random error is an estimate of between-studies variance. This between-studies error is thought to be analogous to study-level sampling error. The variance components can be illustrated by the following equation (Lipsey & Wilson, 2001):

$$\nu_i^* = \nu_\theta + \nu_i \quad (18)$$

where, ν_θ is the random or between-subjects component, and ν_i is the subject-level sampling error.

Identifying the random effects variance component is the more difficult of the two components and can be assessed using a noniterative methods based on method of moment or iterative methods based on maximum likelihood. The method of moments estimate is calculated using the following formula (Lipsey & Wilson, 2001):

$$\nu_\theta = \frac{Q - (k - 1)}{\sum \omega_i - \left(\frac{\sum \omega_i^2}{\sum \omega_i} \right)} \quad (19)$$

where, Q is the value of the homogeneity test, k is the number of effect sizes and ω_i is the inverse weight for each effect size. The iterative maximum likelihood random effects variance estimate is a more accurate measure and was calculated using SPSS Macros written by David Wilson (Lipsey & Wilson, 2001).

Fixed and random effects models were fit to the effect size data for the Pros and Cons for each of the four Stage transitions (PC-C, C-PR, PR-A, A-M). The random effects variance component (ν) for each transition was determined for each transition for each construct. A Q -test was then conducted on the random effects variance component in order determine if the null ($\nu = 0$) was rejected. A significant Q -test for the random effects variance component indicates that the random effects component is significantly greater than zero. If significantly greater than zero, the variance in the sample of effect sizes is greater than would be expected from

sampling error alone (Lipsey & Wilson, 2001). In this case, statistically the random effects model is appropriate. A non-significant Q -test for the random effects component would indicate statistical support for the fixed effects model. Additionally, it is suggested that a random effects model is appropriate for studies pooled across populations with pre-existing differences (Hedges & Olkin, 1985). Additional justification for the random effects model where the random effects variance component is found to be significant due to the wide range of age groups and recruitment settings the populations are drawn from in the studies combined in this meta-analysis.

Follow-up Comparisons

When conducting follow-up comparisons for the ANOVA analog, a Bonferoni test is sometimes recommended since typical follow-up tests for ANOVA such as Tukey are not available. A Bonferoni correction would be used for data given a fixed effects model. Since the random effects model is already a conservative approach to examining relationships among the effect sizes, Bonferoni corrections were not used for follow-ups to random effects comparisons.

Publication Bias or The 'File Drawer' Problem

Publication bias is always a potential problem when conducting meta-analyses. One of the most concerning problems occurs when a meta-analysis is examining intervention effects, since historically there has been a propensity to published studies with statistically positive results. One common method of testing publication bias is the “fail-safe K ” method. The impact of any remaining sampling bias was estimated by computing the “fail-safe K ”. This is an estimate of the number

of undiscovered studies that, if known, would in aggregate reduce the overall meta-analysis effect size so that it was not statistically significant. Fail-safe K is computed using the following equation:

$$K_0 = K \left[\frac{ES}{ES_c} - 1 \right] \quad (20)$$

where K_0 = the number of studies with an effect size of zero required to reduce the overall effect size to nonsignificance, K = the observed number of studies, ES = the observed mean effect size, and ES_c = the minimum effect size deemed significant. In the current study it is not of theoretical importance to test if the effect size estimates calculated are significantly different from zero, in fact some effect sizes are anticipated to approach zero. In the context of this study ES_c is not relevant and therefore the fail-safe K is not an appropriate measure of publication bias.

Since the current study is not directly examining overall treatment effects a more important bias measure in this context will be the examination of the publication characteristics as potential moderator variables. Therefore, effect sizes for published and unpublished studies will be compared to assess the potential impact of publication bias on effect sizes. Additionally, publication status will be treated as a potential moderator variable and will be subjected to the moderator analyses described above.

Missing Data Procedures. A variety of missing data strategies have been developed to statistically deal with missing data, unfortunately very few have been specifically designed to deal with missing data in meta-analytic studies. Three types of missing data are found when conducting meta-analyses, these are: 1) entire

studies; 2) essential information for computing effect sizes; and 3) missing characteristic variables.

When data is missing at the study level due to non-publication, typically this is considered publication bias and is often called the “file drawer” problem and is typically assessed using the fail-safe K . Unfortunately the fail-safe K is not relevant to the current study; therefore the impact of the missing studies can not be assessed.

Some studies were missing information for calculating effect sizes. When possible, information was extracted from alternative sources. For instance, in one study sample sizes by stage were not reported precluding the ability to calculate the pooled variance (Hulton, 2001). In this case, alternative sources of data (i.e., mean squared error term) were used instead. Additionally, for some studies alternative calculation methods were used to compute effect sizes (as described above) and adjustments were made to minimize potential bias. Otherwise, studies missing essential information to compute effect sizes were excluded from the study.

Data missing from characteristic variables, that is, potential moderator variables can be handled in a variety of ways: complete case analysis, mean substitution, and available case analysis (Pigott, 2001). Available case analysis is the most common procedure used in meta-analytic studies and allows for the most data to be retained thereby increasing power. Available case analysis was used in this study.

Outliers

Since such a wide range of potential moderating variables were likely to be examined and large variations in effect sizes across the transitions were anticipated,

only the most extreme effect sizes (2 to 3 standard deviations from the mean) were considered for removal or recoding. First, any identified outliers were scrutinized to assess possible sources of error. Only variables with clear sources of error (that can not be corrected) were considered for removal. Next, effects sizes were compared to the mean effect sizes two and three standard deviations from the mean were identified. Studies were then coded as containing outliers or not and crosstabs were conducted with potential moderating variables.

Graphing Techniques

In order to visually compare results between moderator variables graphically several techniques were employed, including *T*-score by Stage graphs and forest plots.

T-score by Stage Graphs

In order to create graphical representations in the “classic” *T*-score by Stage format, as typically seen in the TTM body of literature effect sizes were converted into “*T*-scores” and graphed by Stage. In order to illustrate the results to show the effect size differences, a starting point of 0 was chosen for the PC Stage for each set of data. Effect sizes were then incrementally added to this starting point for each Stage transition. The data was then recentered by computing the mid-point of the effect sizes by subtracting the difference between the lowest and highest effect sizes, dividing by 2 and adding this to the the lowest effect size.

$$\text{Midpoint} = \frac{T_{\text{high}} - T_{\text{low}}}{2} + T_{\text{low}} \quad (21)$$

This midpoint then functions as the T -score of 50 (once the score is converted as described below) and is subtracted from all Stage scores. This gives the number of standard deviations above and below the midpoint for each Stage. The scores are then converted to T -scores by multiplying by 10 and adding 50. Finally, these T -scores are plotted by Stage.

Forest Plots

Forest plots provide a visual tool for assessing differences between studies and study characteristics. The primary data provided in a forest plot is the effect size estimate and the confidence interval around that estimate. Typically the means and confidence intervals are plotted around an axis point that is set at zero; this provides a visual aid for assessing significance of the mean. That is, if the confidence interval around the mean does not cross the zero axis then the mean is significantly different from zero. For treatment effects, a confidence interval that is greater than zero would mean the mean is significant with respect to the null hypothesis. In this study, the point of interest is the comparative value of an individual mean to the overall mean of each effect size estimate for each transition since there is no null hypothesis that is being tested. Therefore, forest plots will utilize the mean effect sizes estimate of the given transition for its axis rather than the zero (i.e., the null).

Power Analysis

The principal question of power for meta-analysis involves not so much whether or not the overall effect size is statistically significant but rather whether there is sufficient power to determine if the effect size distribution is heterogeneous.

Power for the Q test depends on the ratio of between- to within-study variance (Hedges & Pigott, 2001). It is difficult to know what this ratio might be a priori. As an estimate, Schmidt (1992) reports a range of .33 to 1.0 across a large number of meta-analyses that he examined. Hedges and Pigott (2001) suggest variance ratios of .33, .67, and 1.00 be considered small, medium, and large degrees of heterogeneity, respectively. The figure below gives power for this range of variance ratios for sample sizes of 10 to 150 studies and $\alpha = .05$. These results suggest that for the overall meta-analysis (across behaviors), power would be excellent for medium and large degrees of heterogeneity and would be very good (at least .80) even for a small degree of heterogeneity, since the sample size is nearly 150. For Q tests within behaviors, the degree of heterogeneity would have to be in the medium to large range for power to be good for the expected sample sizes. Based on the results of a previous study on Decisional Balance (Hall & Rossi, 2004), the degree of heterogeneity within behaviors was anticipated to be fairly large, since significant Q test statistics were obtained for each of the five behaviors that were tested individually, with sample sizes ranging from only 9 to 15.

Figure 4. Power for Q Test of Effect Size Homogeneity for Small, Medium, and Large Between- to Within-Study Variance Ratios ($\alpha = .05$)

Results

General Characteristics of the Studies

One hundred sixteen studies encompassing 55 different target behaviors (Table 3) were examined in this meta-analysis. Some studies reported multiple studies (e.g., Nigg et al., 1998) or multiple behaviors (e.g., Herrick et al, 1997), therefore a total of 146 cross-sectional datasets were included. One hundred forty four reported sufficient data for the Pros of behavior change and 144 reported

sufficient data for the Cons of behavior change. Approximately 32,000 pieces of data were extracted, coded or computed to serve as the basis for subsequent analyses.

Table 3

List of Target Behaviors

Administrative Change	Anorexia – Recovery From
Asthma – Medication	Back Pain /Keeping Body Posture
Management	
Binge Drinking Acquisition	Binge Drinking Cessation
Bone Density Testing	Breast Self-Examination
Bulimia – Recovery From	Bullying Prevention
Calcium Intake	Cocaine Use
Colorectal Cancer Screening	Condom Use - General
Condom Use with Main Partner	Condom Use with Other Partners
Condom Use – Anal Sex	Condom Use – Vaginal Sex
Contraception – General	Daily Use of Dental Floss
Decreasing Drug Use	Delinquent Behavior
Depression Prevention	Diabetes – Medication
	Management
Dietary Fat Reduction	Domestic Violence
Drug Treatment	Exercise
Fruit & Vegetable Consumption	Fruit Intake
Glucose Testing	Healthy Diet
Mammography	Oral Hygiene
Organ Donation – Family Consent	Organ Donation – Intentions
Participating in Decision Making for Medication	Physicians Assisting Smokers
Quitting Drugs	
Safer Sex Decision Making	Radon Testing
Sex Decision Making/ Abstinence – Non-Virgins	Sedentary Behavior
Smokeless Tobacco Use	Sex Decision Making/ Abstinence – Virgins
Smoking Cessation	Smoking Acquisition
Stress Management	STD Screening
Sunscreen Use	Sun Protection
Vegetable Intake	Tooth-Friendly Diet
Weight Loss	Weight Bearing Exercise

The studies were conducted in 18 different countries including Australia, Canada, China, Denmark, England, Finland, Germany, Israel, Japan, The Netherlands, Northern Ireland, Norway, Portugal, Scotland, Spain, Switzerland, United States and Wales, with each study conducted in the native language of the given country. Seventy-five percent of the studies were conducted in the United States and two percent of the studies included multiple countries (Table 4). It should be noted that not all countries and languages are listed separately in the table since data from some countries were combined in the studies.

Table 4

Summary of Country and Language

Study Characteristic	Categories	Sample Size	% Across Studies
Country	Australia	1	.68
	Canada	2	1.37
	China	2	1.37
	England	2	1.37
	Germany	20	13.70
	Japan	3	2.05
	Netherlands	2	1.37
	Norway	1	.68
	Switzerland	1	.68
	United States	109	74.66
	Multiple	3	2.05
	<i>Total</i>	146	100%
US vs Non-US	US	109	74.66
	Non-US	34	23.29
	Multiple	3	2.05
	<i>Total</i>	146	100%
Language	Chinese	2	1.37
	Dutch	2	1.37
	English	115	78.77
	French	1	.68
	German	20	13.70
	Japanese	3	2.05
	Norwegian	1	.68
	Multiple	2	1.37
	<i>Total</i>	146	100%
English vs Non-English	English	115	64.97
	Non-English	31	35/03
	<i>Total</i>	146	100%

The studies utilized three types of sampling procedures, convenience samples (85%), randomly sampled participants (14%), mixed studies (1%), that is, they used a combination of the first two procedures. One study did not provide sufficient information to determine sampling method. The total number of participants for the

meta-analysis was 85,272. The sample sizes for the studies ranged from 19 to 21,535 participants.

Table 5

Summary of Sampling Methods across Studies

Study Characteristic	Categories	Sample Size	% Across Studies
Sampling Method	Convenience	122	83.56
	Random	21	14.38
	Mixed	1	68
	Not Reported	2	1.37
<i>Total</i>		146	100%

The datasets came from a variety of sources, including peer-reviewed journals (55%), dissertations or theses (21%), manuscripts in Preparation (9%), conference presentations (8%), unpublished data (5%), and technical manuals (3%).

Table 6

Summary of Publication Status across the Studies

Study Characteristic	Categories	Sample Size	% Across Studies
Publication Status	Peer-Reviewed Journal	80	54.79
	Dissertation / Thesis	30	20.55
	Manuscript in Preparation	13	8.90
	Conference Presentation	11	7.53
	Unpublished Data	8	5.48
	Technical Manual	4	2.74
<i>Total</i>		146	100%

The author, year of study, target behavior, sample size, and description of participants, mean age, age group, sampling method and country for each study can

be found in Table 7. Additionally, information regarding each of the studies can be found in Appendix B. Table B.1 provides detailed information on the Stages of Change for each study and Table B.2 provides detailed matrix of the coded variables used in the moderator analyses.

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Table 7

Study Characteristics

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampl- ing Method	Country
Acton et al.	2001	Smoking Cessation	205	Psychiatric outpatients	Treatment centers	Adults	41.2	Conven.	United States
Ahijevych et al.	1999	Smoking Cessation	95	Black and White women smokers	Community centers; Worksites	Adults	34.6	Conven.	United States
Bane et al.	1999	Smoking Cessation	281	Pregnant women; low SES	Clinic	Adults	23.8	Conven.	United States
Banikarim et al.	2003	STD Screening-Change in Partners	135	English-speaking single females seeking services at an urban reproductive health clinic	Clinic	Adults	Not reported	Conven.	United States
		STD Screening-Main	201	English-speaking single females seeking services at an urban reproductive health clinic	Clinic	Adults	Not reported	Conven.	United States
Basler et al.	1999	Exercise	451	Patients of German general practitioners	Physician's office	Adults	48.0	Random	Germany
Block et al.	1998	Condom Use	127	Graduate and undergraduate women	College / University	College	Not reported	Conven.	United States
Borland et al.	2000	Smoking Cessation	304	RDD	Community	Adults	Not reported	Random	Australia

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampl- ing Method	Country
Boudreaux et al.	1998	Smoking Cessation	554	Outpatient primary care; low SES	Clinic	Adults	47.2	Random	United States
Buckworth et al.	2002	Exercise	57	Young adult males and females in elective college level conditioning activity classes	College / University	College	21.2	Conven.	United States
Callaghan et al.	2002	Exercise	298	Chinese undergraduate students attending classes in the nursing and psychology departments at the Chinese University of Hong Kong	College / University	College	20.0	Conven.	China
Chamot et al.	2001	Mammo- graphy	885	Random Swiss women	Community	Adults	56.4	Random	Switzerland
DiClemente et al.	1991	Smoking Cessation	1466	Radio and newspaper ads; Texas	Community	Adults	41.0	Conven.	United States
Dijkstra et al.	1996	Smoking Cessation	275	Local ad for smokers (Dutch population)	Community	Adults	41.4	Conven.	Netherlands
Dijkstra et al.	1998	Smoking Cessation	1540	Smokers recruited by advertisements in local newspapers	Community	Adults	Not reported	Conven.	Netherlands
Dryfoos	1996	Glucose Testing	338	Representative Diabetes Sample	Community	Adults	59.1	Random	United States

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampling Method	Country
		Diabetes: Medication Management	1048	Representative Diabetes Sample	Community	Adults	59.1	Random	United States
Eaton et al.	1992	Physicians Assisting Smoker	165	Physicians	Community	Adults	43.0	Conven.	United States
Evers et al.	2001	Decreasing Drug Use	293	Adolescents in participating schools	School	Adol.	Not reported	Conven.	England/ Israel
Evers et al.	2003	Stress Management	241	Undergraduate students, graduate students, faculty and staff at a university	College / University	College/ Adults	21.6	Conven.	United States
Fahrenwald et al.	2003	Exercise	30	WIC mothers from a WIC program in a small Midwest city	WIC Program	College/ Adults	24.3	Conven.	United States
Fava et al.	1995	Smoking Cessation	4144	Rhode Island sample	Community	Adults	40.7	Random	United States
Frenn et al.	2003	Dietary Fat Reduction	74	Sixth, Seventh, and Eighth grade students who attended a central city middle school serving low-income, culturally diverse students	School	Adol.	13.8	Conven.	United States

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampling Method	Country
Galavotti et al.	1995	Contraception-General	233	Women high risk for HIV; low SES	Homeless shelters; Drug treatment facilities; Hi-drug use / prostitution neighborhoods	Adults	28.0	Conven.	United States
		Condom Use - Main	233	Women high risk for HIV; low SES	Homeless shelters; Drug treatment facilities; Hi-drug use / prostitution neighborhoods	Adults	28.0	Conven.	United States
		Condom Use - Other	122	Women high risk for HIV; low SES	Homeless shelters; Drug treatment facilities; Hi-drug use / prostitution neighborhoods	Adults	28.0	Conven.	United States
Gazabon	2000	Condom Use	340	Women sexually at risk for HIV	Community	Adults	31.0	Conven.	United States

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampling Method	Country
Giebel	1999	Smoking Cessation	235	Military sample	Military	Adults	26.0	Conven.	Germany
		Dietary Fat Reduction	361	Military sample	Military	Adults	27.0	Conven.	Germany
		Exercise	361	Military sample	Military	Adults	28.0	Conven.	Germany
		Stress Management	244	Military sample	Military	Adults	29.0	Conven.	Germany
Grimley et al.	1995	Contraception-General	244	Undergraduate psychology; New England	College / University	College	18.9	Conven.	United States
		Condom Use - Main	78	Undergraduate psychology; New England	College / University	College	18.9	Conven.	United States
		Condom Use - Other	134	Undergraduate psychology; New England	College / University	College	18.9	Conven.	United States
Happel	2002	Fruit & Vegetable Consumption	255	University students	College / University	College	21.4	Conven.	Germany
Hempelmann	2003	Tooth-friendly Diet	448	Employees of three different companies	Worksites	Adults	Not reported	Conven.	Germany

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampling Method	Country
Henderson	1999	Breast Self-Examination	214	Female employees from a large, Midwestern university	College / University	Adults	39.8	Random	United States
Herrick et al.	1997	Dietary Fat Reduction	392	Worksite employees	Worksite	Adults	42.2	Conven.	United States
		Exercise	389	Worksite employees	Worksite	Adults	42.2	Conven.	United States
		Smoking Cessation	393	Worksite employees	Worksite	Adults	42.2	Conven.	United States
		Sun Protection/Reduction	392	Worksite employees	Worksite	Adults	42.2	Conven.	United States
Herzog et al.	1999	Smoking Cessation	1390	Worksite employees	Study centers; Worksites	Adults	39.3	Random	United States
Hulton	2001	Sex Decision Making / Abstinence (Non Virgins)	103	7th graders; Virginia	School	Adol.	Not reported	Conven.	United States
		Sex Decision Making / Abstinence (Virgins)	622	7th graders; Virginia	School	Adol.	Not reported	Conven.	United States

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampling Method	Country
Jeffries	2001	Exercise	537	Predominantly low-income patients over the age of 18 attending primary care clinics from four separate sites; Louisiana	Primary care clinics	Adults	45.3	Random	United States
Johnson, J.L. et al.	2002	Bone Density Testing	465	UnitedHealthcare; Women ages 45+; New England	Community	Adults	62.4	Conven.	United States
		Calcium Intake	419	UnitedHealthcare; Women ages 45+; New England	Community	Adults	62.4	Conven.	United States
Johnson, S.S. et al.	2002	Participating in Decision Making for Medication	185	UnitedHealthcare; Women ages 45+; New England	Community	Adults	62.4	Conven.	United States
Johnson et al.	2002	Smoking Cessation	296	Ethnically diverse Parents with young children	Community health centers that serve diverse, low-income populations	Adults	28.4	Conven.	United States

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampling Method	Country
Jordan	2002	Anorexia-Recovery From	276	Recruited internationally	Internet / Treatment centers / University	Adults	30.5	Conven.	United States
		Bulimia - Recovery From	148	Recruited internationally	Internet / Treatment centers / University	Adults	30.0	Conven.	United States/ England
Jordon et al.	2002	Exercise	223	New England undergraduate psychology	College / University	College	19.8	Conven.	United States
Katlin	2001	Drug Treatment	114	Chemical abusers in out-patient treatment	Treatment centers	Adults	37.2	Conven.	United States
Keller	1998	Eating behavior-MEN	405	Participants in a health check-up for cardiovascular risk factors at their general practitioner's office.	Physician's office	Adults	49.2	Conven.	Germany
	1998	Eating behavior-WOMEN	407	Participants in a health check-up for cardiovascular risk factors at their general practitioner's office.	Physician's office	Adults	49.2	Conven.	Germany

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampling Method	Country
Keller et al.	2001	Back Pain	149	Employees of a large administrative unit (unemployment office)	Work site	Adults	40.2	Conven.	Germany
Keller et al.	2001	Fruit & Vegetable Consumption	282	Non-representative, higher education over-represented	Not reported	Adults	40.0	Conven.	Germany
Keller et al.	2002	Oral Hygiene	276	Not reported	Not reported	Adults	38.0	Conven.	Germany
Keller et al.	2003	Stress Management	665	Participants in a health check-up for cardiovascular risk factors at their general practitioner's office	Physician's office	Adults	48.4	Conven.	Germany
Keller et al.	1999	Smoking Cessation	401	Patients of general practitioners	Physician's office	Adults	47.4	Conven.	Germany
King et al.	1996	Exercise	332	2 worksites - government agency; med center	Worksites	Adults	40.2	Conven.	United States
		Smoking Cessation	296	2 worksites - government agency; med center	Worksites	Adults	40.2	Conven.	United States
Kraft et al.	1999	Smoking Cessation	421	Norwegian sample	Community	Adults	Not reported	Conven.	Norway

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampling Method	Country
Kremers et al.	2001	Smoking Acquisition	21535	Seventh graders in a large international sample of European adolescents	School	Adol.	13.2	Conven.	Denmark; Finland; Netherlands; Portugal; Spain; UK
Lauby et al.	1998	Contraception - General	2361	Women- HIV; High-risk HIV, unintended pregnancy	Community-based sites; Facility-based sites	Adults	Not reported	Conven.	United States
		Condom Use - Main	2925	Women- HIV; High-risk HIV, unintended pregnancy	Community-based sites; Facility-based sites	Adults	Not reported	Conven.	United States
		Condom Use - Other	1213	Women- HIV, High-risk HIV, unintended pregnancy; U.S.	Community-based sites; Facility-based sites	Adults	Not reported	Conven.	United States
Lerner	1990	Delinquent Behavior	159	At-risk adolescents at juvenile court schools, training schools, and Urban Collaborative Accelerated	Juvenile court schools; Training schools; Urban Collaborative Accelerated Program	Adol.	15.5	Conven.	United States

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampling Method	Country
Levesque et al.	2000	Administrative Change	134	University employees	College / University	Adults	Not reported	Conven.	United States
Levesque	1999	Domestic Violence	256	Men in group counseling for partner violence	Treatment Centers	Adults	Not reported	Conven.	United States
Levesque et al.	1999	Collaborative Delivery Service	31	University staff/administration	College / University	Adults	Not reported	Conven.	United States
Levesque et al.	1999	Depression Prevention	181	Undergraduate students/ Mental health agency staff, family, and friends	University/ Community	College/ Adults	Not reported	Conven.	United States
Lowry	2000	Smokeless Tobacco Use	99	Young adult male college students who had used SLT in the past or who were currently using SLT and were between the ages of 18 and 25 attending a 2 or 4 year college	College/University	College	20.5	Conven.	United States
Maier	2002	Exercise	251	Employees of unemployment office, police personnel and others	Not reported	Adults	40.7	Conven.	Germany

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampling Method	Country
Ma et al.	2002	Fruit Intake	1545	Telephone screened volunteers from 10 states; Follow-up mailed surveys	Community	Adults	Not reported	Random	United States
		Vegetable Intake	1545	Telephone screened volunteers from 10 states; Follow-up mailed surveys	Community	Adults	Not reported	Random	United States
Maleszka	2002	Smoking Cessation	216	Not reported	Not reported	Adults	34.5	Conven.	Germany
Manne et al.	2002	Colorectal Cancer Screening	480	Siblings of individuals diagnosed with colorectal cancer	Cancer centers/ Physician practice groups	Adults	47.8	Conven.	United States
Marcus et al.	1992	Exercise	717	Worksite (retail, industrial, government, medical centers)	Worksites	Adults	41.5	Conven.	United States
Marcus et al.	1994	Exercise	431	Women from three worksites	Worksites	Adults	41.1	Conven.	United States
Mauriello	2001	Stress Management	294	Rhode Island high school students	School	Adol.	Not reported	Conven.	United States

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampling Method	Country
Mettler et al.	2000	Exercise	690	Volunteers from the community intervention program	Community Intervention Program	Adults	40.2	Random	United States
Migneault et al.	1997	Binge Drinking Acquisition	421	10th/11th grade vocational students; Rhode Island	School	Adol.	16.2	Conven.	United States
		Binge Drinking Cessation	255	10th/11th vocational students; Rhode Island	School	Adol.	16.2	Conven.	United States
Moll	2001	Physical activity	287	University students; 14% medical, 14% law students, rest: other	University	College	25.0	Conven.	Germany
Morrison-Beedy et al.	2001	Condom Use - Main	254	Sexually active, single urban women from two urban health centers in a city in western New York state	Clinic	Adults	27.0	Conven.	United States
		Condom Use - Other	110	Sexually active, single urban women from two urban health centers in a city in western New York state	Clinic	Adults	27.0	Conven.	United States

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampling Method	Country
Nigg et al.	1998	Exercise	240	Undergraduate psych students	College / University	College	19.1	Conven.	United States
Nigg et al.	1998	Exercise	346	RDD; Rhode Island	Community	Adults	43.0	Conven.	United States
Nigg & Courneya	1998	Exercise	819	5 community high schools	School	Adol.	15.0	Conven.	Canada
Noar et al	1998	Condom Use - Vaginal Sex	168	Undergraduate psych/soc/fraternity male students	College / University	College	19.53	Conven.	United States
Norman et al.	2002	Sedentary Behavior	178	Adolescents recruited through primary care providers	Community	Adol.	13.1	Conven.	United States
		Sedentary Behavior	254	Adolescents recruited through primary care providers	Community	Adol.	13.2	Conven.	United States
O'Connell & Velicer	1988	Weight Loss	264	Undergraduate/ graduate students in psychology courses	College / University	College	Not reported	Conven.	United States
Otake & Shimai	2001	Smoking Acquisition	556	Senior high students	School	Adol.	Not reported	Conven.	Japan

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampl- ing Method	Country
		Smoking Acquisition	1002	Junior high students	School	Adol.	Not reported	Conven.	Japan
Pallonen et al.	1998	Smoking Acquisition	505	3 Rhode Island vocational-tech high schools (never smokers)	School	Adol.	Not reported	Conven.	United States
		Smoking Cessation	254	4 Rhode Island vocational-tech high schools (current smokers)	School	Adol.	16.6	Conven.	United States
Park et al.	2003	Physicians Counseling Smokers	259	Primary care physicians, Rhode Island	Physician's office	Adults	44.0	Conven.	United States
Perez	2001	Condom Use	828	Non-pregnant female youth obtaining contraceptive services at one of four federally funded family planning clinics	Clinic	Adol.	Not reported	Conven.	United States
Plummer et al.	2001	Smoking Acquisition	2010	High school students; Rhode Island	School	Adol.	15.2	Conven.	United States
		Smoking Cessation	798	High school students; Rhode Island	School	Adol.	15.2	Conven.	United States

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampl- ing Method	Country
Evers et al.	2001	Condom Use	270	Students from years 9-11 in 7 different schools	School	Adol.	Not reported	Conven.	England
		Waiting to have sex	602	Students from years 9-11 in 7 different schools	School	Adol.	Not reported	Conven.	England
Prochaska, J.J. et al.	2003	Smoking Cessation	322	Smokers from four psychiatric outpatient clinics; San Francisco	Clinic	Adults	42.0	Conven.	United States
Prochaska, J.O. et al.	1994	Condom Use -Anal Main	325	Community sample w/ Hx of high-risk sex	Community	Adults	31.9	Conven.	United States
Rakowski et al.	1992	Mammo- graphy	141	Worksite volunteers	Worksites	Adults	52.6	Conven.	United States
Redding	1990	Safer Sex Decision Making	213	University undergraduates (psychology and chemistry)	College / University	College	20.2	Conven.	United States
Redding	1993	Safer Sex Decision Making	305	Sexually active students attending a mid-size, northeastern state university	College / University	College	19.0	Conven.	United States
Reed	1996	Exercise	271	phone book (6 states); 3 weddings in New England;	Community / Weddings	Adults	47.8	Mixed	United States

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampl- ing Method	Country
Riley et al.	2000	Stress Management	19	HIV-negative women from an HIV high-risk community w/a high incidence of STDs and drug use; HIV-positive women from an HIV community health center	Community health center	Adults	32.9	Conven.	United States
Riley et al.	2003	Stress Management	126	HIV-positive women recruited as part of a larger study from three HIV primary care clinics in northeast Ohio	Clinic	Adults	34.7	Conven.	United States
Riley et al.	2003	Stress Management	42	Impoverished HIV-positive women	Not Reported	Adults	38.4	Not Reported	United States
Robbins et al.	2001	Organ Donation – Family Consent	163	Legal next of kin from 19 organ procurement organizations	Organ Procurement Organizations	Adults	46.5	Conven.	United States
Robbins	1999	Organ Donation – Intentions	278	Undergraduate students age 18 and older enrolled in psychology and nursing courses at URI; Rhode Island	College / University	College	20.8	Conven.	United States

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampling Method	Country
Robbins	2002	Organ Donation - Intentions	333	College students with sophomore and junior standing from four historically African American colleges or universities in North Carolina	College / University	College	18.0	Random	United States
Robbins	1999	Organ Donation - Intentions	475	Adults in Louisiana	Community	Adults	42.8	Random	United States
Robbins	2002	Organ Donation - Intentions	2233	College students at URI; Rhode Island	College / University	College	19.0	Conven.	United States
Rossi	1990	Radon Testing	698	Worksite employees	Work site	Adults	42.0	Conven.	United States
Rossi	1990	Sunscreen Use	227	Smoking study participants	Not reported	Adults	44.9	Conven.	United States
Rossi et al.	2001	Cocaine Use	298	In/ outpatient drug treatment	Treatment centers	Adults	29.6	Conven.	United States
Rossi, SR et al.	2001	Dietary Fat Reduction	2639	9th grade students from 22 Rhode Island high schools	School	Adol.	15.2	Conven.	United States

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampl- ing Method	Country
Rossi, SR et al.	2001	Fruit & Vegetable Consump- tion	353	Older adults	Community (for seniors)	Adults	Not reported	Conven.	United States
Rossi, SR et al.	2001	Dietary Fat Reduction	1204	RDD; Rhode Island	Community	Adults	42.0	Random	United States
Rossi, SR et al.	1993	Dietary Fat Reduction	196	Non-smoking Rhode Island residents (RDD)	Community	Adults	43.5	Random	United States
Ruggiero et al.	2000	Smoking Cessation	206	Pregnant smoking women from community health clinics in New England	Clinic	Adults	25.4	Conven.	United States
Ruggiero et al.	2003	Glucose Testing	668	Canadian sample recruited for intervention	Community	Adults	55.8	Conven.	Canada
Sarkin et al.	2001	Exercise	670	List provided by market research company including apparently healthy adults (no signs of chronic disease)	Community	Adults	50.9	Conven.	United States
Schmaling et al.	2000	Asthma: Medication Manage- ment	53	Adult asthma patients	Private Practice Asthma Clinic; Emergency Department; Hospital Clinic	Adults	36.1	Conven.	United States

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampl- ing Method	Country
Schorling	1995	Smoking Cessation (Women)	243	Rural African-American female smokers	Community	Adults	40.1	Random	United States
		Smoking Cessation (Men)	292	Rural African-American male smokers	Community	Adults	41.9	Random	United States
Schumann et al.	2003	Smoking Cessation	877	General population sample	Community	Adults	41.6	Random	Germany
Shulze	2003	Daily Use of Dental Floss	453	Employees of three different companies	Worksites	Adults	Not reported	Conven.	Germany
Silverman	1995	Condom Use	223	University students; Hong Kong	College/ University	College	20.4	Conven.	China
		Condom Use	230	University students	College/ University	College	19.1	Conven.	United States
Snow et al.	1992	Smoking Cessation	191	Newspaper ad for smoking and alcohol	Community	Adults	44.1	Conven.	United States
Stark et al.	1998	Condom Use - Main	822	Inner city females at high risk for HIV or STD's	Community	Adults	25.6	Conven.	United States
		Condom Use - Other	754	Inner city females at high risk for HIV or STD's	Community	Adults	26.6	Conven.	United States
Susenbeth	2000	Condom Use	96	Bisexual men	Not reported	Adults	29.0	Conven.	Germany

Table 7 (continued)

Source	Year	Target Behavior	N/ Data Set	Sample Description	Setting	Age Group	Mean Age	Sampling Method	Country
Tseng	2001	Exercise	154	Elders residing in six assisted living facilities located in two large adjacent cities in an upper Midwest state	Assisted Living Facilities	Adults	Not reported	Conven.	United States
Tsoh	1993	Quitting Drugs	169	Adult drug addicts/ Mass treatment programs; Lo SES;	Treatment centers	Adults	34.6	Conven.	United States
Van Marter et al.	2003	Bullying Prevention	473	Middle school students	School	Adol.	Not reported	Conven.	United States
Velicer et al.	1985	Smoking Cessation	930	Volunteers from newspaper article/ ads; RI and TX	Community	Adults	Not reported	Conven.	United States
Wakui et al.	2002	Exercise	450	Female students from two universities in Tokyo	College/ University	College	18.4	Conven.	Japan
Whyte	2003	Dietary Fat Reduction	416	Male and female adults aged 18 to 60 recruited via the internet	Internet	Adults	30.0	Conven.	United States
Wright et al.	2002	Weight Bearing Exercise	250	Female member of UnitedHealthcare of New England, ages 45+	Community	Adults	62.4	Conven.	United States

Note: Conven. = convenience sampling.

Structure of the Decisional Balance Measure

Factor Structure. The internal validity of the two-factor structure of Pros and Cons of Change identified by Velicer et al. (1985) was maintained for 96% of the datasets. One dataset (Bane et al., 1999) reported 2 Pros and 2 Cons; three others (Pallonen et al., 1997, Studies 1 and 2; Plummer et al., 2001) reported 2 Pros and 1 con, and lastly Susenbeth (2000) reported 1 pro and 2 Cons.

Alpha Coefficients. One hundred twelve datasets for Pros and 114 datasets for Cons included alpha coefficients as a measure of internal consistency. For Pros the average coefficient alpha was .82 ($SD = .09$), with a range from .58 to .96. The average coefficient alpha for Cons was a bit lower at .76 ($SD = .10$), and ranged from .41 to .94.

Scale and Construct Correlations. Thirty-two datasets reported scale correlation coefficients for the Pros and Cons measures, with an average of .04 ($SD = .20$), and a range from $-.54$ to .38. Twenty-seven datasets reported latent variable (construct) correlation coefficients based on structural equation modeling, with an average of .08 ($SD = .27$), and a range from $-.29$ to .63.

Function: Patterns and Crossovers

Stages. Not all studies used all five Stages of Change. As mentioned previous, historically the Preparation Stage did not always exist as part of the model therefore a handful of studies did not include the Preparation Stage. During the conduct of some studies, occasionally particular Stages included very few participants or a disproportionately small number of participants in a given Stage.

Researchers sometimes chose to combine Stages in order to compensate for a small sample size. Overall, 91% of the datasets included the Preparation Stage, and 8% of the studies including the Preparation Stage combined the Preparation Stage with the Contemplation Stage when reporting results. Eighty-four percent of the studies included the Maintenance Stage, and 11% of those combined Action and Maintenance.

Crossovers. Crossovers occur when the standardized Pros and Cons scores change position relative to each other. If, at one Stage Cons are higher than Pros and at the next Stage Pros are higher than Cons, then on a graph a literal crossing of lines occur, hence the name crossover. Therefore, it can be said that the crossover is a function of how much and when the Pros increase and the Cons decrease (Prochaska et al., 1994). In this study, crossovers were determined for all datasets that reported *T*-scores or graphs based on *T*-scores; crossovers could be determined for 86% of the datasets.

Seventeen percent of the crossovers revealed multiple intersections, or crossovers, of the Pros and Cons. Twenty-five percent of the crossovers occurred in the transition from Precontemplation to Contemplation. The greatest number of crossovers, 32%, occurred during the Stage transition from Contemplation to Preparation. Eighteen percent of the crossovers occurred in the transition from Preparation to Action. A handful of studies did not include Preparation as a Stage of Change. This resulted in possible crossovers in the transition from Contemplation to Action. Four percent of the studies had crossovers in the Contemplation to Action

transition. The fewest number of crossovers, 2%, occurred in Action to Maintenance. Finally, there was one dataset in which no crossover occurred at all.

Sample size can impact the graphical representations of the crossovers based on the standardized *T*-scores. Large sample sizes can “pull” the cross-over towards a given Stage. Sample sizes across the crossover transitions were examined to provide a gross assessment of the relationship between sample size and Stage transition. Interestingly, for the crossovers found between PC-C, the largest sample sizes average was in the Precontemplation Stage ($n = 275$) with the second largest in Contemplation ($n = 146$). For the crossovers found between C-PR, although the largest mean sample size was in the Maintenance Stage ($n = 129$), the Precontemplation, Contemplation and Preparations Stages were also reasonably large and of similar magnitude ($n = 120, 111, 98$, respectively). The crossovers found between PR-A had the largest mean sample size in the Maintenance Stage ($n = 136$), with the rest of the Stages somewhat evenly distributed. The crossovers found between A-M also had the largest mean sample size in Maintenance Stage ($n = 415$) with quite small mean sample sizes for Precontemplation, Contemplation and Preparation ($n = 15, 25, 9$, respectively). Following a similar trend the C-A transition had the largest sample size in Maintenance ($n=83$), with notably smaller averages for the previous three Stages ($n = 23, 29, 28$). Lastly, the studies that displayed multiple crossovers displayed a somewhat unique pattern of mean sample sizes, with the largest mean sample sizes on the polar ends of the Stage distribution (Precontemplation, $n = 112$ and Maintenance, $n = 131$) and similar mean sample

sizes for the middle three Stages ($n = 73, 67, 65$). Table 8 displays the mean sample sizes across the Stages of Change for each of the primary cross-over transitions.

Table 8

Mean Samples Sizes by Stage for Each Crossover Transitions

Crossover Transition		Stage of Change				
		P	C	PR	A	M
PC-C	Mean N	275	146	97	52	109
	N	30	30	24	23	16
	SD	427	293	156	38	97
C-PR	Mean N	120	111	98	59	129
	N	40	40	39	34	33
	SD	159	150	139	78	191
PR-A	Mean N	69	50	71	43	136
	N	22	21	21	22	22
	SD	69	37	80	36	116
A-M	Mean N	15	25	9	46	415
	N	3	2	2	3	3
	SD	10	34	9	11	483
C-A	Mean N	23	29	-	28	83
	N	5	5	-	5	5
	SD	10	21	-	18	64
Multiple	Mean N	112	73	67	65	131
	N	21	20	19	20	19
	SD	150	100	76	69	233

Magnitude of Transitions

Overview. A total of 2144 primary effect sizes were calculated across 4 Stage transitions for the Decisional Balance measures. Nine hundred forty-seven unadjusted Hedges' g or Standard Score effect sizes were calculated for decisional balance. These 947 effect sizes were then adjusted for sample size, resulting in 947 adjusted effect sizes. Finally, 250 effect sizes based on the standard score method were corrected using the Pros and Cons regression correction (see Equation 119).

Table 9 displays the sample size and calculation adjusted effect sizes for the Pros and Cons across the Stage transitions for all datasets.

Table 9

Adjusted Effect Sizes of the Pros and Cons of Change for All Studies across Stage Transitions

Study/ Author	Year	Target Behavior	N/ data-set	Effect Sizes for Stage Transitions							
				Pros				Cons			
				PC-C	C-PR	PRA	A-M	PC-C	C-PR	PR-A	A-M
Acton et al.	2001	Smoking Cessation	205	.76	-.15	-.52	.33	-.20	.00	-.31	-.17
Ahijevych et al.	1999	Smoking Cessation	95	.66	.27	n.a.	n.a.	-.11	-.33	n.a.	n.a.
Bane et al.	1999	Smoking Cessation	281	.58	.19	-.68	-.19	-.11	-.15	-.12	-.28
Banikarim et al.	2003	STD Screening-Change in Partners	135	.28	.62	.18	.06	-1.42	-.18	-.37	.09
Banikarim et al.	2003	STD Screening-Main	201	-.32	.10	-.15	.76	.25	.07	.07	-.42
Basler et al.	1999	Exercise	451	.63	.39	-.08	.07	.18	-.28	-.51	.14
Block et al.	1998	Condom Use	127	.26	n.a.	n.a.	n.a.	-.08	n.a.	n.a.	n.a.
Borland et al.	2000	Smoking Cessation	304	.54	.32	.18	n.a.	.16	-.17	-.23	n.a.
Boudreaux et al.	1998	Smoking Cessation	554	1.28	-.22	-.56	-1.64	-.16	-.59	-.58	-.78
Buckworth et al.	2002	Exercise	57	n.a.	n.a.	n.a.	.98	n.a.	n.a.	n.a.	-1.26
Callaghan et al.	2002	Exercise	298	1.68	.39	.36	.36	.28	-.42	.06	-.20
Chamot et al.	2001	Mammography	885	.97	n.a.	n.a.	.27	-.77	n.a.	n.a.	-.06
DiClemente	1991	Smoking Cessation	1466	.82	.18	n.a.	n.a.	-.31	-.25	n.a.	n.a.
Dijkstra et al.	1996	Smoking Cessation	275	.73	.56	-.48	.12	.23	-.14	-.32	-.39
Dijkstra et al.	1998	Smoking Cessation	1540	n.a.	n.a.	n.a.	n.a.	.02	-.01	n.a.	n.a.
Dryfoos	1996	Glucose Testing Diabetes:	338	1.01	.08	.79	.28	.44	-.17	-.58	-.49
Dryfoos	1996	Medication Mangt Physicians	1048	n.a.	n.a.	n.a.	.11	n.a.	n.a.	n.a.	-.69
Eaton et al.	1992	Assisting Smokers	165	.50	.58	.06	-.42	-.46	.08	-.78	.75
Evers et al.	2001	Condom Use	270	-1.07	1.02	.44	-.26	.00	.37	-.48	.16
Evers et al.	2001	Decreasing Drug Use	293	.07	.49	.26	-.06	-.44	-.06	-.05	-.43
Evers et al.	2001	Waiting to have sex	602	.10	-.05	n.a.	n.a.	-.55	-.42	n.a.	n.a.

Table 9 (continued)

Study/ Author	Year	Target Behavior	N/ data-set	Effect Sizes for Stage Transitions							
				Pros				Cons			
				PC-C	C-PR	PRA	A-M	PC-C	C-PR	PR-A	A-M
Evers et al.	2003	Stress Management	241	.81	.07	-.06	-.72	.03	-.03	-.47	-.31
Fahrenwald et al.	2003	Exercise	30	.37	1.21	.06	-.11	-.35	-.73	.00	-.41
Fava et al.	1995	Smoking Cessation	4144	.57	.06	n.a.	n.a.	.02	-.07	n.a.	n.a.
Frenn et al.	2003	Dietary Fat Reduction	74	.36	.45	.11	.32	.25	-.19	-.30	.09
Galavotti et al.	1995	Contraception - General	233	.40	.43	-.03	.28	-.35	.11	-.41	.24
Galavotti et al.	1995	Condom Use - Main	233	.23	.29	.25	.09	-.10	-.02	-.09	.06
Galavotti et al.	1995	Condom Use - Other	122	.01	.07	.40	-.42	.19	-.19	.48	-.61
Gazabon	2000	Condom use	340	.37	.12	.16	-.07	.11	-.22	-.16	-.41
Giebel	1999	Smoking Cessation	235	1.00	-.87	1.33	-.99	-.20	.10	-1.63	.14
Giebel	1999	Dietary Fat Reduction	361	.79	-.12	.17	-.11	-.37	-.20	-.26	-.16
Giebel	1999	Exercise	361	.86	-.16	.04	.53	-.62	-.13	.03	-.50
Giebel	1999	Stress	244	.59	.52	-.15	-.16	.40	.54	-.73	.01
Grimley et al.	1995	Contraception - General	244	.39	.66	.38	-.41	.13	-.29	-.37	.17
Grimley et al.	1995	Condom-main	78	1.29	.36	.44	.09	.07	-.29	-.30	-.14
Grimley et al.	1995	Condom-other Fruit &	134	.73	.17	.36	-.05	-.07	-.13	.19	-.06
Happel	2002	Vegetable Consumption	255	.49	.42	n.a.	n.a.	.22	-.16	n.a.	n.a.
Hempelmann	2003	Tooth-friendly Diet	448	n.a.	n.a.	n.a.	.17	n.a.	n.a.	n.a.	-.33
Henderson	1999	Breast Self-Examination	214	.07	.49	.26	-.06	-.65	.01	-.16	-.43
Herrick et al.	1997	Dietary Fat Reduction	392	.21	.18	.42	-.49	.17	-.29	-.18	-.55
Herrick et al.	1997	Exercise	389	1.11	-.14	.39	.05	.50	-.19	-.74	.09
Herrick et al.	1997	Smoking Cessation	393	.31	.05	.64	-.10	-.22	-.58	-.27	-.38
Herrick et al.	1997	Sun Protection/Reduction	392	.19	-.12	.86	-.19	-.52	-.12	-.17	.07
Herzog et al.	1999	Smoking Cessation	1390	.62	.35	n.a.	n.a.	-.16	-.05	n.a.	n.a.

Table 9 (continued)

Study/ Author	Year	Target Behavior	N/ data-set	Effect Sizes for Stage Transitions							
				Pros				Cons			
				PC-C	C-PR	PRA	A-M	PC-CC	PR-PR	PR-A	A-M
Hulton	2001	Sex Decision Making /Abstinence (Non Virgins)	103	1.00	-.19	-.63	.96	-.89	.25	.74	-1.51
Hulton	2001	Sex Decision Making /Abstinence (Virgins)	622	.69	-.01	.13	n.a.	-.70	-.03	-.24	n.a.
Jeffries	2001	Exercise	537	.96	-.10	.02	.03	-.01	-.25	-.16	-.14
Johnson et al.	2002	Smoking Cessation	296	.63	.24	n.a.	n.a.	.00	-.03	n.a.	n.a.
Johnson, J.L. et al.	2002	Bone Density Testing	465	.90	.39	-.11	.14	.30	.05	-.06	-.35
Johnson, J.L. et al.	2002	Calcium Intake	419	.72	.33	-.04	.26	.28	-.07	.18	-.23
Johnson, S.S. et al.	2002	Participating in Decision Making for Medication	185	.51	-.10	-.09	.50	.22	.12	-.50	.03
Jordan	2002	Anorexia - Recovery From	276	.75	.08	.05	.19	-.45	-.29	.04	-.50
Jordan	2002	Bulimia - Recovery From	148	.72	.30	-.16	-.20	-.41	-.10	-.13	-.34
Jordon et al.	2002	Exercise	223	1.18	1.04	.45	-.45	-.10	-.11	.39	-.09
Katlin	2001	Drug Treatment	114	.70	.00	.43	-.21	.58	.00	-.42	-.32
Keller	1998	Healthy Eating	405	.53	.21	.45	-.39	-.22	-.40	.06	-.61
Keller	1998	Healthy Eating	407	.57	.46	-.09	-.01	-.15	-.05	-.22	-.19
Keller et al.	1999	Smoking Cessation	401	.56	-.14	.33	.04	-.38	-.49	-.70	-.09
Keller et al.	2001	Back Pain	149	.63	-.12	.32	.06	-.03	-.19	-.30	-.14
Keller et al.	2001	Fruit and Vegetable Intake	282	.87	.32	n.a.	n.a.	.05	-.21	n.a.	n.a.
Keller et al.	2002	Oral Hygiene	276	.39	.24	-.23	.17	.08	-.62	.47	-.27
Keller et al.	2003	Stress Management	665	.61	.17	.10	-.31	.08	-.20	.11	-.04
King et al.	1996	Exercise	332	1.58	-.42	n.a.	n.a.	-.41	.09	n.a.	n.a.
King et al.	1996	Smoking Cessation	296	1.31	-.33	.42	n.a.	-.33	-.13	.04	n.a.
Kraft et al.	1999	Smoking Cessation	421	.54	.00	n.a.	n.a.	-.53	.15	n.a.	n.a.
Kremers et al.	2001	Smoking Acquisition	21535	.49	-.37	n.a.	n.a.	-.93	.28	n.a.	n.a.
Lauby et al.	1998	Contraception - General	2361	.50	.26	-.02	.26	-.11	-.32	-.32	-.19

Table 9 (continued)

Study/ Author	Year	Target Behavior	N/ data-set	Effect Sizes for Stage Transitions							
				Pros				Cons			
				PC-C	C-PR	PRA	A-M	PC-C	C-PR	PR-A	A-M
Lauby et al.	1998	Condom Use - Main	2925	.72	.19	.07	-.05	-.19	-.30	-.23	-.13
Lauby et al.	1998	Condom Use - Other	1213	.92	-.14	.31	.08	-.03	-.04	-.49	.02
Lerner	1990	Delinquent Behavior	159	.68	n.a.	n.a.	-.43	.14	n.a.	n.a.	-.19
Levesque et al.	1999	Domestic Violence	256	-.05	.49	.12	n.a.	.38	-.21	-.61	n.a.
Levesque et al.	1999	Collaborative Delivery Service	31	.21	n.a.	n.a.	.21	.78	n.a.	n.a.	.91
Levesque et al.	2000	Administrative Change	134	n.a.	n.a.	n.a.	.28	n.a.	n.a.	n.a.	-.14
Levesque et al.	1999	Depression Prevention	181	.56	.04	.24	-.37	.22	.50	-.55	-.56
Lowry	2000	Smokeless Tobacco Use	99	.00	.51	n.a.	n.a.	-.17	-.03	n.a.	n.a.
Ma et al.	2002	Fruit Intake	1545	.85	-.01	-.16	-.12	.36	-.16	-.27	.00
Ma et al.	2002	Vegetable Intake	1545	.73	.09	.03	-.45	.40	-.12	-.17	-.18
Maier	2002	Exercise	251	.86	.47	-.19	.39	.23	-.35	-.68	-.35
Maleszka	2002	Smoking Cessation	216	.64	.27	-.03	-.44	.12	-.25	-.40	-.32
Manne et al.	2002	Colorectal Cancer Screening	480	n.a.	n.a.	n.a.	n.a.	-1.18	.40	-.80	-.52
Marcus et al.	1992	Exercise	717	1.40	.13	.25	.01	.36	-.37	-.25	-.41
Marcus et al.	1994	Exercise	431	1.09	-.08	.29	.36	-.55	-.37	-.55	-.23
Mauriello	2001	Stress Management	294	.99	-.34	-.20	.06	.12	-.52	.22	-.51
Mettler et al.	2000	Exercise	690	n.a.	-.14	.55	-.02	n.a.	-.36	-.64	-.24
Migneault et al.	1997	Binge Drinking Acquisition	421	1.05	n.a.	n.a.	-.04	.05	n.a.	n.a.	-.05
Migneault et al.	1997	Binge Drinking Cessation	255	.07	.77	.15	-.05	-.58	.28	-.69	-.33
Moll	2001	Physical Activity	287	.67	.41	-.01	.25	.00	-.56	-.14	-.30
Morrison-Beedy et al.	2001	Condom Use- Main	254	1.16	-.14	n.a.	n.a.	.51	-.21	n.a.	n.a.
Morrison-Beedy et al.	2001	Condom Use- Other	110	.33	.00	n.a.	n.a.	1.52	-1.72	n.a.	n.a.
Nigg & Courneya	1998	Exercise	819	1.30	-.08	.63	-.05	.43	-.27	-.09	-.18
Nigg et al. (240)	1998	Exercise	240	.31	.41	.60	-.40	.32	-.10	.01	-.51
Nigg et al. (352)	1998	Exercise	346	.91	.94	.34	-.54	-.31	-.03	.38	-.32

Table 9 (continued)

Study/ Author	Year	Target Behavior	N/ data-set	Effect Sizes for Stage Transitions							
				Pros				Cons			
				PC-C	C-PR	PRA	A-M	PC-C	C-PR	PR-A	A-M
Noar et al.	1998	Condom Use - Vaginal Sex	168	.49	-.04	-.01	.52	.19	-.74	.01	-.01
Norman et al.	2002	Sedentary Behavior	178	.36	.17	.07	-.31	-.96	.01	-.45	.18
Norman et al.	2002	Sedentary Behavior	254	.57	.10	.18	-.19	-.41	-.58	-.26	-.12
O'Connell & Velicer	1988	Weight Loss	123	1.00	n.a.	n.a.	-.48	.37	n.a.	n.a.	.39
Otake & Shimai	2001	Smoking (JR) Acquisition	556	.73	.18	.35	n.a.	-.29	-.24	-.78	n.a.
Otake & Shimai	2001	Smoking (SR) Acquisition	1002	.44	.30	-.03	n.a.	-.43	.08	-.69	n.a.
Pallonen et al.	1997	Smoking Acquisition	505	.89	-1.05	2.60	n.a.	-.33	-.06	-.84	n.a.
Pallonen et al.	1997	Smoking Cessation Physicians	254	.97	.11	.36	.22	-.09	-.34	-.09	-.49
Park et al.	2003	Counseling smokers	259	.70	.45	-.07	.34	.21	-.58	.87	-1.16
Perez	2001	Condom Use	828	.70	.24	.03	.12	.09	.04	-.02	-.24
Plummer et al.	2001	Smoking Acquisition	2010	.74	.54	n.a.	n.a.	-.49	-.60	n.a.	n.a.
Plummer et al.	2001	Smoking Cessation	798	.81	.32	.02	.37	-.36	-.42	-.18	-.63
Prochaska et al.	1990	Condom Use - Anal Main	325	1.33	n.a.	n.a.	.27	-.21	n.a.	n.a.	-.21
Prochaska, JJ et al.	2003	Smoking Cessation	322	.93	.25	n.a.	n.a.	-.31	-.03	n.a.	n.a.
Rakowski et al.	1992	Mammography	141	.59	n.a.	n.a.	.34	-.36	n.a.	n.a.	-.33
Redding	1990	Safer Sex Decision Making	213	1.27	n.a.	n.a.	n.a.	-.03	n.a.	n.a.	n.a.
Redding	1993	Safer Sex Decision Making	305	1.26	n.a.	n.a.	-.05	-.11	n.a.	n.a.	-.28
Reed	1996	Exercise	271	1.75	.63	.26	-.42	-.38	-.09	-.34	-.10
Riley et al.	2000	Stress Management	19	.22	.25	-.40	-.10	.19	-.75	.77	-.30
Riley et al.	2003	Stress Management	42	-.32	-.08	-.26	.32	-.20	.39	-.36	.04
Riley et al.	2003	Stress Management	126	.79	-.09	-.13	-.10	.01	.47	-.32	-.05
Robbins et al.	2002	Organ Donation	2233	.74	-.17	.17	.10	-.33	.11	-.17	-.22
Robbins et al.	2002	Organ Donation	333	.33	.17	.26	-.47	-.08	.27	-.61	.29
Robbins et al.	1999	Organ Donation	475	.60	-.05	n.a.	n.a.	-.32	-.37	n.a.	n.a.
Robbins et al.	1999	Organ Donation	280	.48	.20	n.a.	n.a.	-.49	-.04	n.a.	n.a.

Table 9 (continued)

Study/ Author	Year	Target Behavior	N/ data-set	Effect Sizes for Stage Transitions							
				Pros				Cons			
				PC-C	C-PR	PRA	A-M	PC-C	C-PR	PR-A	A-M
Robbins et al.	2001	Organ Donation	163	.59	.04	.21	n.a.	-.18	-.35	-.19	n.a.
Rossi	1990	Sunscreen Use	136	.86	n.a.	n.a.	1.05	.11	n.a.	n.a.	-.25
Rossi	1990	Radon Testing	698	1.00	n.a.	n.a.	n.a.	-.27	n.a.	n.a.	n.a.
Rossi et al.	2001	Cocaine Use	298	1.15	n.a.	n.a.	.00	.50	n.a.	n.a.	-.21
Rossi, SR et al.	1993	Dietary Fat Reduction	196	.78	n.a.	n.a.	-.47	.56	n.a.	n.a.	-.27
Rossi, SR et al.	2001	Dietary Fat Reduction	1204	.21	.08	-.25	-.06	.49	.05	-.10	-.02
Rossi, SR et al.	2001	Fruit & Vegetable Consumption	353	.47	.33	-.04	-.11	-.12	-.06	-.30	.46
Rossi, SR et al.	2001	Dietary Fat Reduction	2639	.73	.12	.20	.12	-.06	-.09	-.20	-.26
Ruggiero et al.	2000	Smoking Cessation	206	.52	.08	n.a.	n.a.	-.02	-.24	n.a.	n.a.
Ruggiero et al.	2003	Glucose Testing	668	.29	.02	.29	.28	.30	-.04	-.46	.01
Sarkin, et al.	2001	Exercise	670	1.01	.54	-.16	-.42	.25	-.11	-.46	-.23
Schmaling	2000	Medication Management	53	2.21	-.19	.26	-.09	1.14	-.73	-.85	-.40
Schorling	1995	Smoking Cessation-	243	.51	-.06	n.a.	n.a.	-.47	.05	n.a.	n.a.
Schorling	1995	Smoking Cessation-	292	.36	.38	n.a.	n.a.	-.10	-.13	n.a.	n.a.
Schulze	2003	Daily Use of Dental Floss	877	.76	.33	-.24	.38	.31	-.23	.20	-.71
Schumann et al.		Smoking Cessation	453	-.32	-.10	-.75	-.07	.66	.12	-.85	.49
Silverman	1995	Condom Use	223	.20	-.15	.42	-.32	-.16	-.01	-.38	-.08
Silverman	1995	Condom Use	230	.19	.38	-.02	.32	.18	-.61	.20	-.36
Snow et al.	1992	Smoking Cessation	191	.47	.95	n.a.	n.a.	-.27	-.41	n.a.	n.a.
Stark et al.	1998	Condom Use - Other	754	.78	.09	.45	.04	n.a.	n.a.	n.a.	n.a.
Stark et al.	1998	Condom Use - Main	822	.73	.09	.22	-.16	n.a.	n.a.	n.a.	n.a.
Susenbeth	2000	Condom Use	96	n.a.	n.a.	n.a.	.12	n.a.	n.a.	n.a.	n.a.
Tseng	2001	Exercise	154	.93	.85	.49	.29	-.03	.19	-.30	-.46
Tsoh	1993	Quitting Drugs	169	.66	-.22	n.a.	n.a.	.47	-.66	n.a.	n.a.
Van Marter et al.	2003	Bullying	473	.57	.61	n.a.	n.a.	.02	-.10	n.a.	n.a.
Velicer et al.	1985	Smoking Cessation	930	.75	.00	-.29	-.40	.10	.06	-.59	-.38
Wakui et al.	2002	Exercise	450	.67	-.19	-.01	.09	-.06	-.07	-.27	.23

Table 9 (continued)

Study/ Author	Year	Target Behavior	N/ data-set	Effect Sizes for Stage Transitions							
				Pros				Cons			
				PC-C	C-PR	PRA	A-M	PC-C	C-PR	PR-A	A-M
Whyte	2003	Dietary Fat Reduction	416	.36	.26	-.18	.93	.51	-.45	.07	-.57
Wright et al.	2002	Weight Bearing Exercise	250	.86	.18	.23	.15	.27	-.21	-.15	-.56

Outliers. Outliers were examined for each Stage transition of both the Pros and Cons measures. Potential outliers identified by calculating the standard deviation of the mean for each effect size across the four Stage transitions. Effect sizes that were 2 *SD* or 3 *SD* from the mean were carefully examined. Once outliers were corrected for clerical or calculation error, preliminary analyses of the outliers were conducted. Between 4 and 9 effect sizes were identified as 2 or 3 *SD* above the mean for each of the transitions, with a total of 27 for Pros and 21 for Cons. The 20 effect sizes for Pros and 14 for Cons that were greater than 2 *SD* above the mean (but less than 3 *SD* above the mean) were examined by Stage transition. Essentially, all these effect sizes showed clear clusters. For example, 7 effect sizes were identified as 2 *SD* above the mean for Pros transition PC-C; four of these effect sizes (Evers et al., 2001; Schumann et al., 2003; Banikarim et al., 2003; Riley et al., 2003) were clustered between -.3 and -.4 and three of the studies (King et al., 1996; Callaghan et al., 2002; Reed, 1996) were clustered between 1.6 and 1.8. Interestingly, the three studies clustered around 1.6 and 1.8 examined exercise, which is a behavior previously found to have, overall, the largest effect sizes across the Stages (Hall & Rossi., 2004) and in particular for the PC-C transition (Hall & Rossi., 2003).

Therefore, it is clear since essentially all effect sizes clustered together and often did so in theoretically predictable manner, for this study - the standard of 2 *SD* above the mean was considered insufficient for identifying outliers. Further analysis was then conducted.

Effect sizes found to be 3 *SD* or more above the mean were examined for possible removal. In total 14 effect sizes were identified, 7 for Pros and 7 for Cons. These outliers were examined to assess possible relationships with various potential moderator variables. No significant relationships were found between the outliers and each of the moderating variables, including behavior category, cessation versus acquisition behaviors, age, calculation method, and publication status. Significant differences were found for recruitment setting ($\chi^2 = 15.002$, $df = 6$, $p < .020$). In particular a large portion of the outliers were studies that recruited participants from clinic settings. Analysis revealed that these datasets typically were small in sample size. Although all datasets included in this study had a sample size of 19 or greater, since the total sample size for each study is divided across the Stages of Change in a given dataset, some of these studies were found to have remarkably small sample sizes per Stage.

In the end, the outlier analyses provided the basis for three criteria to be used to determine the removal of the outliers (1) effect sizes must be at least 3 *SD* from the mean for a given Stage; and (2) effect sizes must be based on sample sizes with Stage sample sizes less than 5; and/or (3) effect sizes must be greater than .2 from the next closest effect size cluster. Therefore, if the effect size was 3 *SD* above the mean and met one of the other two criteria the effect size was removed. Of the 14

outliers identified as 3 *SD* above the mean, six Pros and six Cons were removed and one Pros and one Cons was retained (see Table 10 below).

Table 10

Summary of Outliers 3 SD from the Mean

	Source	Behavior	Transition	Effect Size
PROS				
Removed	Evers et al., 2001	Condom Use	PC-C	-1.07
	Schmaling et al., 2000	Medication Management	PC-C	2.212
	Pallonen et al., 1997	Smoking Acquisition	C-PR	-1.05*
	Geibel, 1999	Smoking Cessation	C-PR	-.87
	Pallonen et al., 1997	Smoking Acquisition	PR-A	2.60
	Boudreaux et al., 1998	Smoking Cessation	A-M	-1.64*
Retained	<i>Fahrenwald et al., 2003</i>	<i>Exercise</i>	<i>C-D</i>	<i>1.21</i>
CONS				
Removed	Banikarim et al., 2003	STD Screening	PC-C	-1.42*
	Morrison-Beedy et al., 2001	Condom Use	PC-C	1.52*
	Morrison-Beedy et al., 2001	Condom Use	C-PR	-1.72*
	Geibel, 1999	Smoking Cessation	PR-A	-1.63*
	Hulton, 2001	Sex Decision Making	A-M	-1.51
	Levesque et al., 1999	Administrative Change	A-M	.91
Retained	<i>Buckworth et al., 2002</i>	<i>Exercise</i>	<i>A-M</i>	<i>-1.26</i>

Note. Asterisks indicate effect sizes based on Stage sample sizes less than five.

Magnitudes across all Datasets. Fixed and random effects models were fit to the effect size data for the Pros and Cons for each of the four Stage transitions (PC-C, C-PR, PR-A, A-M). The random effects variance component (v) was determined for each Stage transition for each construct. A Q -test was then conducted on the random effects variance component in order determine if there is statistical support for the random effects model.

The largest *ES* average was found for the Pros of Change, specifically in the transition between the Precontemplation and Contemplation Stages. This effect size

was found to be significantly greater than zero for both the fixed and random effects model, with a mean of .63 ($p < .01$; $CI = .61$ to $.66$) for the fixed effects and mean of .65 ($p < .01$; $CI = .60$ to $.70$) for the random effects model. The random effects variance component and overall test for heterogeneity was found to be significant ($\nu = .06$; $Q(df = 135) = 504.60, p < .01$).

A smaller increase was seen in the transition from Contemplation to Preparation for the Pros of Change with significant effects for the fixed effects ($M = .14, p < .01$; $CI = .11$ to $.17$) and random effects model ($M = .17, p < .01$; $CI = .12$ to $.21$). The random effects variance component and overall test for heterogeneity for this transition was found to be significant ($\nu = .03$; $Q(df = 121) = 275.01, p < .01$).

Again, significant ($p < .01$) but smaller increases were seen for the Pros of Change for the transition Preparation to Action for both models. A mean of .12 was found for both models, though with a smaller confidence interval for the fixed effects ($CI = .08$ to $.16$) than for the random effects ($CI = .06$ to $.18$) model. The random effects variance component and overall test for heterogeneity was found to be significant ($\nu = .04$; $Q(df = 99) = 206.65, p < .01$).

Essentially no effect was found from Action to Maintenance. The fixed effects ($M = .02, p = .17$; $CI = -.01$ to $.06$) and random effects ($M = .02, p = .60$; $CI = -.05$ to $.08$) means were not found to be significantly different from zero. As with the other transitions, the random effects variance component and overall test for heterogeneity was found to be significant ($\nu = .06$; $Q(df = 107) = 290.01, p < .01$).

The Cons of Change showed somewhat of an inverse pattern across transitions, though with overall smaller effect sizes. The smallest effect for the Cons

of Change was found for the transition from Precontemplation to Contemplation. Although small the fixed effects ($M = -.07, p < .01; CI = -.10 \text{ to } -.05$) and random effects ($M = -.08, p = .01; CI = -.13 \text{ to } -.02$) models revealed effect sizes significantly different from zero. As with the Pros of Change transitions, the random effects variance component and overall test for heterogeneity was found to be significant ($\nu = .07; Q(df = 135) = 620.55, p < .01$).

Small, but relatively larger decreases were found for the Cons from Contemplation to Preparation for the fixed effects ($M = -.14, p < .01; CI = -.17 \text{ to } -.11$) and random effects ($M = -.15, p < .01; CI = -.19 \text{ to } -.11$) models. The random effects variance component and overall test for heterogeneity was found to be significant ($\nu = .01; Q(df = 123) = 174.44, p < .01$).

Significant, and even larger, effect sizes were found for Preparation to Action for the fixed effects ($M = -.26, p < .01; CI = -.30 \text{ to } -.22$) and random effects ($M = -.24, p < .01; CI = -.30 \text{ to } -.18$). The random effects variance component and overall test for heterogeneity was found to be significant ($\nu = .04; Q(df = 98) = 212.57, p < .01$).

Lastly, the Action to Maintenance transition showed significant effects for fixed ($M = -.22, p < .01; CI = -.26 \text{ to } -.19$) and random ($M = -.23, p < .01; CI = -.28 \text{ to } -.18$) effects models. And as with all other transitions, the random effects variance component and overall test for heterogeneity was found to be significant ($\nu = .02; Q(df = 104) = 167.87, p < .01$). A summary of all transitions for Pros and Cons of Change for both fixed and random effects models is found in Table 11.

Table 11

Comparison of Fixed and Random Effect Models for Effect Sizes of Pros and Cons across Stage Transitions

	<i>N</i>	FIXED EFFECTS					RANDOM EFFECTS				
		<i>ES</i>	<i>SE</i>	95% <i>CI</i>		<i>p</i>	<i>ES</i>	<i>SE</i>	95% <i>CI</i>		<i>p</i>
				L	U				L	U	
PROS											
PC-C	136	.63	.01	.61	.66	<.01	.65	.02	.60	.70	<.01
C-PR	122	.14	.01	.11	.17	<.01	.17	.02	.12	.22	<.01
PR-A	100	.12	.02	.08	.16	<.01	.12	.03	.06	.18	<.01
A-M	108	.02	.02	-.01	.06	.17	.02	.03	-.05	.08	.60
CONS											
PC-C	136	-.07	.01	-.10	-.05	<.01	-.08	.02	-.13	-.04	.01
C-PR	124	-.14	.01	-.17	-.11	<.01	-.15	.02	-.19	-.11	<.01
PR-A	100	-.26	.02	-.30	-.22	<.01	-.24	.03	-.30	-.18	<.01
A-M	105	-.22	.02	-.26	-.19	<.01	-.23	.02	-.28	-.18	<.01

Note. *N* = sample size; *ES* = mean effect size; *L* = lower bound; *U* = upper bound; *p* = significance of effect as compared to zero; * indicates overall significant differences between groups at $p < .05$.

Due to the significant random effects variance component and overall test for heterogeneity for all transitions for both the Pros and Cons of Change, the random effects model was used for the remainder of effect size analyses. The graphical representation of the mean scores for all 146 datasets for Pros and Cons based on the random effects results is illustrated below (Figure 5).

Figure 5. Composite Decisional Balance Graphic Using Random Effects Model.

Significant homogeneity Q -tests were found for all Stage transitions for both the Pros and Cons. This indicates that the effect size distributions are heterogeneous for both Decisional Balance measures; therefore, analyses to assess for possible moderators of the effect size distribution are warranted. A summary of the Q -tests can be found in Table 12.

Table 12

Overall Test of Homogeneity and Random Effects Variance for Mean Effect Sizes of the Pros and Cons across Stage Transitions

	PROS				CONS			
	PC-C	C-PR	PR-A	A-M	PC-C	C-PR	PR-A	A-M
ν	.06	.03	.04	.06	.07	.01	.04	.02
Q	504.60	275.01	206.65	290.01	620.55	174.44	203.13	167.87
df	135	121	99	107	135	123	98	104
p	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01

Note. ν = random effects variance component; Q = overall test of homogeneity; df = degrees of freedom; p = p -value; Q/df = normalized chi-squared index

Moderators of Effect Size Distribution.

Potential categorical moderators of effect sizes were explored by examining subgroups. Based on the findings above, random effects modeling was employed in each of the ANOVA analogs. Calculation Method was explored first to ensure bias was not introduced by the differing methods of effect size calculation and to assess the effectiveness of the regression correction developed in Chapter 5. Following the comparison of calculation methods, behavior categories were explored. A priori behavioral subgroup analyses were conducted. Additional potential moderators were then examined.

Calculation Method. In order to ensure the regression correction developed in Chapter 5 for calculation method was effective, the first potential moderator assessed was calculation method. As described previously, effect sizes were calculated by two primary methods: Hedges' g and Standard Score. Seventy percent of the datasets

were calculated using Hedges' g and 30% were based on the Standard Score method, which was adjusted using the regression correction. No significant differences were found between the two methods using random effects modeling. The between-group tests of homogeneity for calculation methods for the Pros and Cons of Change across Stage transitions are reported in Table 13.

Table 13

Between Groups Test of Homogeneity of Calculation Method for the Pros and Cons across Stage Transitions

	PROS				CONS			
	PC-C	C-PR	PR-A	A-M	PC-C	C-PR	PR-A	A-M
<i>Q</i>	.63	.00	.41	.47	.37	.28	.16	2.61
<i>df</i>	1	1	1	1	1	1	1	1
<i>p</i>	.43	1.00	.52	.49	.54	.60	.69	.11

Additionally, using random effects modeling, no within group tests of heterogeneity were found to be significant. The sample sizes, mean effect sizes and 95% confidence intervals are presented in Table 14 below. The p -values displayed in this table indicate whether or not the given effect sizes are significantly greater than zero.

Comparison of Calculation Methods

	CALCULATION METHOD											
	<i>Hedges' g</i>						<i>Standard Score</i>					
	<i>N</i>	<i>ES</i>	<i>SE</i>	95% <i>CI</i>		<i>p</i>	<i>N</i>	<i>ES</i>	<i>SE</i>	95% <i>CI</i>		<i>p</i>
				L	U					L	U	
PROS												
PC-C	97	.67	.04	.60	.74	< .01	39	.62	.05	.51	.72	< .01
C-PR	87	.17	.03	.11	.23	< .01	35	.17	.05	.07	.27	< .01
PR-A	72	.13	.04	.06	.21	< .01	28	.09	.05	-.01	.20	.09
A-M	78	.00	.04	-.07	.08	.96	30	.05	.06	-.07	.16	.39
CONS												
PC-C	96	-.06	.04	-.13	.01	.08	40	-.10	.06	-.21	.00	.06
C-PR	89	-.16	.02	-.20	-.12	< .01	35	-.13	.04	-.20	-.06	< .01
PR-A	71	-.25	.04	-.33	-.18	< .01	28	-.23	.06	-.33	-.12	< .01
A-M	76	-.26	.03	-.31	-.20	< .01	29	-.17	.04	-.26	-.09	< .01

Note. *N* = sample size; *ES* = mean effect size; *L* = lower bound; *U* = upper bound; *p* = significance of effect as compared to zero.

Magnitudes within Behaviors.

Since heterogeneity was found overall and no significant differences were found for calculation method, behavior categories were explored as possible moderator variables.

Many of the 55 target behaviors included in this study are represented by only one dataset, thereby precluding meaningful subgroup analyses. Thirty-three of the target behaviors had data for each of the transitions for both Pros and Cons. For descriptive purposes, the magnitudes of effects for each of the transitions for these target behaviors are depicted in composite graphics and displayed in Appendix C. Primary behavior categories were created (see Appendix D) in order to group together studies that examined similar behaviors. In total, 10 behavior categories included 3 or more datasets, including: contraception, condom use, diet, drugs, exercise, medical screening, organ donation, smoking, sex decisions, and stress.

Mean effect sizes, standard errors, 95% confidence intervals, and *p*-values for behavior categories with 3 or more datasets can be found in Table 15 and Table 16.

Table 15

Comparison of Behavior Categories for Pros of Change

PROS		Contraception	Condom Use	Diet	Drugs	Exercise	Medical Screening	Organ Donation	Smoking	Sex Decisions	Stress
PC-C	<i>N</i>	3	17	15	4	20	5	5	33	5	7
	<i>ES</i>	.45	.61	.59	.51	.98	.59	.56	.63	.72	.65
	<i>SE</i>	.18	.08	.08	.21	.07	.15	.13	.05	.14	.15
	<i>L</i>	.10	.46	.44	.10	.83	.29	.30	.53	.44	.35
	<i>U</i>	.80	.77	.74	.91	1.12	.89	.82	.73	1.0	.95
	<i>p</i>	.01	<.01	<.01	.01	<.01	<.01	<.01	<.01	<.01	<.01
C-PR	<i>N</i>	3	16	13	3	20	3	5	31	3	7
	<i>ES</i>	.40	.13	.18	-.25	.20	.32	-.00	.17	-.06	.10
	<i>SE</i>	.14	.07	.07	.22	.06	.18	.12	.05	.15	.16
	<i>L</i>	.13	-.01	.05	-.68	.08	-.04	-.23	.08	-.35	-.21
	<i>U</i>	.68	.27	.12	.17	.30	.68	.22	.26	.24	.40
	<i>p</i>	<.01	.07	.01	.24	<.01	.08	.97	<.01	.71	.54
PR-A	<i>N</i>	3	14	11	2	20	3	3	18	2	7
	<i>ES</i>	.07	.23	.01	.28	.27	-.01	.21	-.06	-.04	-.09
	<i>SE</i>	.13	.07	.07	.28	.06	.18	.15	.07	.17	.14
	<i>L</i>	-.19	.10	-.13	-.27	.15	-.36	-.08	-.20	-.38	-.37
	<i>U</i>	.33	.37	.16	.82	.38	.34	.50	.08	.29	.18
	<i>p</i>	.58	<.01	.87	.32	<.01	.94	.15	.41	.80	.50
A-M	<i>N</i>	3	16	13	3	21	5	2	13	2	7
	<i>ES</i>	.08	.02	-.07	-.06	.03	.30	-.06	-.08	.29	-.19
	<i>SE</i>	.17	.08	.09	.18	.07	.15	.25	.10	.24	.13
	<i>L</i>	-.26	-.14	-.24	-.40	-.11	.01	-.55	-.28	-.18	-.45
	<i>U</i>	.42	.18	.10	.29	.17	.59	.44	.13	.76	.06
	<i>p</i>	.64	.81	.43	.75	.67	.04	.83	.45	.22	.14

Note. *N*= sample size; *ES* = mean effect size; *L* = Lower bound; *U* = Upper bound; *p* = significance level of effect size as compared to zero.

Table 16

Comparison of Behavior Categories for Cons of Change

CONS	Contraception	Condom Use	Diet	Drugs	Exercise	Medical Screening	Organ Donation	Smoking	Sex Decisions	Stress
PC-C										
N	3	15	15	4	20	5	5	34	5	7
ES	-.14	-.01	.16	.04	.01	-.34	-.28	-.17	-.49	.13
SE	.17	.08	.07	.20	.07	.14	.13	.05	.14	.14
L	-.47	-.17	.02	-.35	-.13	-.61	-.53	-.26	-.75	-.15
U	.20	.15	.30	.42	.15	-.08	-.03	-.07	-.22	.41
p	.43	.91	.03	.84	.88	.01	.03	<.01	<.01	.37
C-PR										
N	3	13	13	3	21	4	5	34	3	7
ES	-.23	-.17	-.14	-.28	-.21	.11	-.03	-.15	-.12	-.01
SE	.01	.06	.05	.19	.04	.13	.09	.03	.11	.14
L	-.43	-.30	-.24	-.65	-.30	-.15	-.20	-.21	-.35	-.28
U	-.03	-.05	-.05	.09	-.12	.36	.14	-.08	.10	.26
p	.03	<.01	<.01	.14	<.01	.42	.70	<.01	.28	.94
PR-A										
N	3	12	11	2	20	4	3	18	2	7
ES	-.36	-.15	-.17	-.11	-.22	-.42	-.33	-.38	.01	-.14
SE	.14	.08	.08	.29	.06	.14	.16	.07	.19	.15
L	-.64	-.31	-.33	-.68	-.35	-.69	-.64	-.53	-.36	-.43
U	-.08	.01	-.01	.46	-.10	-.14	-.02	-.24	.37	.15
p	.01	.06	.04	.71	<.01	<.01	.04	<.01	.97	.34
A-M										
N	3	13	13	3	21	6	2	14	1	7
ES	-.04	-.12	-.19	-.30	-.27	-.24	-.13	-.37	-.28	-.18
SE	.10	.06	.05	.12	.05	.09	.18	.07	.19	.10
L	-.24	-.23	-.30	-.54	-.36	-.42	-.42	-.51	-.66	-.36
U	.17	-.00	-.08	-.06	-.18	-.06	.23	-.23	.09	.01
p	.73	.04	<.01	.02	<.01	.01	.48	<.01	.14	.06

Note. N= sample size; ES = mean effect size; L = Lower bound; U = Upper bound; p = significance level of effect size as compared to zero.

These same data are presented in forest plots in Figure 6 and Figure 7 below.

The reference line in each of the forest plots represents the overall random effects mean for all the behaviors combined (see Table 11). The mean and confidence intervals for each of the behaviors is then plotted in comparison to the overall mean.

The forest plots show that for Pros for exercise are significantly greater than the

overall mean in the PC-C and PR-A transitions. The Pros for smoking were found to be significantly less than the overall mean for PR-A and Pros of Medical Screening were found to be significantly less than the mean for the A-M transition. The Cons for diet were found to be significantly greater than the overall mean for the PC-C transition and the Cons for exercise were found to be significantly less than the C-PR transition.

Figure 6. Forest Plots of Behavior Categories for Pros Stage Transitions (Means and Confidence Intervals)

Figure 7. Forest Plots of Behavior Categories for Cons Stage Transitions (Means and Confidence Intervals)

For further exploration between and within behavior categories, only behavior categories with a sample size greater than five for all transitions were selected. These five behavior categories included - condom use, diet, exercise, smoking, and stress. ANOVA analogs were performed to identify possible effect size differences among the behavior categories for Pros and Cons of Change. Consistent with the overall results, significant differences were found between the five behaviors on Pros of Change for the PC-C transition ($Q(df=4) = 17.80, p = < .01$) and for the PR-A transition ($Q(df=4) = 19.23, p = < .01$). No significant differences were found between the groups for any of the Cons of Change transitions.

A follow-up comparison of effect sizes for the transition from PC-C showed the magnitude of Pros for exercise to be significantly greater than the Pros for smoking ($Q = 6.48, p = .01$), stress ($Q = 5.36, p = .02$), condom use ($Q = 10.14, p < .01$), and diet ($Q = 10.13, p < .01$). A follow-up comparison of effect sizes for the transition from PR-A showed the magnitude of Pros for condom use to be significantly greater than the Pros for smoking ($Q = 6.48, p = .01$), stress ($Q = 5.36, p = .02$), and the Pros of exercise to be significantly greater than smoking ($Q = 6.48, p = .01$), and diet ($Q = 5.36, p = .02$).

Within group tests of homogeneity for each of the five major behavior categories were calculated (Table 17.). Using a random effect model, the effect sizes distributions for the majority of the behavior categories were found to be homogeneous for each of the Stage transition for Pros and Cons. Heterogeneity was only found for the Pros of Change for exercise in the transition from C-PR ($Q(df=$

19) = 40.31, $p < .01$) and for Pros of Change for smoking in the transition from PR-A ($Q(df = 15) = 35.06, p < .01$).

Table 17

Within Group Homogeneity Tests of the Pros and Cons across Stage Transitions for Behavior Categories

		PROS				CONS			
		PC-C	C-PR	PR-A	A-M	PC-C	C-PR	PR-A	A-M
Overall - Within	Q	85.69	78.39	62.57	60.52	75.46	73.40	55.83	67.03
	df	81	77	60	59	80	78	58	57
	p	.34	.43	.39	.42	.62	.56	.56	.17
Condom Use	Q	19.52	6.88	5.91	6.95	3.72	13.89	10.54	9.10
	df	16	15	13	15	14	12	11	12
	p	.24	.96	.95	.96	1.00	.31	.48	.69
Diet	Q	5.27	4.13	2.70	14.83	12.00	3.44	1.61	13.23
	df	10	9	7	8	10	9	7	8
	p	.87	.90	.91	.06	.28	.94	.98	.10
Exercise	Q	23.29	40.13*	18.03	23.82	21.72	15.58	24.77	23.04
	df	19	19	19	20	19	20	19	20
	p	.22	.00	.52	.25	.30	.74	.17	.29
Stress	Q	2.15	1.47	.87	4.64	1.23	5.24	5.73	4.43
	df	6	6	6	6	6	6	6	6
	p	.91	.96	.99	.59	.98	.51	.45	.62
Smoking	Q	35.45	25.59	35.06*	10.27	36.77	35.25	13.17	17.22
	df	30	28	15	10	31	31	15	11
	p	.23	.60	.00	.42	.22	.27	.59	.10

A Priori Behavior Sub-Group Comparisons. Although the majority of the effect size distributions for the behavior categories across the Stage transitions for the Pros and Cons were not found to be heterogeneous, a priori sub-group comparisons were established for theoretical purposes. Therefore variety of sub-groups comparisons were made, including behavioral comparisons (e.g., smoking

cessation versus smoking acquisition) and descriptive comparisons (e.g., healthy versus unhealthy behaviors).

Smoking Cessation versus Smoking Acquisition

The behavior category of smoking was made up primarily of smoking cessation and smoking acquisition. Effect size means, sample sizes, standard error, 95% confidence intervals, and p -values for smoking cessation and acquisition were computed (Table 18) and composite graphics were created (Figure 8 and Figure 9). In order to determine potential differences between these behaviors, an ANOVA analog using random effects modeling was performed on the two groups. No significant differences were found for the Pros of Change. Significant differences were found between smoking cessation and smoking acquisition for Cons of Change in the transition from PC-C ($Q(df=1) = 8.50, p < .01$) and in the transition from PR-A ($Q(df=1) = 7.18, p < .01$). Due to lack of data for the A-M transition for smoking acquisition differences between smoking cessation and smoking acquisition could not be computed.

Table 18

Comparison of Smoking Acquisition and Smoking Cessation

	SMOKING											
	Smoking Acquisition						Smoking Cessation					
	N	ES	SE	95% CI		p	N	ES	SE	95% CI		p
				L	U					L	U	
PROS												
PC-C	5	.65	.13	.39	.91	<.01	25	.64	.06	.53	.76	<.01
C-PR	5	.19	.12	-.04	.42	.11	25	.15	.05	.04	.25	<.01
PR-A	3	.16	.27	-.36	.69	.54	14	-.08	.12	-.30	.15	.52
A-M	0	-	-	-	-	-	12	-.18	.06	-.21	-.04	.19
CONS												
PC-C*	5	-.48	.12	-.71	-.25	<.01	26	-.11	.05	-.21	-.01	.03
C-PR	5	-.18	.10	-.37	.01	.06	26	-.14	.04	-.22	-.06	<.01
PR-A*	3	-.75	.14	-1.03	-.47	<.01	14	-.32	.07	-.46	-.18	.01
A-M	0	-	-	-	-	-	12	-.38	.06	-.50	-.26	<.01

Note. *N* = sample size; *ES* = mean effect size; L = lower bound; U = upper bound; *p* = significance of effect as compared to zero; * indicates overall significant differences between groups at $p < .05$.

Figure 8. Composite Graphic for Smoking Acquisition.

Figure 9. Composite Graphic for Smoking Cessation.

Smoking Cessation – Pros and Cons of Smoking versus Quitting

The behavior category of smoking cessation was made up of studies that examined either the Pros and Cons of Quitting Smoking or the Pros and Cons of Smoking. Effect size means, sample sizes, standard error, 95% confidence intervals, and *p*-values for Pros and Cons of Quitting Smoking and Pros and Cons of Smoking were computed (Table 19) and composite graphics were created (Figure 10 and Figure 11). In order to determine potential differences between these behaviors, an ANOVA analog using random effects modeling was performed on the two groups. No significant differences were found for the Pros of Change. Significant differences were found between the magnitudes of effect for the Cons of Change in the transition from PC-C ($Q = 4.85, p < .028$) and in the transition from A-M ($Q = 7.32, p < .007$).

Table 19

Comparison of Pros and Cons of Quitting Versus Smoking for Smoking Cessation Studies

	SMOKING CESSATION											
	<i>Pros and Cons of Quitting</i>						<i>Pros and Cons of Smoking⁺</i>					
	<i>N</i>	<i>ES</i>	<i>SE</i>	95% <i>CI</i>		<i>p</i>	<i>N</i>	<i>ES</i>	<i>SE</i>	95% <i>CI</i>		<i>p</i>
				L	U					L	U	
PROS												
PC-C	5	.48	.14	.21	.74	< .01	20	.69	.07	.55	.82	< .01
C-PR	4	.12	.15	-.18	.42	.43	20	.15	.05	.05	.25	< .01
PR-A	5	-.05	.23	-.51	.40	.82	9	-.08	.15	.37	.22	.62
A-M	5	-.21	.17	-.55	.13	.22	6	-.01	.15	-.30	.28	.96
CONS												
PC-C*	5	.08	.10	-.11	.28	.40	20	-.17	.06	-.28	-.06	< .01
C-PR	6	-.09	.09	-.25	.08	.32	20	-.14	.04	-.21	-.07	< .01
PR-A	4	-.52	.17	-.86	-.18	< .01	9	-.27	.09	-.44	-.11	< .01
A-M*	5	-.09	.12	-.33	.15	.48	7	-.49	.08	-.65	-.33	< .01

Note. + indicates that the Pros and Cons of Smoking are reversed. *N* = sample size; *ES* = mean effect size; L = lower bound; U = upper bound; *p* = significance of effect as compared to zero; * indicates overall significant differences between groups at $p < .05$.

Figure 10. Composite Graphic for Pros and Cons of Quitting Smoking.

Figure 11. Composite Graphic for Pros and Cons of Smoking.

Condom Use – General, Main, Other

The behavior category of condom use was made up primarily of studies that examined either condom use in general or more specifically with a main partner or

other partner. Effect size means, sample sizes, standard error, 95% confidence intervals, and p -values for these three sub-sets of condom use were computed (Table 20) and composite graphics were created (Figure 12, Figure 13 and Figure 14). In order to determine potential differences between these behavioral subsets, an ANOVA analog using random effects modeling was performed on the three groups. Significant differences were only found for the Pros of Change in the transition from C-PR ($Q(df=2) = 6.22, p = .04$). No significant differences were found for any of the transitions of the Cons of Change for these three groups.

Table 20

Comparison of Condom Use Sub-Groups

	CONDOM USE																	
	General						Main						Other					
	N	ES	SE	95% CI		p	N	ES	SE	95% CI		p	N	ES	SE	95% CI		p
				L	U					L	U					L	U	
PROS																		
PC-C	5	.42	.10	.22	.62	<.01	5	.67	.10	.46	.87	<.01	5	.73	.11	.51	.95	<.01
C-PR*	5	.23	.09	.06	.40	.01	5	.18	.07	.05	.31	.01	5	-.03	.08	-.18	.12	.69
PR-A	5	.16	.09	-.01	.33	.07	4	.14	.08	-.01	.29	.07	4	.37	.08	.22	.52	<.01
A-M	6	.01	.07	-.14	.15	.92	4	-.05	.07	-.20	.10	.48	4	.02	.08	-.12	.18	.75
CONS																		
PC-C	6	.05	.07	-.10	.20	.51	4	-.17	.06	-.29	-.05	.01	4	.01	.09	-.19	.18	.84
C-PR	6	-.04	.09	-.21	.13	.62	4	-.27	.07	-.41	-.12	<.01	3	-.07	.09	-.27	.09	.46
PR-A	5	-.16	.13	-.41	.09	.21	3	-.20	.15	-.50	.10	.20	3	-.13	.16	-.44	.19	.42
A-M	5	-.16	.08	-.31	-.01	.03	3	-.10	.09	-.27	.07	.24	3	-.05	.09	-.24	.13	.57

Note. N = sample size; ES = mean effect size; L = lower bound; U = upper bound; p = significance of effect as compared to zero; * indicates overall significant differences between groups at $p < .05$.

Figure 12. Composite Graphic for Condom Use – General.

Figure 13. Composite Graphic for Condom Use – Main Partner.

Figure 14. Composite Graphic for Condom Use – Other Partner.

Follow-up comparisons showed that condom use -general ($Q = 4.95, p = .026$) and condom use – main ($Q = 4.41, p = .035$) were significantly greater than condom use – other.

Dietary Fat Reduction versus Fruit and Vegetable Consumption

The behavior category of diet was made up primarily of studies that examined either dietary fat reduction or fruit and vegetable consumption. Effect size means, sample sizes, standard error, 95% confidence intervals, and p -values for dietary fat reduction and fruit and vegetable consumption separately were computed (Table 21) and composite graphics were created (Figure 15 and Figure 16). In order to determine potential differences between these two behavioral subsets, an ANOVA analog using random effects modeling was performed. No significant differences were found for the Pros or Cons of Change for any of the transitions of for these two groups.

Table 21

Effect Size Comparison of Dietary Fat Reduction and Fruit and Vegetable Consumption

	DIET											
	Dietary Fat Reduction						Fruit And Vegetable Consumption					
	N	ES	SE	95% CI		p	N	ES	SE	95% CI		p
				L	U					L	U	
PROS												
PC-C	7	.48	.09	.31	.65	<.01	5	.69	.09	.51	.87	<.01
C-PR	6	.13	.05	.04	.22	.01	5	.11	.05	.01	.22	.03
PR-A	6	.04	.09	-.14	.22	.66	3	-.08	.13	-.34	.18	.55
A-M	7	.04	.15	-.26	.34	.80	3	-.24	.24	-.71	.23	.31
CONS												
PC-C	7	.20	.11	-.01	.40	.06	5	.20	.11	-.03	.42	.09
C-PR	6	-.10	.05	-.19	-.01	.04	5	-.14	.05	-.24	-.03	.01
PR-A	6	-.16	.05	-.26	-.07	.00	3	-.24	.09	-.41	-.08	.00
A-M	7	-.27	.07	-.41	-.14	.00	3	-.03	.11	-.24	.19	.81

Note. *N* = sample size; *ES* = mean effect size; *L* = lower bound; *U* = upper bound; *p* = significance of effect as compared to zero; * indicates overall significant differences between groups at $p < .05$.

Figure 15. Composite Graphic for Dietary Fat Reduction.

Figure 16. Composite Graphic for Fruit and Vegetable Consumption.

Additional Moderators of Effect Size Distribution

Since overall effect sizes were heterogeneous and only a few instances of heterogeneity were found for Stage transitions within behaviors, additional moderators of effect size distribution were explored.

Age Group – Adolescents, College, and Adults.

Effect size means, sample sizes, standard error, 95% confidence intervals, and p -values for age group were computed (Table 22) and composite graphics were created (Figure 17, Figure 18 and Figure 19). Differences among age groups were assessed for the Pros and Cons effect sizes across each of the four Stage transitions using random effects modeling. No significant differences were found between adolescents, college students and adults for any of the transitions for Pros. Significant differences for Cons of Change were only found for the PC-C transition ($Q(df = 2) = 13.54, p < .01$). Follow-up analogs showed that Cons of Change were significantly greater for adolescents than college students ($p < .01$) and adults ($p < .01$).

Table 22

Comparison of Age Groups

	AGE GROUP																	
	<i>Adolescents</i>						<i>College</i>						<i>Adults</i>					
	<div>95% CI</div>						<div>95% CI</div>						<div>95% CI</div>					
	N	<i>ES</i>	<i>SE</i>	L	U	<i>p</i>	N	<i>ES</i>	<i>SE</i>	L	U	<i>p</i>	N	<i>ES</i>	<i>SE</i>	L	U	<i>p</i>
PROS																		
PC-C	22	.62	.07	.48	.75	<.01	20	.62	.08	.46	.77	<.01	90	.67	.04	.60	.74	<.01
C-PR	20	.19	.06	.07	.31	.00	16	.24	.07	.10	.39	.00	83	.16	.03	.10	.22	<.01
PR-A	16	.16	.07	.03	.30	.02	13	.26	.08	.10	.42	.00	67	.08	.04	.01	.16	.02
A-M	15	.03	.08	-.13	.19	.71	16	.01	.09	-.16	.18	.88	73	.03	.04	-.05	.10	.48
CONS																		
PC-C*	23	-.31	.07	-.44	-.17	<.01	20	-.01	.08	-.17	.14	.86	89	-.03	.03	-.10	.04	.39
C-PR	21	-.15	.05	-.24	-.06	.00	16	-.15	.06	-.26	-.03	.01	83	-.15	.02	-.20	-.11	<.01
PR-A	17	-.25	.07	-.39	-.12	.00	13	-.10	.09	-.27	.06	.22	65	-.26	.04	-.34	-.19	<.01
A-M	14	-.23	.06	-.35	-.11	.00	16	-.18	.07	-.32	-.05	.01	71	-.23	.03	-.29	-.18	.05

Note. N = sample size; ES = mean effect size; L = lower bound; U = upper bound; p = significance of effect as compared to zero; * indicates overall significant differences between groups at $p = < .05$.

Figure 17. Composite Graphic for Adolescents.

Figure 18. Composite Graphic for College Students.

Figure 19. Composite Graphic for Adults.

Cessation versus Acquisition

Effect size means, sample sizes, standard error, 95% confidence intervals, and p -values for cessation and acquisition behaviors were computed (Table 23) and composite graphics were created (Figure 20 and Figure 21). Effect sizes for cessation and acquisition behaviors were compared across the four Stage transitions using random effects modeling. Acquisition behaviors were significantly greater than cessation behaviors for the Pros of Change in the transition from PC-C ($Q(df=1) = 3.88, p = .05$) and in the transition from PR-A ($Q(df=1) = 7.58, p = .01$). No significant differences were found between acquisition and cessation behaviors for the Cons of Change.

Table 23

*Means, Standard Error and Confidence Intervals for Cessation and Acquisition**Behaviors*

	ACQUISITION						CESSATION					
	N	ES	SE	95% CI		p	N	ES	SE	95% CI		p
				L	U					L	U	
PROS												
PC-C*	90	.70	.04	.62	.77	<.01	46	.58	.05	.48	.67	<.01
C-PR	81	.17	.03	.11	.23	<.01	41	.17	.04	.09	.26	.00
PR-A*	72	.17	.03	.10	.24	<.01	28	-.01	.06	-.12	.10	.86
A-M	80	.05	.04	-.03	.12	.22	28	-.07	.06	-.20	.05	.27
CONS												
PC-C	89	-.08	.04	-.15	.00	.04	47	-.07	.05	-.17	.03	.15
C-PR	81	-.16	.03	-.20	-.11	<.01	43	-.14	.03	-.20	-.08	<.01
PR-A	72	-.23	.04	-.31	-.16	<.01	27	-.27	.06	-.39	-.15	<.01
A-M	76	-.21	.03	-.27	-.16	<.01	29	-.28	.05	-.37	-.19	<.01

Note. N = sample size; ES = mean effect size; L = lower bound; U = upper bound; p = significance of effect as compared to zero; * indicates overall significant differences between groups at $p = < .05$.

Figure 20. Composite Graphic for Cessation Behaviors.

Figure 21. Composite Graphic for Acquisition Behaviors.

Healthy versus Unhealthy

Effect size means, sample sizes, standard error, 95% confidence intervals, and *p*-values for health and unhealthy behaviors were computed (Table 24) and

composite graphics were created (Figure 22 and Figure 23). Effect sizes for healthy and unhealthy behaviors were compared across the four Stage transitions using random effects modeling. Mean effect sizes for healthy behaviors were significantly greater than unhealthy behaviors for the Pros of Change in the transition from PR-A ($Q(df=1) = 9.08, p = .003$) and from A-M ($Q(df=1) = 5.82, p = .007$). No significant differences were found between healthy and unhealthy behaviors for the Cons of Change.

Table 24

Comparison of Healthy and Unhealthy Behaviors

	HEALTHY						UNHEALTHY					
	N	ES	SE	95% CI		p	N	ES	SE	95% CI		p
				L	U					L	U	
PROS												
PC-C	72	.71	.04	.63	.79	<.01	45	.60	.05	.50	.70	<.01
C-PR	66	.18	.03	.11	.25	<.01	41	.18	.05	.09	.27	.00
PR-A*	61	.17	.04	.10	.24	<.01	29	-.04	.06	-.16	.08	.49
A-M*	70	.06	.04	-.01	.14	.09	28	-.14	.06	-.27	-.01	.03
CONS												
PC-C	72	.00	.04	-.08	.08	.97	46	-.11	.05	-.21	-.01	.03
C-PR	65	-.17	.02	-.21	-.12	<.01	43	-.12	.03	-.18	-.06	<.01
PR-A	60	-.21	.04	-.28	-.13	<.01	28	-.29	.06	-.41	-.16	<.01
A-M	67	-.22	.03	-.28	-.17	<.01	29	-.25	.05	-.35	-.15	<.01

Note. N = sample size; ES = mean effect size; L = lower bound; U = upper bound; p = significance of effect as compared to zero; * indicates overall significant differences between groups at $p < .05$.

Figure 22. Composite Graphic for Studies Examining Healthy Behaviors.

Figure 23. Composite Graphic for Studies Examining Unhealthy Behaviors.

Response Format

Effect size means, sample sizes, standard error, 95% confidence intervals, and *p*-values for cessation and acquisition behaviors were computed (Table 25) and

composite graphics were created (Figure 24 and Figure 25). Effect sizes for Decisional Balance measures using “How Important” and “Agree/Disagree” likert scales were compared across the four Stage transitions using random effects modeling. No significant differences were found between response formats for the Pros of Change. The mean effect sizes for the “Agree/Disagree” format were significantly greater than “How Important” format for the Cons of Change in the transition from PR-A ($Q(df=1) = 3.99, p = .046$).

Table 25

Comparison of Response Formats

	RESPONSE FORMAT											
	How Important						Agree / Disagree					
	N	ES	SE	95% CI		p	N	ES	SE	95% CI		p
				L	U					L	U	
PROS												
PC-C	113	.66	.03	.60	.73	<.01	13	.54	.10	.35	.74	<.01
C-PR	102	.18	.03	.13	.24	<.01	10	.17	.09	-.02	.35	.08
PR-A	81	.12	.03	.05	.18	.00	10	.26	.11	.05	.47	.01
A-M	90	.00	.03	-.06	.07	.89	11	.12	.10	-.07	.32	.22
CONS												
PC-C	112	-.05	.03	-.11	.01	.12	15	-.21	.09	-.40	-.03	.02
C-PR	102	-.15	.02	-.19	-.11	<.01	13	-.22	.07	-.35	-.09	.00
PR-A*	80	-.23	.03	-.29	-.16	<.01	12	-.43	.09	-.61	-.24	<.01
A-M	89	-.22	.03	-.27	-.17	<.01	12	-.32	.08	-.47	-.17	<.01

Note. N = sample size; ES = mean effect size; L = lower bound; U= upper bound; *p* = significance of effect as compared to zero; * indicates overall significant differences between groups at $p < .05$.

Figure 24. Composite Graphic for “How Important” Format.

Figure 25. Composite Graphic for “Agree/Disagree” Format.

Country – US versus Non-US

Effect size means, sample sizes, standard error, 95% confidence intervals, and *p*-values for US and non-US studies were computed (Table 26) and composite

graphics were created (Figure 26 and Figure 27). In order to determine potential differences between these sub-groups, an ANOVA analog using random effects modeling was performed. No significant differences were found for the Pros or Cons of Change across the Stage Transitions for studies conducted in the US or outside of the US.

Table 26

Comparison of Country

	COUNTRY											
	US						Non-US					
	N	ES	SE	95% CI		p	N	ES	SE	95% CI		p
				L	U					L	U	
PROS												
PC-C	103	.68	.03	.61	.74	< .01	30	.60	.06	.49	.71	< .01
C-PR	90	.18	.03	.12	.24	< .01	29	.18	.06	.06	.28	< .01
PR-A	72	.12	.04	.05	.19	< .01	26	.14	.06	.01	.26	.03
A-M	80	.01	.04	-.06	.09	.73	26	.03	.07	-.10	.16	.61
CONS												
PC-C	101	-.07	.03	-.14	-.00	.04	32	-.05	.06	-.16	.07	.43
C-PR	90	-.15	.02	-.19	-.11	< .01	31	-.17	.04	-.25	-.08	< .01
PR-A	72	-.23	.04	-.30	-.16	< .01	25	-.29	.07	-.42	-.16	< .01
A-M	78	-.25	.03	-.30	-.19	< .01	25	-.16	.05	-.26	-.06	< .01

Note. N = sample size; ES = mean effect size; L = lower bound; U = upper bound; p = significance of effect as compared to zero; * indicates overall significant differences between groups at $p < .05$.

Figure 26. Composite Graphic for Studies Conducted in the US.

Figure 27. Composite Graphic for Studies Conducted Outside the US.

Language – English versus Non-English

Effect size means, sample sizes, standard error, 95% confidence intervals, and *p*-values for studies conducted in English and in languages other than English

were computed (Table 27) and composite graphics were created (Figure 28 and Figure 29). In order to determine potential differences between these sub-groups, an ANOVA analog using random effects modeling was performed. No significant differences were found for the Pros or Cons of Change across the Stage Transitions for studies conducted in English or a language other than English.

Table 27

Comparison of Language

	LANGUAGE											
	<i>English</i>						<i>Non-English</i>					
	<i>N</i>	<i>ES</i>	<i>SE</i>	95% CI		<i>p</i>	<i>N</i>	<i>ES</i>	<i>SE</i>	95% CI		<i>p</i>
				<i>L</i>	<i>U</i>					<i>L</i>	<i>U</i>	
PROS												
PC-C	108	.67	.03	.60	.73	<.01	28	.61	.06	.49	.72	<.01
C-PR	96	.18	.03	.12	.24	<.01	26	.14	.06	.02	.26	.02
PR-A	77	.13	.03	.07	.20	<.01	23	.06	.07	-.08	.20	.43
A-M	84	.01	.04	-.06	.08	.78	24	.04	.07	-.10	.18	.57
CONS												
PC-C	107	-.07	.03	-.14	.00	.05	29	-.10	.06	-.22	.02	.11
C-PR	96	-.15	.02	-.19	-.11	<.01	28	-.14	.05	-.23	-.05	<.01
PR-A	77	-.24	.03	-.30	-.17	<.01	22	-.28	.07	-.42	-.13	<.01
A-M	82	-.24	.03	-.29	-.18	<.01	23	-.20	.06	-.31	-.10	<.01

Note. N = sample size; ES = mean effect size; L = lower bound; U = upper bound; *p* = significance of effect as compared to zero; * indicates overall significant differences between groups at *p* = < .05.

Figure 28. Composite Graphic for Studies Conducted in English.

Figure 29. Composite Graphic for Studies Conducted in Languages Other than English.

Publication Status

Effect size means, sample sizes, standard error, 95% confidence intervals, and *p*-values for peer-reviewed journals and non-peer-reviewed sources were computed (Table 28) and composite graphics were created (Figure 30 and Figure 31). Effect sizes for datasets that were from peer-reviewed journals and non-peer-reviewed datasets were compared across the four Stage transitions using random effects modeling. No significant differences between effect sizes were found between data from peer-reviewed journals and non-peer-reviewed sources for the Pros of Change. Mean effect sizes for peer-reviewed journals were significantly greater than non-peer-reviewed sources for the Cons of Change in the transition from PR-A ($Q(df = 1) = 4.10, p = .043$).

Table 28

Comparison of Publication Status

	PUBLICATION STATUS											
	Peer-Reviewed						Non-Peer-Reviewed					
	N	ES	SE	95% CI		p	N	ES	SE	95% CI		p
				L	U					L	U	
PROS												
PC-C	74	.69	.04	.61	.76	< .01	62	.61	.04	.52	.70	< .01
C-PR	68	.14	.03	.08	.21	< .01	54	.21	.04	.13	.29	< .01
PR-A	53	.13	.04	.05	.21	< .01	47	.11	.05	.02	.20	.02
A-M	53	.03	.05	-.07	.18	.58	55	.01	.05	-.08	.10	.86
CONS												
PC-C	73	-.12	.04	-.20	-.04	< .01	63	-.03	.04	-.11	.06	.55
C-PR	69	-.16	.02	-.20	-.11	< .01	55	-.13	.03	-.20	-.07	< .01
PR-A*	53	-.30	.04	-.38	-.22	< .01	46	-.17	.05	-.26	-.08	< .01
A-M	51	-.20	.04	-.27	-.13	< .01	54	-.25	.03	-.32	-.19	< .01

Note. N = sample size; ES = mean effect size; L = lower bound; U = upper bound; *p* = significance of effect as compared to zero; * indicates overall significant differences between groups at $p = < .05$.

Figure 30. Composite Graphic for Peer-Reviewed Publications.

Figure 31. Composite Graphic for Non-Peer-Reviewed Datasets.

Actual versus Reversed

In some cases, the Pros and Cons are inversely defined, that is, the measures focus on the positive aspects of an unhealthy rather than of a healthy behavior (e.g.,

Borland & Segan, 2000; Velicer et al., 1985; Rossi et al., 2001). For example, a study may examine the Pros of smoking (Velicer et al., 1985) rather than the Pros of quitting smoking (Keller et al., 1999). Actual and reversed refer to the way in which the data were used in the Pros and Cons analyses. Effect size means, sample sizes, standard error, 95% confidence intervals, and *p*-values for actual and reversed behaviors were computed (Table 29) and composite graphics were created (Figure 32 and Figure 33). Effect sizes for the behaviors with Pros and Cons reported in the “actual” direction and behaviors with the measures reversed were compared across the four Stage transitions using random effects modeling. For the Pros of Change in the transition from PR-A, the mean effect size for “actual” was significantly greater than the mean for the “reversed” measures ($Q(df = 1) = 5.73, p = .02$). For the Cons of Change, the “reversed” measures showed a larger decrease than the “actual” measures for the A-M transition.

Table 29

Comparison of Direction of Pros and Cons

	DIRECTION OF PROS AND CONS											
	<i>Actual</i>						<i>Reversed</i>					
	<i>N</i>	<i>ES</i>	<i>SE</i>	95% CI		<i>p</i>	<i>N</i>	<i>ES</i>	<i>SE</i>	95% CI		<i>p</i>
				<i>L</i>	<i>U</i>					<i>L</i>	<i>U</i>	
PROS												
PC-C	103	.67	.03	.61	.74	< .01	33	.59	.06	.48	.70	< .01
C-PR	91	.19	.03	.13	.25	< .01	31	.13	.05	.04	.23	.01
PR-A*	82	.15	.03	.09	.22	< .01	18	-.02	.07	-.16	.11	.72
A-M	92	.02	.04	-.05	.09	.51	16	-.02	.08	-.19	.14	.79
CONS												
PC-C	103	-.04	.03	-.11	.03	.23	33	-.17	.06	-.29	-.06	< .01
C-PR	93	-.16	.02	-.21	-.12	< .01	31	-.12	.04	-.19	-.05	< .01
PR-A	81	-.25	.04	-.32	-.18	< .01	18	-.21	.07	-.35	-.07	< .01
A-M*	89	-.21	.03	-.26	-.16	< .01	16	-.34	.06	-.46	-.23	< .01

Note. N = sample size; ES = mean effect size; L = lower bound; U = upper bound; *p* = significance of effect as compared to zero; * indicates overall significant differences between groups at $p < .05$.

Figure 32. Composite Graphic for "Actual".

Figure 33. Composite Graphic for "Reversed".

Overview of Moderators

For descriptive and summary purposes the mean effect sizes for each of the primary moderator variables is listed in Table 30.

Table 30

Overview of Effect Sizes by Moderator Variable

	PROS				CONS			
	PC-C	C-PR	PR-A	A-M	PC-C	C-PR	PR-A	A-M
Behavior Category								
Contraception	.45	.40	.07	.08	-.14	-.23	-.36	-.04
Condom Use	.61	.13	.23	.02	-.01	-.17	-.15	-.12
Diet	.59	.18	.01	-.07	.16	-.14	-.17	-.19
Drugs	.51	-.25	.28	-.06	.04	-.28	-.11	-.30
Exercise	.98	.20	.27	.03	.01	-.21	-.22	-.27
Medical Screening	.59	.32	-.01	.30	-.34	.11	-.42	-.24
Smoking	.63	.17	-.06	-.08	-.17	-.15	-.38	-.37
Sex Decisions	.72	-.06	-.04	.29	-.49	-.12	.01	-.28
Stress	.65	.10	-.09	-.09	.13	-.01	-.14	-.18
Organ Donation	.56	-.00	.21	-.06	-.28	-.03	-.33	-.13
Health Status								
Healthy	.71	.18	.18	.06	.00	-.17	-.21	-.22
Unhealthy	.60	.18	-.04	-.14	-.11	-.12	-.29	-.25
Prevention	.51	.05	.20	.00	-.26	-.12	-.34	-.27
Non-Health Related	.66	.19	.18	-.04	-.45	-.15	-.74	-.05
Cess vs Acq								
Cessation	.58	.17	-.01	-.07	-.07	-.14	-.27	-.28
Acquisition	.70	.17	.17	.05	-.08	-.16	-.24	-.21
Frequency								
Daily	.69	.17	.10	-.02	.00	-.16	-.22	-.27
Situational	.59	.20	.18	.07	-.16	-.17	-.26	-.12
Yearly+	.59	.08	.12	.22	-.38	.03	-.43	-.20
Age Group								
Adolescents	.62	.19	.16	.03	-.31	-.15	-.25	-.23
College	.62	.24	.26	.01	-.01	-.15	-.10	-.18
Adults	.67	.16	.08	.03	-.03	-.15	-.26	-.23
Country								
US	.68	.18	.12	.01	-.07	-.15	-.23	-.25
Non-US	.60	.17	.14	.03	-.05	-.17	-.29	-.16
Language								
English	.67	.18	.13	.01	-.07	-.15	-.24	-.24
Non-English	.61	.14	.06	.04	-.10	-.14	-.28	-.20
Publication Status								
Peer-Reviewed	.69	.14	.13	.03	-.12	-.16	-.30	-.20
Non-Peer-Reviewed	.61	.21	.11	.01	-.03	-.13	-.17	-.25
Direction of Measure								
Actual	.67	.19	.15	.02	-.04	-.16	-.25	-.21
Reversed	.59	.13	-.02	-.02	-.17	-.12	-.21	-.34
DB Response Format								
How Important	.66	.18	.12	.00	-.05	-.15	-.23	-.22
Agree/Disagree	.54	.17	.26	.12	-.21	-.22	-.43	-.32
Calculation Method								
Hedges' g	.67	.17	.13	.00	-.06	-.16	-.25	-.26
Standard Score	.62	.17	.09	.05	-.10	-.13	-.23	-.17

Discussion

In examining Decisional Balance and Stages of Change for 55 different behaviors across a variety of populations, several common characteristics were found. Structure, function and generalizability of the Stages of Change and Decisional Balance measures as well as the magnitude of effect and homogeneity for effect size distributions across Stage transitions for the Pros and Cons are discussed.

Structure

The internal validity of the two-factor structure of Pros and Cons of Change identified by Velicer et al. (1985) was maintained for 96% of the datasets, which is consistent with the 92% found by Prochaska et al. (1994) and 94% found by Hall and Rossi (2004). Although a large percentage of the studies support a much simpler configuration than posited by Janis and Mann (1977) as Prochaska et al. (1994) suggests, it should be noted it is unclear whether the measurement development in each study includes a sufficient variety of items to test this comparison effectively.

One hundred twelve datasets included alpha coefficients as a measure of internal consistency. For Pros the average coefficient alpha was .82 ($SD = .09$), with a range from .58 to .96, whereas the average coefficient alpha for Cons was a bit lower at .76 ($SD = .10$) and ranged from .41 to .94. The internal consistency measures found in this study overall are slightly lower with ranges wider than previous studies. In comparison, Prochaska (1994) found measures of internal consistency ranging from .75 to .95 and Hall and Rossi (2004) ranging from .41 to .95, whereas the current study found an overall range of .41 to .96. The similarity

between the current study and the study by Hall and Rossi (2004) is somewhat surprising since the current study has nearly twice as many studies. It is likely that future studies will find internal consistencies well within this range.

Function

Consistent patterns were found for Pros and Cons; for instance, in nearly all studies the Cons of Changing outweighed the Pros of Changing during the Precontemplation Stage. Additionally, the majority of crossovers occur by the Action Stage. Although often thought of as a simple function, the crossovers in this study revealed possible complexities suggesting further examination is needed. For example, 17% of the datasets revealed multiple intersections of the Pros and Cons. Additionally, many of the studies have large numbers of participants in one Stage and not another and these unequal distributions of sample size across the Stages may “pull” on the crossover resulting in a less stable pattern. Preliminary examinations of the use of effect sizes to graph crossovers reveal that the use of this procedure could help resolve this problem, especially in the context of meta-analytic studies when relying on secondary data. Although not pursued in the present study, further exploration of the ability of the effect size graphic procedure to correct this problem is needed. In particular, a comparison study of various weighted transformations of crossover graphs with the procedure used in this study is warranted. It appears the use of weighting procedures may help elucidate the apparent cross-over biases.

Random and fixed effects models were fit to the effect size distributions for the Pros and Cons of Change across the Stage transitions. Statistically, for each of these analyses on the total sample, the random effect variance component was found to be significant. The significant random effects components for each of the Stage transitions for the Pros and Cons support the use of the random effects model. Theoretically, due the large variation on populations across the 146 datasets, a random effects modeling approach was warranted. Another important distinction between fixed and random effects models is the overall inferential goal. A fixed effects model aims to make inferences regarding the particular observed parameters whereas the random effects model aims to make inferences regarding the distribution of effects (Hedges & Vevea, 1998). Therefore, the random effects model will enable greater generalization beyond the observed studies, which is an important goal of this study.

The decision to use a fixed versus random effects model is an important one, and was so especially in the context of this study. Table 31 and Table 32 show the pattern of results for the primary moderators using fixed effects versus random effects modeling. Between-group heterogeneity is displayed for the major moderator categories (in bold) and within-group heterogeneity is displayed for the sub-groups (non-bolded text). It is clear that the pattern effects are distinct between the two models. A much larger percentage of heterogeneity is identified with the fixed effect model than the random effects model. Overall, this pattern of effects is as predicted. Increased standard error in the random effects model produces wider confidence

intervals, therefore in the context of hypothesis-testing there is a greater likelihood of retaining the null with random effects relative to fixed effects. In sum, a random effects model is theoretically most consistent with the inferential goals for this study and was statistically supported.

Table 31

Patterns of Fixed and Random Effect Results across Moderator Variables for Pros

	PROS							
	<i>Fixed Effects</i>				<i>Random Effects</i>			
	PC-C	C-PR	PR-A	A-M	PC-C	C-PR	PR-A	A-M
Behavior Category	+	+	+	+	+		+	
Contraception				*				
Condom Use	*							
Diet	*		*	*				
Drugs								
Exercise	*	*	*	*		*		
Medical Screening	*				*			
Smoking	*	*	*	*			*	
Sex Decisions	*		*	*	*			
Stress								*
Organ Donation				*				
Health Status	+		+	+			+	+
Healthy	*	*	*	*				
Unhealthy	*	*	*	*				
Prevention		*		-				-
Other	*			-				-
Cess vs Acq	+		+		+		+	
Acquisition	*	*	*	*				
Cessation	*	*	*	*			*	
Frequency		+		+				
Daily	*	*	*	*				
Situational	*	*		*				
Yearly+	*							
Age Group			+	+				
Adolescents	*	*	*	*				
College	*	*		*				
Adults	*	*	*	*				
Country	+							
US	*	*	*	*				
Non-US	*		*	*				
Language	+							
English	*	*	*	*				
Non-English	*	*		*				
Publication Status	+							
Peer-Reviewed	*	*	*	*				
Non-Peer-Reviewed	*	*		*				
Direction of Measure	+		+				+	
Actual	*	*	*	*				
Reversed	*	*	*	*			*	
DB Response Format				+				
How Important	*	*	*	*				
Agree/Disagree	*			*				
Calculation Method								
Hedges' g	*	*	*	*				
Standard Score	*	*	*	*				

Note. + indicates significant between group heterogeneity; * indicates significant within group heterogeneity

Patterns of Fixed and Random Effect Results across Moderator Variables for Cons

	CONS							
	<i>Fixed Effects</i>				<i>Random Effects</i>			
	PC-C	C-PR	PR-A	A-M	PC-C	C-PR	PR-A	A-M
Behavior Category	+	+	+	+	+			
Contraception								
Condom Use			*					
Diet	*			*				
Drugs	*							
Exercise	*		*					
Medical Screening	*		*		*			
Smoking	*	*	*	*				*
Sex Decisions			*	-				-
Stress				-				-
Organ Donation		*		-				-
Health Status	+							
Healthy	*		*	*				
Unhealthy	*			*				
Prevention	*	*	+	-			+	-
Other	*	*		-				-
Cess vs Acq	+			+				
Acquisition	*	*	*	*				
Cessation	*			*				
Frequency	+	+	+	+	+			+
Daily	*		*	*				
Situational	*	*	*					
Yearly+	*	*	*					
Age Group	+		+	+	+			
Adolescents	*	*	*					
College	*	*		*				
Adults	*		*	*				
Country	+				+			
US	*	*	*	*				
Non-US	*		*					
Language								
English	*	*	*	*				
Non-English	*							
Publication Status			*				+	
Peer-Reviewed	*	*	*	*				
Non-Peer-Reviewed	*		*	*				
Direction of Measure	+			+				+
Actual	*	*	*	*				
Reversed	*		*					
DB Response Format	+	+	+					
How Important	*	*	*	*				
Agree/Disagree	*		*		*			
Calculation Method	+			+				
Hedges' g	*	*	*	*				
Standard Score	*		*	*				

Note. + indicates significant between group heterogeneity; * indicates significant within group heterogeneity

The largest effect size average was found for the Pros of Change, specifically in the transition between the Precontemplation and Contemplation Stages. The magnitude of this effect was .65 standard deviations. Additionally, smaller increases were seen in transitions from Contemplation to Preparation (Hedges' $g = .17$) and Preparation to Action ($g = .12$), with essentially no effect found from Action to Maintenance ($g = .02$). The Cons of change showed an inverse pattern across transitions, though with overall smaller effect sizes. Essentially no effect was found from Precontemplation to Contemplation ($g = -.08$), with relatively small decreases in Cons from Contemplation to Preparation ($g = -.15$), Preparation to Action ($g = -.24$), and Action to Maintenance ($g = -.23$). These results suggest interventions may provide the greatest impact with maximum efficiency by placing the most emphasis on Pros during the Precontemplation Stage, followed by additional efforts during the Contemplation and Preparation Stages. In contrast, Cons are most likely to be useful during the Preparation Stage with continued emphasis, somewhat surprisingly, into the Action Stage.

The Strong and Weak Principles of Change have shown approximately 1 standard deviation increase in the Pros of Change as one progresses from Precontemplation to Action, whereas the Weak principle is approximately a $\frac{1}{2}$ standard deviation (Prochaska, 1994) or .62 SD (as found by Hall & Rossi, 2004) decrease in the Cons of Change as one progresses from Precontemplation to Action). Since the Strong and Weak Principles measure the maximum increase and decrease of the Pros and Cons from Precontemplation to Action, rather than an absolute

difference, these two principles are “biased”. That is, the principles result in a potential over-estimation of the cumulative effect size across the three transitions PC-C, C-PR, and PR-A. Therefore it was predicted that $(PC-C) + (C-PR) + (PR-A) < 1\ SD$ (standard deviation) for Pros and $(PC-C) + (C-PR) + (PR-A) < .62\ SD$ for Cons. Based on the overall effect size estimates across the Stage transitions this prediction was not entirely supported. The total cumulative effect size for Pros = .96 and the cumulative effect for Cons = .70. Although the total for the Pros of Change was just slightly below 1 *SD* the Cons of Change was actually greater than .62 *SD*.

In general, use of effect sizes to assess the magnitude of Stage transitions can provide guidance in the development of tailored interventions by suggesting how much intervention resources should be allocated for each construct at each Stage transition. But most importantly, in order to best utilize effect size estimated for intervention purposes, detailed analyses of moderators of heterogeneity is essential for identifying where and when these effect sizes may vary.

Heterogeneity

As predicted, the overall effect size distributions for each of the Stage transitions for both the Pros and Cons were found to be heterogeneous. This warranted investigation of potential moderators of effect size distribution. Graphical and statistical approaches were used to explore moderators.

Calculation Method

No significant differences were found between the two primary calculation methods. This finding provides additional support for the effectiveness of the

adjustment for calculation method developed in Chapter 5. The regression adjustment for calculation enabled 30% of the studies to be retained in this meta-analyses that otherwise would have been excluded. Overall, this increased the power of the study and allowed more thorough moderator analyses to be conducted.

Target Behaviors and Behavior Categories

The overall heterogeneity of the distribution (found for the effect sizes for both the Pros and Cons for each of the Stage transitions) signified that modifiers of magnitude were likely present across the datasets. The most apparent potential moderator of effect size was thought to be behavior.

Due to the large number of target behaviors represented by only one or two studies, analyses by target behaviors were limited. Additionally, an important consideration for the interpretation of magnitude across moderators, in relation to the small target behavior sample sizes, is the potential for differential impact of unequal representation of moderators. For example, in this meta-analysis 21 datasets investigated exercise, yet only one study examined calcium intake. Exercise studies were generally found to have greater magnitudes than other behaviors, specifically in the PC-C and PR-A transitions (see Figure 6), and therefore a disproportionate number of exercise studies in an alternate moderator analysis, such as publication status, could create an upward bias in a given subset for these transitions. Therefore unequal weighting of moderators such as behaviors may influence differences between behaviors on the results of a given dimension of the constructs.

Behavior categories were created to aggregate similar behaviors together to enhance the ability to conduct sub-group analyses. Preliminary descriptive analyses

were performed on the ten behavior categories with more than 3 datasets. In general, the mean effect sizes for the behavior categories did not vary greatly from the overall means (for all 146 datasets) for the Pros and Cons of each Stage transition. Fifty percent of the mean effect sizes for the behavior categories varied less than .1 *SD* from their respective Stage transition mean. No mean effect size was found to be larger than .42 *SD* from the given mean for the Stage transition. The largest difference in means between each of the behavior categories was .65 *SD*. These relationships can be seen graphically in the forest plots above (see Figure 6 and Figure 7). The means and confidence intervals are plotted for each behavior. The axis for each transition is set at the overall mean for the study (i.e., mean for all 146 datasets).

Five behavior categories had sample sizes of greater than five. These five behaviors (condom use, diet, exercise, smoking, stress) were included in analog ANOVA analyses to assess differences among the behaviors. Significant differences between behavior categories were only found for the Pros of Change. These differences were in the transitions between PC-C and PR-A. Exercise was found to be significantly greater than each of the four other behavior categories for PC-C and significantly greater than smoking and diet in the PR-A transition. Interestingly, Hall and Rossi (2004) found exercise to have the largest magnitude of effect from Precontemplation to Action for the Pros of Change in comparison to other behavior categories examined (specifically diet, smoking, and condom use). It appears that instead of having larger effects across all stage transitions, the differences for exercise are in the PC-C and PR-A transitions. One important consideration is the

potential difference in algorithms found in the exercise studies. Marcus et al. (1992) used a measure called the Contemplation Ladder. This measure was subsequently used by other researchers. Future studies should compare effect size differences between these two types of algorithms. Lastly, condom use was found to be significantly greater than smoking and stress in the transition from PR-A for Pros.

Within-group heterogeneity was assessed for each of the behavior categories to determine if variation within the categories existed. Of the 45 heterogeneity tests, only 2 were found to be significant: the distribution of effect sizes for the C-PR transition of exercise and the PR-A transition for smoking. This indicates that the overall behavior categories are homogeneous and likely few moderators are present within the behavior categories.

Although it is beyond the scope of this study to conduct full moderator analyses of each of these behaviors, a priori sub-groups analyses were conducted and variety of comparisons explored. Firstly, since the smoking behavior category was primarily made up smoking acquisition and smoking cessation, these two behaviors were compared. Smoking acquisition and cessation were in fact found to be different in the PR-A Stage transition. Interestingly, there were also differences found between these two behaviors in the PC-C Stage transition. In efforts to understand these differences, general differences between these behaviors were considered. For instance, the all smoking acquisition studies were conducted with adolescents. Since all smoking acquisition studies were all conducted with adolescent samples, comparisons between age groups for the smoking category were not possible. In the larger study context, when all studies were combined, no differences were found

between age groups; therefore it is believed that age is not moderating this effect.

Clearly more research is needed to understand the influence on age since age is nested in these analyses.

Unlike smoking cessation, smoking acquisition is a prevention behavior. That is, by examining behavior change in smoking acquisition one is looking at “changing” a behavior that does not yet exist. Interestingly, when comparing the composite profile of smoking acquisition (Figure 34) with the composite profile of all the prevention behaviors (Figure 35) identified in this study, we can see a large difference between the Pros and Cons at Precontemplation with the Pros decreasing and the Cons increasing. A somewhat flat profile is seen between C-PR. Finally a flip flopped pattern for PR-A can be seen -- with the Pros strongly increasing and the Cons strongly decreasing. A similar pattern is also seen for behaviors that are infrequently performed (“yearly” behaviors) (Figure 36). The conceptual link between infrequent or “yearly” behaviors and acquisition or prevention behaviors is the overall minimal activity or engagement an individual has in the behavior of interest. This may have an influence on the relevance of the Contemplation-Preparation process as currently defined by the model for such behaviors.

Figure 34. Composite Profile for Smoking Acquisition.

Figure 35. Composite Profile for Prevention Behaviors.

Figure 36. Composite Profile of "Yearly" behaviors.

More simply, the overall pattern of differences between smoking acquisition and smoking cessation were consistent with the findings of the differences between acquisition (e.g., exercise) and cessation (e.g., quitting drugs) behaviors across all the

datasets. As with smoking, comparisons revealed significant differences for the PC-C and PR-A transitions.

Smoking cessation was examined more closely in efforts to determine possible differences between the use of different Pros and Cons measures when examining smoking cessation. Some studies examine the Pros and Cons of Smoking whereas others examine the Pros and Cons of Quitting Smoking. This difference can be somewhat complicated. Firstly, in order to create conceptual consistency in the Pros and Cons with other behaviors, the Pros and Cons of Smoking are reversed such that the Pros of Smoking (which typically decrease across the stages) are depicted as the “Cons” and the Cons of Smoking are depicted as “Pros”. The importance of this change in the context of averaging effect sizes across studies comes into play with the directionality of the parameter estimate. Effect sizes combined that are representing the opposite direction will wash each other out and in essence “average” zero. Additionally, graphically this reversal aids in visual comparisons across studies. But this reversal is certainly of theoretical interest and therefore has been examined within smoking cessation as well as across studies. Across all studies the comparison of effect sizes based on the “actual” direction of the Pros and Cons versus those Pros and Cons that have been “reversed” revealed significant differences for two Stage transitions (PR-A for Pros and A-M for Cons). For smoking, significant differences were found for the Cons of Change in the PC-C and A-M transitions, with smaller effect sizes for these transitions identified for the Cons of Quitting.

Another a priori behavioral comparison included the behavior category of condom use. Condom use was comprised of three primary sub-groups, condom use in general, for main partner, and for “other” partner. Condom use in general and condom use with main partner were found to be significantly greater than condom use with “other” for the C-PR transitions for Pros. Interestingly, this difference creates a composite profile for condom use with “other” that is similar to infrequently or “yearly” performed behaviors (as seen in Figure 36). In these profiles the Pros and Cons appear to have essentially the same *T*-scores and show essentially no change from C-PR. This similarity of pattern could be attributed to the fact that condom use with an “other” or secondary partner may be as infrequent as other “infrequent” behaviors.

The final a priori behavioral comparison was between the two diet sub-groups, dietary fat reduction and fruit and vegetable consumption. No significant differences between these two groups were found.

In addition to the a priori behavioral comparisons and the moderators discussed above, several other moderators were explored. Velicer et al. (2000) illustrated that the relationship between the Stages and Decisional Balance for an unhealthy behavior is different than for a healthy behavior. That is the pattern for an unhealthy behavior was such that the Cons decreased across the Stages whereas the Pros displayed a curvilinear pattern, which paralleled the decline of the Cons in the later Stages. In contrast, healthy behaviors showed more of an X configuration, with the Pros continuing to increase across the Stages whereas the Cons decrease across the Stages. This finding was replicated in the current study. Unhealthy behaviors

showed a significant decrease in the Pros of Change in the PR-A and A-M transition, producing the curvilinear pattern Velicer et al. (2000) describes.

Two response formats were used for the Pros and Cons measures in the majority of studies. Significant differences were only found for the Pros of Change in the PR-A. No significant differences were found for the Cons of Change. It is unclear what this difference indicates, but it would be warranted to explore these differences further. Unfortunately, the majority of the studies utilized the How Important format which may have influenced the degree of significance found between the two.

Generalizability.

Overall, the generalizability of the Transtheoretical Model across a variety of populations was supported with this large set of studies examining Stage of Change, Pros and Cons, and the relationship between them. A variety of moderators were explored but most notably, no significant differences in effect size distributions were found across the Stage transitions for country or language. These homogeneous findings lend important credence to the generalizability of the observed constructs. Although an attempt was made to examine demographic variables within studies of a particular behavior, these analyses were plagued by small sample sizes. Therefore as more studies emerge, it will be necessary to continue to look at the Transtheoretical constructs for particular demographic variables across behaviors. The populations varied greatly across studies and although many subject characteristics were examined as moderator variables, the investigation of some of these sample

characteristics (e.g., gender) are best examined using longitudinal techniques and therefore interpretation should be made with caution. It is important that population characteristics continue to be examined to make a more definitive statement of generalizability.

Prochaska et al. (1994) originally found support for the strong generalizability of the TTM for Stage of Change and Pros and Cons across 12 behaviors. Hall and Rossi (2004) provided additional support for the generalizability of these constructs across 37 Behaviors. The current study continues to provide support for the generalizability of the model for a growing number of behaviors, 55 behaviors in total. Although there is strong support on the whole for the generalizability of the Transtheoretical Model and the integration of the Decisional Balance measures across the Stages of Change, there were some study characteristics that should be examined more closely to assess potential limitations of the model or necessary adaptations of the constructs. For instance, when averaged, behaviors identified as infrequent or “yearly” (e.g., mammography) seemed to show an overall lack of change between C-PR (see Figure 36) for both the Pros and Cons. In this case, the typical staging (e.g., time frame) for Contemplation and Preparation may not be sufficient. It will be important in the future to assess the relationships of other TTM constructs across the Stages for moderators such as frequency of behavior (i.e., “yearly”) in order to establish if these relationships persist before making clear statements regarding generalizability. That is, if this pattern of essentially no change for the Pros and Cons from Contemplation to Preparation for behaviors that are performed “yearly” is also found for other constructs, such as Self-efficacy and

Processes, this would give rise to the concern to the generalizability of Contemplation and Preparation Stages for behaviors that infrequently occur. It is clear that further research is needed to more clearly identify such patterns.

Table 33 provides an overview of the between-group heterogeneity across the moderator variables. Although overall generalizability for the model was found, it is clear that a variety of characteristics can influence the degree of change in the Pros and Cons during a particular stage of the change process. These results provide a guide for where future studies can focus in order to establish more definitive relationships between variables and establish fine-grained analyses of these nuances.

Table 33

Between Groups Heterogeneity for Primary Moderators

Primary Moderators	PROS				CONS			
	PC-C	C-PR	PR-A	A-M	PC-C	C-PR	PR-A	A-M
Behavior Category	*		*		*			
DFR vs FV								
Smk Acq vs Cess					*		*	
Condoms		*						
Health Status			*	*				
Cess vs Acq	*		*					
Frequency					*			*
Age Group					*			
Country								
Language								
Publication Status							*	
Direction of Measure			*					*
DB Response Format							*	
Calculation Method								

Note. Asterisks indicate significant between-group differences.

In sum, the results suggest interventions may provide the greatest impact with maximum efficiency by placing the most emphasis on increasing the Pros during the Precontemplation Stage, followed by additional efforts during the Contemplation and Preparation Stages. In contrast, efforts to decrease the Cons are most likely to be useful during the Preparation Stage with continued emphasis into the Action Stage. Contrary to prediction, these results are only partly consistent with previous studies, which agree that Decisional Balance is especially salient in the earlier Stages of Change (Redding et al., 1999; Velicer et al., 2000). Instead it appears that Pros of Change are more salient in the earlier Stages whereas the Cons of Change are more salient in the later Stages. Future studies examining moderator variables in greater detail can help more definitively determine the amount intervention resources should be allocated for each construct at each Stage transition in each behavior providing continued guidance in the development of tailored interventions.

Although a large number of studies overall were included in this meta-analysis, small sample sizes often precluded meaningful analyses of moderators. Continued efforts to gather studies to increase these sample sizes should be made. The primary analyses conducted in the study included ANOVA analogs to compare moderator subgroups. In addition to ANOVA analogs, one can employ the use of meta-regression to examine the association of effect among study characteristics. Meta-regression is a more sophisticated approach to assessing moderators when heterogeneity is observed (Song, Sheldon, Sutton, Abrams, Jones, 2001). Future studies should examine moderators using meta-regression in order to determine overall which moderators contribute to the variance in the effect size distributions.

All datasets utilized cross-sectional data; therefore although the effect sizes were exploring the increase and decreases across the Stage transitions between participants in various Stages, it cannot be assumed the same relationships will necessarily occur when examining the movement of participants from one Stage to another with longitudinal data. Therefore, it is important these results be compared to the examination of these relationships using longitudinal data.

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**A CROSS-SEQUENTIAL ANALYSIS AND CROSS-VALIDATION OF
DECISIONAL BALANCE ACROSS STAGE TRANSITIONS**

Introduction

The primary goal of examining cross-sectional data is to use readily available or easily attainable data to explore theoretical relationships that explain a phenomenon across a temporal dimension. It is anticipated that cross-sectional investigations will provide a snap shot of what one might see if these same relationships were examined using more costly longitudinal data where individuals are actually followed over time. Ultimately, cross-sectional investigations are most valuable if they have the ability to provide the same or similar relationships as longitudinal investigations.

The Transtheoretical Model (TTM) is a theoretical model which explains behavior change through a variety of constructs which explain change across a temporal dimension. The central organizing construct of the TTM characterizes behavior change over time through five distinct Stages of Change: Precontemplation, Contemplation, Preparation, Action, and Maintenance. Two intermediate indicators of when these changes will occur are Decisional Balance (weighing of Pros and Cons) and Self-efficacy (Situational Confidence or Temptation). Additionally, the TTM explains behavior change strategies through ten Processes of Change.

A previous study examining the TTM (Prochaska, Velicer, Guadagnoli, Rossi & DiClemente, 1991) has demonstrated the ability of longitudinal studies to validate

cross-sectional results. To date, no study has investigated the ability of longitudinal data to validate cross-sectional results in the context of TTM Stage transitions. Additionally, there are currently no established techniques for examining the effect sizes of Stage transitions in longitudinal data, therefore this study was treated as an exploratory examination of longitudinal datasets. Additionally, previously examined cross-sectional relationships will be compared to these longitudinal results.

Stages of Change and Decisional Balance

Stages of Change

In health psychology, the concept of change occurring in a series of stages has been examined in efforts to understand the temporal aspects of change in human nature or behavior. An example of the stage concept can be seen in Horn's (1976; Horn & Waingrow, 1966) work with smoking behavior and cessation. Horn developed a four stage process of change investigating smoking behavior, which consisted of 1) contemplation of change; 2) the decision to change; 3) short-term change; and 4) long-term change. Although arising independently and in a different context, the Stages of Change as conceptualized by the TTM are similar to Horn's stages. Over the years, through its own evolution, the TTM ultimately identified five Stages (DiClemente, Prochaska, Fairhurst, Velicer, Velasquez, et al., 1991).

The algorithms for the five Stages of Change are specific for each behavior, but usually follow these general Stage concepts. Participants are considered to be in the Precontemplation Stage if they report an undesired status, that is, the presence of a problem behavior or the lack of a healthy one, and express no intention of changing

in the next six months. Participants are considered in the Contemplation Stage if they intend to change in the next six months. Participants in the Preparation Stage plan to change in the next month and have begun to engage in target behaviors, but have not yet met particular criteria. Participants reach the Action Stage once they have met the given behavioral criteria. Lastly, if the participant has met the specified behavioral criteria for greater than six months, they have reached the Maintenance Stage.

Decisional Balance

The TTM originated by integrating theories of psychotherapy as well as incorporating constructs from alternative models. One of the most important and reliable TTM constructs, Decisional Balance, was inspired by Janis and Mann's (1977) conflict model of decision-making. Janis (1959) proposed a descriptive schema called a "balance sheet" of incentives. The four main categories of consideration for decisional conflicts are: a) *utilitarian gains and losses for self*; b) *utilitarian gains and losses for significant others*; c) *self-approval or –disapproval*; d) *approval or disapproval by significant others*. These four comparative categories of potential positive and negative incentives involve both instrumental effects of utilitarian objectives and nonutilitarian considerations such as issues of self-esteem and value-based determinations.

The development of the TTM Decisional Balance measure (Velicer, DiClemente, Prochaska, and Brandenburg, 1985) was based on the 8 factors (4 gains and 4 losses) of Janis and Mann (1977). The researchers constructed the scale to study the decision-making process across the Stages for smoking cessation. Instead

of achieving an 8 factor-structure as anticipated, principal components analysis identified two orthogonal components. These two components were called the Pros and Cons of Smoking.

Following the original study by Velicer, the use of the construct began to expand, encompassing an array of behaviors such as exercise, condom use, and mammography screening. This early work culminated in a paper by Prochaska et al. (1994), which looked at patterns in Decisional Balance across Stages in 12 behaviors.

Strong and Weak Principles

Across twelve studies (Prochaska, 1994), mathematical relationships were found between the pros and cons of changing and progress across the early Stages into Action (Prochaska, 1994). The Strong Principle of Change states that $PC \rightarrow A \cong 1 SD \uparrow$ PROS: progress from Precontemplation to Action involves approximately one standard deviation increase in the Pros of Changing. The Weak Principle of Change states that $PC \rightarrow A \cong .5 SD \downarrow$ CONS: progress from Precontemplation to Action involves approximately .5 SD decrease in the Cons of Changing.

In re-examination of the Strong and Weak Principles, the magnitude of the maximum increase in the Pros of Change was again found to be greater than the maximum decrease in the Cons of Change from Precontemplation to Action across 37 difference health behaviors (Hall & Rossi, 2004). Consistent with Prochaska's (1994) Strong Principle, the average effect size for the pros was approximately one standard deviation ($d = 1.05$, $SD = .45$), almost identical to Prochaska's (1994)

original finding ($d = 1.06$, $SD = .26$). Hall and Rossi's (2004) findings also revealed that Prochaska's Weak Principle might not be so weak. That is, the average effect size for cons was stronger ($d = .62$, $SD = .38$) than was found in the previous study ($d = .45$, $SD = .22$) by Prochaska (1994), though clearly the cons remains weak relative to the pros. Practical implications of these principles are that the pros of changing must increase twice as much as the cons must decrease, suggesting that an intervention place twice as much emphasis on raising the benefits as on reducing the costs or barriers.

Stage Transitions

The Strong and Weak Principles are useful for understanding the amount of work generally needed to move from Precontemplation to Action. Although the principles have been important in conceptualizing and understanding the relationship between Decisional Balance and Stages of Change, the Strong and Weak Principles are essentially action-oriented when applied to interventions. By examining characteristics of the transition only from Precontemplation to Action, and using these to tailor interventions, one is potentially neglecting three Stages: Contemplation, Preparation and Maintenance. In contract, Stage transition analyses can help identify the most effective strategy for tailoring behavior change interventions. For instance, for a given behavior, if the effect size from Precontemplation to Contemplation for Pros is large but very small for Cons, Pros could be intervened on whereas Cons could be eliminated in the intervention for precontemplators. From Contemplation to Preparation, if both the Pros and Cons

effect sizes were large, both should be emphasized at this transition. Following this strategy across each Stage transition would create the most efficacious and efficient application of the measure, maximizing the impact and minimizing the resource expenditure. Ultimately, careful and systematic investigation of the changes in these measures across Stage transitions by behavior can provide even more detailed evidence for exactly how to use these measures most efficiently in future Stage-matched interventions.

It has generally been thought that Decisional Balance is especially salient in the earlier Stages of Change. To test this notion, the previous study (Chapter Six) examined 146 independent datasets across 55 health behaviors, generating and synthesizing over 2100 effect sizes. Datasets included nearly 90,000 participants across 18 countries utilizing measures in more than 10 languages. The largest effect size was found for the Pros (see Table 1), specifically in the earliest transition, Precontemplation to the Contemplation Stages (PC-C). Smaller increases were seen in following two Stage transitions, Contemplation-Preparation (C-PR) and Preparation-Action (PR-A), and essentially no effect found in the Action-Maintenance transition (A-M). The Cons showed an inverse pattern across transitions, though with overall smaller effect sizes. Essentially no effect was found for PC-C with relatively small decreases in Cons from C-PR, PR-A and A-M. These results are only partially consistent with the assumption that Decisional Balance is most salient in the earlier Stages of Change. It appears that the Pros are more salient in the earlier Stages whereas the Cons are more salient in the later Stages.

Table 34

Magnitude of Stage Transitions for Pos and Cons of Change

Stage Transitions	PROS					CONS				
	<i>N</i>	<i>ES</i>	<i>SE</i>	95% CI		<i>N</i>	<i>ES</i>	<i>SE</i>	95% CI	
				L	U				L	U
PC-C	136	.65	.02	.60	.70	136	-.08	.02	-.13	-.04
C-PR	122	.17	.02	.12	.22	124	-.15	.02	-.19	-.11
PR-A	100	.12	.03	.06	.18	100	-.24	.03	-.30	-.18
A-M	108	.02	.03	-.05	.08	105	-.23	.02	-.28	-.18

Note. *N* = sample size; *ES* = mean effect size; CI = confidence interval; L = lower bound; U = upper bound

These results suggest interventions may provide the greatest impact with maximum efficiency by placing the most emphasis on Pros during the Precontemplation Stage, followed by additional efforts during the Contemplation and Preparation Stages. In contrast, Cons are most likely to be useful during the Preparation Stage with continued emphasis, somewhat surprisingly, into the Action Stage. In general, use of effect sizes to assess the magnitude of Stage transitions can provide guidance in the development of tailored interventions by suggesting how much intervention resources should be allocated for each construct at each Stage transition.

Figure 37 presents the remarkable pattern that was found from the integration of all of these data. Theoretically, this is one of the clearest and cleanest patterns of relationships that has been found in any single study or combination of studies to date. In the stable Stage of Precontemplation, the Cons of Changing are 0.8 S.D. higher than the Pros. The opposite is true in the stable Maintenance Stage where the

Pros of Changing are 0.8 S.D. higher than the Cons. In the Contemplation Stage, which theoretically is characterized by intensive ambivalence about changing, the Pros and Cons of Changing are equal. The Pros begin to outweigh the Cons in the Preparation Stage. The Pros of Changing are 0.93 *SD* higher in the Maintenance Stage than in the Precontemplation Stage and there is a slight decrease in the Pros of Changing from Action to Maintenance. The Cons are 0.62 *SD* lower in Maintenance than in Precontemplation. Overall, the Pros were found to increase about twice as much as the Cons decrease.

Figure 37. Composite Decisional Balance Profile across 55 Behaviors.

These remarkable relationships between the Pros and Cons and the Stages of Change have been examined cross-sectionally. The cross-sectional relationships are

an essential part of this program of study and clearly provide important insights into the theoretical model and for its practical applications. In efforts to continue to expand this research, to broaden its generalizability and strengthen its potential for application, it is important to begin to explore these relationships in a longitudinal context. The current study aims to begin to establish methods for exploring these relationships and preliminarily compares cross-sectional data with longitudinal data in order to help establish how well cross-sectional data can predict longitudinal relationships in the context of Stage transitions.

Research Hypotheses and Predictions

Hypothesis 1. There is a relationship between the cross-sectional and longitudinal Stage transition effect sizes for Decisional Balance.

Prediction 1. A previous study (Prochaska et al., 1991) demonstrated that cross-sectional and longitudinal data examining patterns of change were comparable. It is predicted that the magnitudes of effect for the cross-sectional and longitudinal data will show similar patterns for Decisional Balance across Stage transitions.

Prediction 2. It is anticipated that the effect size index for the longitudinal data will produce larger effect sizes than the effect size index for independent groups (used for the cross-sectional data) due to the nature of dependency in the longitudinal data. Therefore it is predicted that the longitudinal Stage transition effect sizes will be larger than the cross-sectional Stage transition effect sizes.

Method

Procedure

Since there are no established techniques for examining the effect size of Stage transitions in longitudinal data and there has not previously been a comparison of cross-sectional and longitudinal Stage transitions, therefore this study was approached as exploratory. This study cross-sequentially examined the longitudinal data and therefore should be considered a very preliminary investigation of longitudinal relationships.

Inclusion Criteria. Datasets must include Decisional Balance measures as well as at least two consecutive Stages of Change measured by an algorithm procedure. These datasets must also include at least 2 time points.

Datasets. Longitudinal datasets were acquired through researchers at the Cancer Prevention Research Center at the University of Rhode Island. The data were from three previously conducted studies. Two different health behaviors were examined: smoking cessation and sun protection. The participants of the three studies are as follows:

A Population-based, Stage-based Expert System Intervention for Smoking Cessation (Prochaska, Velicer, Fava, Rossi, & Tsoh, 2001): Random-digit dialing procedure was used to recruit a representative sample of smokers from Rhode Island. A total of 32,456 calls were conducted, 14,266 participants were identified as eligible, and 12,109 agreed to complete a preliminary phone survey. Of these, 4209 were smokers and 7813 were non-smokers. A total of 4144 participants were

included. These participants were randomly assigned to intervention or assessment only. The intervention group received Expert System materials in the mail, including a feedback report and stage-matched self-help manuals. The assessment only group was assessed in 6 month intervals. Participants in the intervention group received progress questionnaires at 3 and 6 months. Phone surveys were given for participants that did not respond via mail within 2 weeks. All participants were assessed by mail or phone at 12, 18 and 24 months.

Impact of Simultaneous Stage-matched Expert System Interventions for Smoking, High Fat Diet and Sun Exposure on a Population of Parents (Prochaska, Velicer, Rossi, Redding, Greene, Rossi, Sun, Fava, LaForge & Plummer, in press): Schools participating in an on-going health promotion study provided a list of parents of 9th graders. Initial screening identified 3507 potential households. A total of 2931 respondents were contacted by phone, with one parent recruited from each eligible household. Eligibility requirements necessitated the participants to be at risk for at least one of the three health risk behaviors (sun, smoking, and diet). Four hundred and seventy one participants were excluded for not meeting eligibility requirement, resulting in a baseline sample of 2460 participants. The 2460 participants were randomly assigned to the intervention or control groups. Participants in both groups were administered follow-up assessments at 12 and 24 months.

At baseline, 711 respondents were identified as smokers. Of the 711 smokers at baseline, 453 completed the 12 Month assessment and 409 completed the 24 Month assessment. For sun exposure, 1802 were identified as being at risk at

baseline, 1318 completed the 12 Month assessment and 1242 completed the 24 Month assessment. For Diet, 1820 were identified as being at-risk at baseline, 1334 completed the 12 Month assessment and 1253 completed the 24 Month assessment. Participants were randomly assigned to one of two groups, Intervention ($N = 1209$) or Assessment Only ($N = 1251$). Participants in both groups were administered follow-up assessments at 12 and 24 months.

Randomized Controlled Community Trial of the Efficacy of Multi-Component Stage-Matched Intervention to Increase Sun Protection among Beachgoers (Weinstock, Redding, Rossi, Maddock, 2001): Seven coastal beaches in Rhode Island were selected for the study. Participants were randomly assigned to intervention or control conditions. Follow-up assessments were conducted for all study participants at 2, 12 months, and 24 months after baseline by mail or telephone. Study retention rates were 83% of baseline at 2 months ($N = 1930$), 70% of baseline at 12 months ($N = 1628$); and 62% of baseline at 24 months ($N = 1449$). Participants completed a survey on the beach with a trained interviewer. Ages of the participants ranged from 16–65, with an average age 33 years. The sample was primarily female (60%), white (94%), single (51%) or married (40%), with at least a high school education (88%), and with a median income of \$45,000–65,000 per year.

Analysis

The longitudinal data was examined by behavior with treatment and control groups combined. Data was analyzed separately by behavior for each study sample. Firstly behaviors were examined separately by adjacent time points (e.g., baseline to

6 months, 6 months to 12 months). Then the longitudinal data were combined across time points by behavior separately for each sample.

Stage Transition Membership. Stage transition membership was established by identifying subjects that moved from one Stage to the next from one time interval to the next. Figure 38 illustrates the Stage transition membership across the time points for participants who moved from Precontemplation to Contemplation. This procedure was repeated for each of the Stage transitions including, Contemplation to Preparation, Preparation to Action, and Action to Maintenance.

Once identified, the participants from each stage transition at each set of time points were grouped together to represent given Stage transitions (e.g., Precontemplation to Contemplation). A true longitudinal exploration would follow participants from Precontemplation to Contemplation to Preparation to Action and finally to Maintenance. Due to sample size issues, a cross-sequentially approach was taken to help increase the number of participants in each Stage transition. This resulted in different subjects in each of the transitions for each set time points.

Note. PC = Precontemplation; C = Contemplation; PR = Preparation; A = Action; M = Maintenance

Figure 38. Stage Transition Membership.

Magnitude. Effect sizes were calculated for each transition across time points. Effect sizes were examined using two main methods: 1) separately for each transition by time point; and 2) collapsed across time points. Magnitudes of effect were assessed using Hedges' g with pooled variance of the standardized gain score:

$$\text{Hedges' } g = \frac{M_1 - M_2}{S_{\text{pooled}}} \quad (22)$$

$$S_{\text{pooled}} = \frac{S_{\text{gain}}}{\sqrt{2(1-r)}} \quad (23)$$

where S_{gain} = the standard deviation of the mean of the difference between the two time points, and r = the correlation of the two means.

Finally, the cross-sectional and longitudinal Stage transition effect sizes for Pros and Cons will be descriptively compared.

T-score by Stage Graphs. In order to create graphical representations in the “classic” T-score by Stage format, as typically seen in the TTM body of literature, effect sizes were converted into “T-scores” and graphed by Stage. In order to illustrate the magnitude of effect across the Stages for the Pros and Cons, a starting point of 0 was chosen for the PC Stage for each set of data. Effect sizes were then incrementally added to this starting point for each Stage transition. Computing the mid-point of the effect sizes served to recenter the data. The midpoint was calculated by subtracting the difference between the lowest and highest effect sizes, dividing by two and adding this to the lowest effect size.

$$\text{Midpoint} = \frac{T_{\text{high}} - T_{\text{low}}}{2} + T_{\text{low}} \quad (24)$$

This midpoint then functions as the T-score of 50 (once the score is converted as described below) and is subtracted from all Stage scores. This gives the number of standard deviations above and below the midpoint for each Stage. The scores are then converted to T scores by multiplying by 10 and adding 50. Finally, these T-scores are plotted by Stage.

Results

Overview. Two behaviors were examined across three longitudinal datasets with a total of 8534 participants. Multiple time points were examined across the

behaviors for a total of 17 sets of comparisons. A total of 136 effect sizes were computed using Hedge's *g*.

Smoking Cessation - "Random Digit Dial" Sample

Mean effect size estimates of the Pros and Cons for each of the Stage transitions for smoking cessation with the "random digit-dial" (RDD) sample across adjacent time points were calculated and are displayed in Table 35. Across the Stages from baseline to six months, small increases were seen from PC-C as well as C-PR for the Pros of Change. A larger magnitude is seen in the opposite direction (decrease) from PR-A. For the Cons of Change, essentially no change was seen in the PC-C and C-PR transitions, whereas nearly .6 *SD* decrease occurred in the transition from PR-A. Due to the fact that only participants in the pre-Action Stages (Precontemplation, Contemplation, and Preparation) were recruited into the original study no participants were available for the A-M transition for the baseline to 6-month time points. A graphical depiction of these transitions can be seen in Figure 39.

As seen in the baseline to 6-month data, the PC-C transition for the Pros of Change a small increase in the Pros of Change was found in the 6- to 12-month time points. Essentially no change occurred in the transition from C-PR. A larger decrease was found for the PR-A transition and a smaller decrease was found from A-M. For the Cons of Change, as seen in the baseline to 6-month data, essentially no change was seen from PC-C. A small increase was seen from C-D. Greater decreases were then found from PR-A and A-M. These changes are illustrated in Figure 40.

Slight increases in the Pros of Change were found for the transitions from PC-C and C-PR for time points 12 months to 18 months. Small decreases were then found for the transitions from PR-A and A-M. For the Cons of Change, a small decrease was seen in the PC-C followed by essentially no change for C-PR. A large decrease was found for the transition from PR-A and a small decrease from A-M. These magnitudes are graphed in Figure 41.

Lastly, for the Pros of Change between time points 18 months to 24 months a small increase was found for the transition from PC-C. Essentially no change occurred from C-PR, followed by a large decrease in the PR-A. Again, essentially no change was found for A-M. For the Cons of Change, essentially no change occurred in the PC-C transition. A small decrease was found for the transition from C-PR whereas the largest decrease was found in the D-A transition. Finally, a small decrease occurred in the A-M transition. These patterns are found in Figure 42.

Table 35

Mean Effect Sizes for Stage Transitions in the Random Digit Dial Sample across Time Points for Smoking Cessation

Stage Transitions	RDD Sample Smoking Cessation							
	BL to 6		6 to 12		12 to 18		18 to 24	
	<i>N</i>	Mean	<i>N</i>	Mean	<i>N</i>	Mean	<i>N</i>	Mean
PROS								
PC-C	235	.22	233	.22	192	.15	145	.16
C-PR	187	.25	151	.08	115	.15	115	-.01
PR-A	65	-.40	81	-.57	54	-.30	50	-.54
A-M		-	65	-.25	118	-.23	117	-.04
CONS								
PC-C	235	.03	233	-.04	192	-.11	145	-.05
C-PR	187	-.08	151	.13	115	.04	115	-.15
PR-A	65	-.57	81	-.46	54	-.45	50	-.90
A-M		-	65	-.55	118	-.17	117	-.10

Figure 39. Graphic for Pros and Cons of Smoking from Baseline to 6 Months for the Random Digit Dial Sample.

Figure 40. Graphic for Pros and Cons of Smoking from 6 to 12 Months for the Random Digit Dial Sample.

Figure 41. Graphic for Pros and Cons of Smoking from 12 to 18 Months for the Random Digit Dial Sample.

Figure 42. Graphic for Pros and Cons of Smoking from 18 to 24 Months for the Random Digit Dial Sample.

Smoking Cessation – All Time Points Combined for the RDD Sample.

Participants in each of the four transition groups were combined across time points in order to increase sample size for each group. Once combined, mean effect sizes and 95% confidence intervals for each transition for the Pros and Cons were computed and displayed in Table 36. The largest increase for Pros was found for the PC-C transition followed by a slight increase in C-PR. The magnitude of effect for the transition from PR –A showed a moderate decrease in effect and continued to decrease in A-M. Essentially no change was found in the transition from PC-C and C-PR for the Cons of Change followed by a large decrease from PR-A and a somewhat smaller decrease found from A-M. These transitions for Pros and Cons are graphically depicted in Figure 43.

Table 36

Mean Effect Sizes for Stage Transitions in the Random Digit Dial Sample with All Time Points Combined

Stage Transitions	RDD Sample - Smoking			
	N	Mean	95% CI	
			Lower	Upper
PROS				
PC-C	805	.19	.01	.37
C-PR	568	.13	-.05	.31
PR-A	250	-.46	-.59	-.33
A-M	299	-.16	-.27	-.05
CONS				
PC-C	805	-.04	-.13	.05
C-PR	568	-.01	-.13	.11
PR-A	250	-.57	-.70	-.44
A-M	300	-.21	-.32	-.10

Figure 43. Graphic for Pros and Cons of Smoking for the Random Digit Dial Sample with all Time Points Combined.

Smoking Cessation - "Parent" Sample.

Effect sizes for each of the Stage transitions for the Pros and Cons of Change across the time points were calculated and are displayed in Table 37. Across the Stages from baseline to six months, a large increase was found in the PC-C with a smaller increase found for the C-PR transition, followed again by a large increase in the transition from PR-A. For the Cons of Change small increases were seen from PC-C as well as C-PR. A large decrease was found for the PR-A transition. As with the RDD sample, due to the fact that only participants in the pre-Action Stages (Precontemplation, Contemplation, and Preparation) were recruited into the original study no participants were available for the A-M transition for the baseline to 6-month time points. A graphical depiction of these transitions can be seen in Figure 44.

For time points 6 months to 12 months for the Pros of Change, essentially no change occurred from PC-C. A small increase was found from C-PR, followed by a large increase for the PR-A transition. Finally, a large decrease was seen for the A-M transition. For the Cons of Change, small decreases were found for the PC-C and C-PR transitions, followed by a remarkably large decrease in the PR-A transition. The transition from A-M displayed a small decrease. These changes are illustrated in Figure 45.

Small increases in the Pros of Change were found for the transitions from PC-C and C-PR for time points 12 months to 24 months. A remarkably large decrease was found for the transitions from PR-A, followed by a small decrease in A-M. For the Cons of Change, small increases were seen in the PC-C and C-PR. A moderate decrease was found for the transition from PR-A and essentially no change occurred in A-M. These magnitudes are illustrated in Figure 46.

Table 37

Mean Effect Sizes for Stage Transitions in the Parent Sample across Time Points for Smoking Cessation

Stage Transitions	Parent Sample – Smoking					
	BL to 6		6 to 12		12 to 24	
	<i>N</i>	Mean	<i>N</i>	Mean	<i>N</i>	Mean
PROS						
PC-C	25	.40	12	.03	19	.38
C-PR	18	.21	10	.23	16	.22
PR-A	5	.53	3	1.01	10	-1.10
A-M		-	5	-.53	7	-.22
CONS						
PC-C	25	.16	12	-.31	19	-.07
C-PR	18	.13	10	-.18	16	-.22
PR-A	5	-.86	3	-1.51	10	-.38
A-M		-		-.17		.00

Figure 44. Graphic for Pros and Cons of Smoking from Baseline to 6 Months for the Parent Sample.

Figure 45. Graphic for Pros and Cons of Smoking from 6 to 12 Months for the Parent Sample.

Figure 46. Graphic for Pros and Cons of Smoking Smoking from 12 to 24 Months for the Parent Sample.

Smoking Cessation – All Time Points Combined for Parent Sample

Participants in each of the four transition groups were combined across time points in order to increase sample size for each group. Once combined, mean effect sizes and 95% confidence intervals for each transition for the Pros and Cons were computed (Table 38). The largest increase for Pros was found for the PC-C transition followed by a small increase in C-PR. The magnitude of effect for the transition from decreased from PR-A and continued to decrease in A-M. Essentially no change was found in the transition from PC-C and C-PR for the Cons of Change followed by a large decrease from PR-A. Finally, a small increase was found from A-M. These transitions for Pros and Cons are graphically depicted in Figure 47.

Table 38

Mean Effect Sizes for Stage Transitions in the Parent Sample for Smoking with All Time Points Combined

Stage Transitions		Parent Sample - Smoking			
		N	Mean	95% CI	
				Lower	Upper
PROS	PC-C	56	.31	0.04	0.58
	C-PR	46	.22	-0.07	0.51
	PR-A	18	-.31	-0.78	0.17
	A-M	13	-.42	-0.98	0.16
CONS	PC-C	56	-.02	-0.28	0.24
	C-PR	44	-.08	-0.38	0.22
	PR-A	18	-.66	-1.16	-0.14
	A-M	11	.16	-0.44	0.75

Figure 47. Graphic for Pros and Cons of Smoking for the Parent Sample with all Time Points Combined.

Sun Protection - "Beach" Sample

Effect sizes for each of the Stage transitions for the Pros and Cons of Change across the time points were calculated and are displayed in Table 39. Across the Stages from baseline to two months, essentially no change was seen from PC-C. A large increase was found for C-PR for the Pros of Change, with smaller increases from PR-A and A-M. For the Cons of Change, a small decrease was found in the PC-C with essentially no change found for the C-PR transition. From PR-A a small increase was found followed by moderate decrease. A graphical depiction of these transitions can be seen in Figure 48.

The transitions for time points 2 months to 12 months for the Pros of Change showed a quite different pattern than baseline to 2 months, with a small increase in the PC-C transition followed by a small decrease in the Pros of Change. The last two

Stages, PR-A and A-M showed essentially no change. In contrast a small increase for the Cons of Change was found for the PC-C transition. The Cons then decreased slightly in C-PR followed by a small increase in PR-A. Finally, essentially no change was seen from A-M. The magnitudes of effect for each of the transitions for Pros and Cons are illustrated in Figure 49.

In the final time points, 12 months to 24 months, for the Pros of Change a moderate increase was found for the PC-C transition. Due to a sample size of one, no effect size could be calculated for the transition from C-D. Essentially no change occurred in the Pros of Change for the transitions from A-M. A large decrease was found for the transitions from PC-C for the Cons of Change. Again, no data was available for the transition from C-PR. Finally, a small decrease was seen in the PR-A followed by essentially no change for A-M. Due to missing data for transition from C-PR, these changes are not illustrated.

Table 39

Mean Effect Sizes for Stage Transitions across Time Points in the Beach Study for Sun Protection

Stage Transitions	Beach Study - Sun Protection					
	BL to 2		2 to 12		12 to 24	
	<i>N</i>	Mean	<i>N</i>	Mean	<i>N</i>	Mean
Pros						
PC-C	50	.04	13	.30	17	.38
C-PR	8	.46	11	-.13	1	-
PR-A	16	.15	18	-.02	20	.70
A-M	22	.18	40	-.06	32	.01
Cons						
PC-C	51	-.18	13	.20	17	-.56
C-PR	8	-.07	11	-.12	1	-
PR-A	15	.17	18	.26	20	.15
A-M	22	-.28	40	.00	32	.07

Figure 48. Graphic of Sun Protection for Baseline to 2 Months for the Beach Study.

Figure 49. Graphic of Sun Protection for 2 to 12 Months for the Beach Study.

Sun Protection - All Time Points Combined for Beach Sample.

Participants in each of the four transition groups were combined across time points in order to increase sample size for each group. Once combined, mean effect sizes and 95% confidence intervals for each transition for the Pros and Cons were

computed (Table 40). Although it appears that small changes occurred for many of the Stage transitions, confidence intervals indicate the only significant change occurred for the Pros in the PR-A transition. This change was a small increase in Pros for the PR-A transition. The magnitudes of effect for each of the transitions for Pros and Cons are graphically depicted in Figure 50.

Table 40

Mean Effect Sizes for Stage Transitions in the Beach Sample with All Time Points Combined

Stage Transitions	Beach Sample – Sun Protection			
	N	Mean	95% CI	
			Lower	Upper
PROS				
PC-C	80	.15	-0.07	0.37
C-PR	20	.14	-0.30	0.58
PR-A	53	.29	0.01	0.56
A-M	94	.03	-0.17	0.23
CONS				
PC-C	80	- .19	-0.41	0.03
C-PR	20	- .17	-0.61	0.27
PR-A	53	.20	-0.07	0.47
A-M	94	- .05	-0.25	0.15

Figure 50. Composite Graphic for Sun Protection in the Beach Sample across All Time Points

Sun Protection - Parent Sample

Effect sizes for each of the Stage transitions for the Pros and Cons of Change across the time points were calculated and are displayed in Table 41. Across time points baseline to 6 months for the Pros of Change, a moderate decrease was found in the PC-C transition with essentially no change for the C-PR transition. Lastly, a slight increase occurred in the transition from PR-A. For the Pros of Change, small decreases were seen from PC-C whereas essentially no change occurred from C-PR. A small increase in magnitude of effect was found from PR-A. As mentioned previously, due to the fact that only participants in the pre-Action Stages (Precontemplation, Contemplation, and Preparation) were recruited into the original study no participants were available for the A-M transition for the baseline to 6-

month time points. A graphical depiction of the magnitudes of effect for the Stage transitions can be seen in Figure 51.

Across time points 6 months to 12 months for the Pros of Change, a small increase was found in the PC-C transition, followed by a moderate increase in C-PR. Again a small increase was found for the Pros of Change from PR-A with an additional increase from A-M. For the Cons of Change, essentially no change was found from PC-C. The C-PR transition showed a small increase in the Cons of Change, followed again by essentially no change in PR-A. Finally, a decrease magnitude was found for the A-M transition from 6 months to 12 months. These changes are illustrated in Figure 52.

Across time points 12 months to 24 months for the Pros of Change, essentially no change was found in PC-C. Small increases were found for C-PR and PR-A, followed by a slight decrease from A-M. Essentially no change occurred in the Cons of Change were found for the transitions from PC-C and C-PR. A slight increase was found for the transition from PR-A with a slight decrease from A-M. These magnitudes are graphed in Figure 53.

Table 41

Mean Effect Sizes for Stage Transitions in the Parent Sample across Time Points for Sun Protection

Stage Transitions	Parent Sample – Sun Protection					
	BL to 6		6 to 12		12 to 24	
	<i>N</i>	Mean	<i>N</i>	Mean	<i>N</i>	Mean
PROS						
PC-C	33	-.36	27	.18	34	.06
C-PR	47	-.04	33	.45	60	.31
PR-A	74	.09	58	.28	86	.41
A-M	-	-	51	.11	102	-.08
CONS						
PC-C	33	-.18	26	.04	34	.02
C-PR	47	-.00	33	.11	60	-.01
PR-A	73	.15	57	.04	84	.09
A-M	-	-	51	-.20	101	-.09

Figure 51. Graphic of Sun Protection for Baseline to 6 Months for the Parent Study

Figure 52. Graphic of Sun Protection for 6 to 12 Months for the Parent Study.

Figure 53. Graphic of Sun Protection for 12 to 24 Months for the Parent Study

Sun Protection - All Time Points Combined for Parent Sample.

Participants in each of the four transition groups were combined across time points in order to increase sample size for each group. Once combined, mean effect sizes and 95% confidence intervals for each transition for the Pros and Cons were computed and are displayed in Table 42. Essentially no change in the Pros was found for the PC-C transition. Small increases were found for the C-PR and PR-A transitions, with essentially no change in the A-M transitions. Essentially no change in the Cons of Change was found across all the Stage transitions. The magnitudes of effect for each of the transitions for Pros and Cons are graphically depicted in Figure 54.

Table 42

Mean Effect Sizes for Stage Transitions in the Parent Sample for Sun Protection with All Time Points Combined

Stage Transitions		Parent Sample – Sun Protection		
		N	Mean	95% CI
				Lower Upper
PROS	PC-C	93	-.04	-.24 .16
	C-PR	139	.23	.06 .40
	PR-A	214	.26	.12 .40
	A-M	152	-.01	-.17 .15
CONS	PC-C	94	-.05	-.25 .15
	C-PR	137	.03	-.14 .20
	PR-A	216	.09	-.04 .22
	A-M	153	-.09	-.25 .07

Figure 54. Composite Graphic for Sun Protection in the Parent Sample across All Time Points

Discussion

Two behaviors, sun protection and smoking cessation, were examined in this study. Two different samples were examined for each of the behaviors. Smoking cessation was examined in a sample of adults that were randomly contacted by phone using a random digit dial procedure as well as in a sample of parents that were identified in connection with a larger health behavior study with adolescents in schools. This same parent sample was analyzed separately for sun protection. Lastly, sun protection was examined in a sample of beach goers.

Overall, the sample sizes for each of the behaviors for the Pros and Cons across the Stage transitions were small. Quite small sample sizes were found for many of the separate time point analyses, especially for the Beach sample. Interpreting the results for each the behaviors for the individual the time points

proved difficult, likely due to the small sample sizes. Clearer patterns began to emerge as sample sizes were increased by combining the Stage transitions across time points. Unfortunately, one consequence of combining the time points across the stages is the loss of independence in the data. When sets of time points are examined separately - each participant, by design, can only be included in one of the four stage transitions for that set of time points. In contrast, when combining sets of time points (e.g., baseline to 6 months with 6 months to 12 months) participants may be included in more than one time point and therefore contribute more than one set of data. This type of dependency in the combined data was not accounted for in the cross-sequential analyses that combined sets of time points. Therefore, although the combined data analyses have the advantage of larger sample size, the results should be interpreted with caution due to the dependency in the data. More research is needed to understand the impact of the dependency and methods developed to account for such dependency.

As predicted, the overall effect sizes appear larger for the longitudinal study

variability of the correlations. This variability is likely to result in an unstable effect size measure, making it difficult to rely on the effect size patterns. Additionally the effect size measure used in the cross-sectional study is calculated using a different procedure. It is unclear how this difference affects the comparison of the two types of data. More research is essential in order to resolve these important issues.

Despite these caveats, composite profiles for each of the behaviors are somewhat consistent with the cross-sectional data. The cross-sectional profile of the Pros and Cons of Change for Smoking Cessation is shown in Figure 55. Nearly all nine of the sets of effects sizes for the Pros decrease in transitions from PR-A and A-M. The primary difference across the longitudinal and cross-sectional profiles for smoking cessation is found in the large decrease later Stage transitions. In light of this pattern, it should be noted that on the whole participants in the Maintenance stages of these longitudinal datasets are recent Maintainers. Since no participants were in the Maintenance Stages at the beginning of the two smoking samples, these Maintainers have only maintained the given behavior for less than a year or two. In contrast, participants in the Maintenance stages of cross-sectional studies may have

Figure 55. Cross-sectional Smoking Cessation Profile (n = 25).

Figure 56. Cross-sectional Profile for Unhealthy Behaviors (n=45).

The cross-sectional profile of the Pros and Cons of Sun Protection is shown in Figure 57. Unfortunately the cross-sectional profile for sun protection is represented by only one study. Although typically profiles represented by one dataset are somewhat unstable, a semi-consistent pattern can be seen between the cross-sectional and longitudinal data. Five out of six longitudinal composite profiles for sun protection show an S shape across the stages for the Pros of change similar to that seen in the cross-sectional sun protection profile below. Additionally, similar to the cross-sectional data, the Cons of Change are somewhat flat across the changes with the largest decrease in the PC-C transition. The reasonably flat profile indicates that only a small amount of change is occurring for the Cons of Sun Protection as individuals move from one Stage to the next.

Figure 57. Cross-sectional Sun Protection Profile (n = 1).

This investigation serves as a very preliminary look into the comparison of cross-sectional and longitudinal data. These preliminary examinations found that overall the cross-sectional and longitudinal data were reasonably comparable, with the earlier stages looking more similar between the two than the later stages. This study is the first step to understanding the utility of cross-sectional data for representing longitudinal relationships across the Stages of Change, specifically for the Pros and Cons of Change. Looking ahead to more comprehensive examinations of longitudinal effect size comparisons of the TTM constructs across the Stages, a variety of limitations should be noted.

Firstly, the exploration of the current longitudinal datasets included the treatment and control groups combined. It would be of great interest to examine these groups separately. Participants in the control group moving from one Stage to the next, aside from the potential impact of assessment, in effect are changing naturalistically. Comparisons of the control groups with the treatment groups would begin to determine if those changing with the aid of an intervention change in a similar fashion to those changing naturalistically. One might ask, is behavior change facilitated by an intervention the same process for those who change naturalistically – just accelerated?

Another important issue is the time interval differences across time points. In the current exploration all adjacent time points were included to increase the number of transitions. This resulted in some effect sizes estimates representing a time interval of 2 months where as another represented 12 months. In the context of a larger study, differences in time intervals should be explored.

The TTM utilizes the Pros and Cons of Change as an important part of the theoretical model of behavior change. Cross-sectional and longitudinal explorations have shown Decisional Balance and the Stages of Change to be theoretically consistent and practically useful. The Pros and Cons are just one aspect of decision making. Literature spanning diverse disciplines such as psychology and economics has begun to amass a rich body of knowledge and theoretical ideas regarding decision making that would likely enrich the TTM. Future research should aim to expand the use of decision making in the context of the TTM of behavior change. Such an endeavor is likely to increase the effectiveness and utility of an already successful model.

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APPENDICES

Appendix A

Table A.1

Coding Manual

Variable Name	Instructions / Description
<i>Study Descriptors</i>	
Study ID	Assign a unique identification number to each study. Each identification number is comprised of the first four letters of the primary author's last name, the first letter of the primary author's first name, the last two digits of the publication year, and a three-letter behavior code. (<i>See list behavior codes below</i>) If a report presents two independent studies (i.e., two independent outcome studies with different participants or different target behaviors) they must be entered independently.
Author	List the last name of author for each dataset. For studies with multiple authors, the primary author's last name is entered, followed by the term "et al."
Year	Enter the 4-digit year of publication. For manuscripts in preparation, enter year of draft. For unpublished datasets, enter year as specified by author, if unspecified list year data was obtained.
Recruitment Setting	Enter the recruitment setting as described in the article/study.
Recruitment Setting Category	Code the Recruitment Setting in to one of the following categories: 1 = community-based 2 = health clinics 3 = physicians offices 4 = school 5 = treatment centers

	6 = university 7 = work sites 8 = other
Country	List the country in which the study took place.
Country Category	Code the country into one of the following: 1= United States 2= Non- US
Language	Enter the language in which the study was conducted (i.e., the language of the measures used).
Language Category	Code Language into the following categories: 1= English 2= Non-English
Publication	Enter the publication type and/or status of the study/data being used.
Publication Category	Code Publication description into the following categories: 1= technical manual 2= dissertation 3= peer review journal 4= manuscript in prep 5= masters thesis 6= unpublished data 7=conference presentation 8= research competency 9 = other
Recruitment Method	Provide a brief description of the sample recruitment method.
Recruitment Method Category	Indicate whether the method for recruiting participants was “Active” (e.g., telephoning people at home, approaching people on the streets) or “Passive” (e.g., mailing out surveys, advertising studies in the newspaper). 1= active 2= passive 3= active/passive 4= not reported
Classification of Study	Describe the type of study conducted (e.g., measurement development, intervention)
<i>Behavior Descriptors</i>	
Target Behavior	List the target behaviors examined in each dataset. (<i>See list of target behaviors for examples</i>). The target behavior is the specific behavior measured by the Stage algorithm

Behavior Category	Enter the primary behavior category on which each study is focused (<i>See list of Behavior Categories</i>)
Cessation vs. Acquisition	<p>Identify the target behavior according to whether it described as ending a current behavior (cessation - e.g., quitting smoking) or starting a new one (acquisition - e.g., bone density testing). Code using the following:</p> <p>1 = acquisition 2 = cessation</p>
Healthy, Unhealthy, Prevention or Non-Health related	<p>Code the target behavior according to whether the behavior is rooted in a healthy (e.g., exercise) or unhealthy (e.g., binge drinking). If a behavior does not examine a health related behavior (administrative change) code accordingly. Code using the following:</p> <p>1 = healthy 2 = unhealthy 3 = non-health related</p> <p>Behaviors that examine prevention behaviors should be coded separately. Prevention of a behavior typically involves individuals whom are likely to be not engaging / exhibiting in a particular behavior, but may or may not in the future. (e.g., smoking acquisition, depression prevention). Code using the following:</p> <p>4 = prevention</p>
Frequency	<p>Identify the frequency in which the behavior is generally performed. A behavior is coded as daily/regularly if the behavior is generally performed daily or multiple times a week (e.g., flossing teeth, exercise). Situational describes the frequency of a behavior for behaviors performed when the situation arises (e.g., condom use). If a behavior is typically performed one a year (e.g., STD screening) or less (e.g., radon testing) it should be coded as yearly. Code into one of the following categories:</p> <p>1 = daily/regularly 2 = situational 3 = yearly +</p>
<i>Sample Descriptors</i>	
Sample Description	Enter the population description as described in the article/study.

Percent Female	Enter the percentage of female participants in each study as stated in the article. If not reported specifically and sufficient data is available, calculate percentage of females.
Percent Male	Enter the percentage of male participants in each study as stated in the article. If not reported specifically and sufficient data is available, calculate percentage of males.
Mean Age	Report the mean age for the entire sample as directly stated in the article. If not reported specifically and sufficient data is available, calculate the mean age.
Age Group	<p>Enter the age group of the participants. This will be based on the description the sample, as well as the setting of the study. Code age group into one of the following categories:</p> <p>1 = adolescents 2 = college 3 = adults 4 = mixed</p>
Educational Level	Report the mean years of education based on the entire sample. It should be entered exactly as it is reported in the text.
Sampling Method	<p>Enter the way in which the sample of participants in each study was selected.</p> <p>1= random 2= convenience 3= mixed 4= not reported</p>
<i>Stage Variables and Descriptors</i>	
Cross-Over Stages	<p>Enter the Stages between which the pros and cons scores graphically cross. This must be based on T-scores values. If t-scores are not reported in a table or graph the cross-over Stage can not be identified.</p> <p>1= PC-C 2= C-PR 3= PR-A 4= A-M 5= C-A 6= multiple 7= raw/no graph 8= other (e.g., No Cross) 9= not available</p>
Inclusion of	Indicate whether or not Preparation Stage is included in the

Preparation Stage	<p>final analysis for the study.</p> <p>1= yes 2= no</p>
Inclusion of Maintenance Stage	<p>Indicate whether or not Maintenance Stage is included in the final analysis for the study</p> <p>1= yes 2= no</p>
Inclusion of Cont/Prep Stage	<p>Indicate whether or not a combined Contemplation/Preparation Stage is included in final analysis for the study.</p> <p>1= yes 2= no</p>
Inclusion of Action/Main Stage	<p>Enter yes or no to indicate whether or not there is a combined Action/Maintenance Stage included in final analysis for the study.</p> <p>1= yes 2= no</p>
Stage Description Code	<p>Indicate how the Staging descriptions were reported in the text. Enter “TTM” if Stage descriptions were only included as general TTM stage descriptions and indicate no target behavior. Enter “SS” if Staging descriptions are study specific, that is, if they are specific to the target behavior in the given study.</p> <p>1= TTM 2= SS 3= not reported</p>
% in Precontemplation	<p>This category is defined as the percentage of participants who were determined to be in the Precontemplation Stage of Change for the given behavior in a study. It is reported exactly as is done in the article. If the percentage of participants in the Precontemplation Stage is not readily available in the article, the percentage can be calculated by dividing the number of participants in each Stage by the total “N” of the study. If there are no Stage percentages in the article, and there is not enough information to calculate them, “NR” should be recorded in the database.</p>
% in Contemplation	<p>This category is defined as the percentage of participants who were determined to be in the Contemplation Stage of Change for the given behavior in a study. It is reported exactly as is done in the article. If the percentage of participants in the</p>

	Contemplation Stage is not readily available in the article, the percentage can be calculated by dividing the number of participants in each Stage by the total “N” of the study. If there are no Stage percentages in the article, and there is not enough information to calculate them, “NR” should be recorded in the database.
% in Preparation	This category is defined as the percentage of participants who were determined to be in the Preparation Stage of Change for the given behavior in a study. It is reported exactly as is done in the article. If the percentage of participants in the Preparation Stage is not readily available in the article, the percentage can be calculated by dividing the number of participants in each Stage by the total “N” of the study. If there are no Stage percentages in the article, and there is not enough information to calculate them, “NR” should be recorded in the database.
% in Action	This category is defined as the percentage of participants who were determined to be in the Action Stage of Change for the given behavior in a study. It is reported exactly as is done in the article. If the percentage of participants in the Action Stage is not readily available in the article, the percentage can be calculated by dividing the number of participants in each Stage by the total “N” of the study. If there are no Stage percentages in the article, and there is not enough information to calculate them, “NR” should be recorded in the database.
% in Maintenance	This category is defined as the percentage of participants who were determined to be in the Maintenance Stage of Change for the given behavior in a study. It is reported exactly as is done in the article. If the percentage of participants in the Maintenance Stage is not readily available in the article, the percentage can be calculated by dividing the number of participants in each Stage by the total “N” of the study. If there are no Stage percentages in the article, and there is not enough information to calculate them, “NR” should be recorded in the database.
%C/D	This category is defined as the percentage of participants who were determined to be in the combined Contemplation/Preparation Stage of Change for the given behavior in a study. It is reported exactly as is done in the article. If the percentage of participants in the Contemplation/Preparation Stage is not readily available in the article, the percentage can be calculated by dividing the number of participants in each Stage by the total “N” of the study. If there is no Contemplation/Preparation Stage, there

	is no mention of Stage percentages in the article, or there is not enough information to calculate them, "NR" should be recorded in the database.
%A/M	This category is defined as the percentage of participants who were determined to be in the combined Action/Maintenance Stage of Change for the given behavior in a study. It is reported exactly as is done in the article. If the percentage of participants in the Action/Maintenance Stage is not readily available in the article, the percentage can be calculated by dividing the number of participants in each Stage by the total "N" of the study.
Are Stage descriptions General TTM category descriptions or Study Specific?	Specify whether the Stage descriptions for each article are written either generally based on the transtheoretical model, or specifically in reference to the studied behavior. If the Stages are described as or based upon the original definition of the transtheoretical model, "TTM" should be noted in the category. If the Stages have been created in accordance with the specific study behavior and are noted as such, "SS" should be recorded. Code based on the following: 1 = TTM 2 = SS 3 = not reported
Does study provide staging items?	Indicate if the study provides the specific Stage items on which the staging algorithms are based.
Stage items=Stage category?	Indicate if the Stage items have a one to one correspondence to the Stage description.
PC; Stage description	Record the Stage description for Precontemplation exactly as is written in the study. The Stages may have been geared specifically toward the target behavior, or may appear in the text as a general description of the transtheoretical model. Either way, enter the exact description as it appears in the database.
C; Stage description	Record the Stage description for Contemplation exactly as is written in the study. The Stages may have been geared specifically toward the target behavior, or may appear in the text as a general description of the transtheoretical model. Either way, enter the exact description as it appears in the database.
PR; Stage description	Record the Stage description for Preparation exactly as is written in the study. The Stages may have been geared specifically toward the target behavior, or may appear in the text as a general description of the transtheoretical model.

	Either way, enter the exact description as it appears in the database.
A; Stage description	Record the Stage description for Action exactly as is written in the study. The Stages may have been geared specifically toward the target behavior, or may appear in the text as a general description of the transtheoretical model. Either way, the exact description appears in the database.
M; Stage description	Record the Stage description for Maintenance exactly as is written in the study. The Stages may have been geared specifically toward the target behavior, or may appear in the text as a general description of the transtheoretical model. Either way, enter the exact description as it appears in the database.
Time Frame for Precontemplation	1= 6-month time period 2= another time period 3= time period not specified 4= not reported
Time Frame for Contemplation	1= 6-month time period 2= another time period 3= time period not specified 4= not reported
Time Frame for Preparation	1= 30 day/1 month time period 2= another time period 3= time period not specified 4= not reported 5= not used
Time Frame for Action	1= less than 6-month time period 2= another time period 3= time period not specified 4= not reported 5= Action/Maintenance
Time Frame for Maintenance	1= greater than 6-month time period 2= another time period 3= time period not specified 4= not reported 5= Action/Maintenance

Decisional Balance Descriptors

Description of Pros and Cons	Provide the exact description of the pros and cons (e.g. Pros and Cons of Smoking or Pros and Cons of Quitting Smoking)
Response Format	Indicate the response format for the Decisional Balance measure
Response Format Category	<p>The two most typical response formats for Decisional Balance are either a likert scale which asks participants to indicate “how important” the given items are to them or to the degree to which they agree or disagree with each of the items. Code response format into one of the following categories:</p> <p>1 = “How Important” 2 = “Agree / Disagree” 3 = other</p>
Number of Pros Items	Enter the number of pros indicated by the author that were used in the final Decisional Balance measure.
Number of Cons Items	Enter the number of cons indicated by the author that were used in the final Decisional Balance measure.
Alpha Pros	Enter the coefficient alpha for the Pros scale calculated specifically for the study. Do not report alpha’s that were reported based on previous studies.
Alpha Cons	Enter the coefficient alpha for the Cons scale calculated specifically for the study. Do not report alpha’s that were reported based on previous studies.

Note. Any data that can not be identified will be indicated in the database by “NR” (not reported).

Behavior Code List

1. ADC	Administrative change
2. AST	Asthma – Medication Management
3. ARF	Anorexia- recovery from
4.	
5. BDA	Binge drinking acquisition
6. BDC	Binge drinking cessation
7. BDT	Bone density testing
8. BPA	Back pain
9. BRF	Bulimia – recovery from

10. BSE	Breast Self-Examination
11. CAI	Calcium intake
12. CDS	Collaborative delivery service
13. CCS	Colorectal cancer screening
14. CCU	Cocaine use
15. CGE	Contraception – general
16. CMA	Condom use - main
17. CUA	Condom use – anal main
18. CUO	Condom use – other
19. CUS	Condom use
20. DBH	Delinquent behavior
21. DDU	Decreasing drug use
22. DFR	Dietary fat reduction
23. DIE	Diet
24. DMM	Participation in decision making for medication
25. DPV	Depression prevention
26. DRT	Drug treatment
27. DVI	Domestic violence
28. EAD	Eating disorders
29. EXE	Exercise
30. FRI	Fruit intake
31. FVC	Fruit and vegetable consumption
32. GLT	Glucose testing
33. HDI	Healthy diet
34. HRP	Hearing Protection
35. MAM	Mammography Screening
36. MEM	Medication management
37. ORD	Organ donation
38. ORH	Oral hygiene
39. PAS	Physician assisted smoker
40. QDR	Quitting drugs
41. RAT	Radon testing
42. SBH	Sedentary behavior
43. SDM	Sex decision making
44. SDN	Sex decision making (non virgins)
45. SDV	Sex decision making (virgins)
46. SMA	Smoking acquisition
47. SMC	Smoking cessation
48. SMG	Stress management
49. SPR	Sun protection / reduction
50. STR	Stress
51. SUU	Sunscreen use
52. SLT	Smokeless tobacco use
53. VIN	Vegetable intake

54. WBE	Weight bearing exercise
55. WLO	Weight loss

Appendix B

Table B.1

Stage Descriptions for Each Study

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Acton et al. (2001) Smoking Cessation	5-item measure	SS	Not seriously considering quitting within the next 6 months	Seriously considering quitting within the next 6 months, however they were not considering quitting within the next 30 days, had not made a quit attempt of 24 hours in past year, or both	Seriously considering quitting in the next 6 months and were planning to quit within the next 30 days, in addition they made a 24 hour quit attempt in past year	Has quit smoking for under 6 months	Has quit smoking for at least 6 months
Ahijevych et al. (1999) Smoking Cessation	3-question algorithm	Not reported	Not intending to quit smoking in the next six months	Intending to quit smoking in the next six months but not intending to quit smoking in the next month?	Intending to quit smoking in the next month and tried to quit in the past year	Not reported	Not reported
Bane et al. (1999) Smoking Cessation	Not reported	SS	Reported smoking at least one cigarette per day during the past 7 days and not seriously considering quitting within the next 6 months	Seriously considering quitting smoking within the next 6 months or considering quitting within the next 30 days, but had not made any quit attempts	Planning to quit within the next 30 days and had made at least one 24-hour quit attempt in the past year	Quit within the past 6 months	Quit more than 6 months before baseline
Banikarim et al. (2003) STD Screening- Change in Partners	3 separate staging algorithms	SS	Women not ready to obtain gonorrhea and Chlamydia screening every time they ever changed partners or had unprotected sex with their current main partner or current side partner	Individuals thinking about obtaining gonorrhea and Chlamydia screening every time they ever changed partners or had unprotected sex with their current main partner or current side partner	Individuals planning to obtain gonorrhea and Chlamydia screening every time they ever changed partners or had unprotected sex with their current main partner or current side partner	Individuals who had been obtaining gonorrhea and Chlamydia screening for 6 months or less every time they ever changed partners or had unprotected sex with their current main partner or current side partner	Individuals who had been receiving gonorrhea and Chlamydia screening for more than 6 months every time they had ever changed partners or had unprotected sex with their current main partner or current side partner

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Banikarim et al. (2003) STD Screening- Main	3 separate staging algorithms	SS	Women not ready to obtain gonorrhea and Chlamydia screening every time they ever changed partners or had unprotected sex with their current main partner or current side partner	Individuals thinking about obtaining gonorrhea and Chlamydia screening every time they ever changed partners or had unprotected sex with their current main partner or current side partner	Individuals planning to obtain gonorrhea and Chlamydia screening every time they ever changed partners or had unprotected sex with their current main partner or current side partner	Individuals who had been obtaining gonorrhea and Chlamydia screening for 6 months or less every time they ever changed partners or had unprotected sex with their current main partner or current side partner	Individuals who had been receiving gonorrhea and Chlamydia screening for more than 6 months every time they had ever changed partners or had unprotected sex with their current main partner or current side partner
Basler et al. (1999) Exercise	Single question 5 choice response format	TTM	No intention to change behavior in the foreseeable future, or denial of need to change.	Intention to change within the next 6 months.	Serious intention to change in the next 30 days.	Initiation of overt behavioral change.	Sustaining behavioral change for 6 months or more.
Block et al. (1998) Condom Use	4 question algorithm w/ process of change self- assessment scale used as criterion for classification	TTM	Often do not see or deny the problem and have no intention of changing their behavior	Acknowledge they have a problem, but are not quite ready to do anything about it; may have indefinite plans to take action in the next 6 months (in the next 6 months)	Plans to take action within a definitive time-frame	Modifying their behavior and environment (within the past 6 months)	The individual continues to resist temptation and to reinforce action
Borland et al. (2000) Smoking Cessation	5 questions (unclear what format)	TTM	Not seriously contemplating quitting in the next 6 months	Seriously contemplating quitting smoking in the next 6 months and not in preparation	Planning to quit in the next 30 days and also having made a quit attempt of at least 24 hours in the last year.	Quit for less than 6 months	Quit for more than 6 months
Boudreaux et al. (1998) Smoking	Single question 5 choice response format	SS	Not thinking about quitting smoking	Thinking about quitting smoking in the next 6 months	Planning to quit smoking in the next 30 days and already made a recent quit attempt	Continuous cessation for greater than 1 day, but less than 6 months	Continuous cessation for greater than 6 months

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Cessation							
Buckworth et al. (2002) Exercise	5-item algorithm (True/False)	SS	Not reported	I currently do not exercise, but am thinking of starting to exercise in the next 6 months	I currently exercise some, but not regularly	I currently exercise regularly, but have only begun doing so within the last 6 months	I currently exercise regularly, but have only begun doing so within the last 6 months
Callaghan et al. (2002) Exercise	Contemplation Ladder (11pt)	SS	I do not currently exercise, and I do not intend to start exercising in the next 6 months	I currently do not exercise, but I am thinking about starting to exercise in the next 6 months	I currently exercise some, but not regularly	I currently exercise regularly and have been exercising at the recommended level for 6 months or less	I currently exercise regularly and have done so for longer than 6 months
Chamot et al. (2001) Mammo- graphy	4-item (6 stages including Relapse Risk and Relapse)	SS	Never had a screening mammogram and no intention of having one in next six months	No screening mammogram in past 2 years, but plans to have one in the next 6 months	Not used	no screening mammogram 2-4 years ago, with one in the past 2 years, intends to have mammogram in future	at least two mammograms in last 4 years, one in last two years, with plans to have mammograms in the future
DiClemente et al. (1991) Smoking Cessation	Number of quit attempts and Yes/No format	SS	Not seriously considering quitting within the next 6 months	Seriously considering quitting within the next 6 months, however they were not considering quitting within the next 30 days, had not made a quit attempt of 24 hours in past year, or both	Seriously considering quitting in the next 6 months and were planning to quit within the next 30 days, in addition they made a 24 hour quit attempt in past year	Not reported	Not reported

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Dijkstra et al. (1996) Smoking Cessation	Single question 5 choice response format	SS	Has been smoking in the past 24 hr and is not planning to quit within the next 6 months	Has been smoking in the past 24 hr and is planning to quit within the next 6 months but not yet within the next month	Has been smoking in the past 24 hr and is planning to quit within the next month	Has not been smoking in the past 24 hr but not longer than 6 months	Has not been smoking for the past 6 months
Dijkstra et al. (1998) Smoking Cessation	Not reported; Includes immotives (3 definitions for immotives)	SS	Planning to quit within the next year; Planning to quit within the next 5 years	Planning to quit within the next 6 months	Planning to quit within the next month	Not reported	Not reported
Dryfoos (1996) Glucose Testing	Single question 5 choice response format	SS	Do you regularly follow your glucose self-testing plan? No, and I do not intend to in the next 6 months.	Do you regularly follow your glucose self-testing plan? No, but I intend to in the next 6 months.	Do you regularly follow your glucose self-testing plan? No, but I intend to in the next 30 days.	Do you regularly follow your glucose self-testing plan? Yes, and I have been, but for less than 6 months.	Do you regularly follow your glucose self-testing plan? Yes, and I have been for more than 6 months.
Dryfoos (1996) Medication Management	Single question 5 choice response format	SS	Do you regularly take your insulin as you were told to by your health care provider? No, and I do not intend to in the next 6 months.	Do you regularly take your insulin as you were told to by your health care provider? No, but I intend to in the next 6 months.	Do you regularly take your insulin as you were told to by your health care provider? No, but I intend to in the next 30 days.	Do you regularly take your insulin as you were told to by your health care provider? Yes, and I have been, but for less than 6 months.	Do you regularly take your insulin as you were told to by your health care provider? Yes, and I have been for more than 6 months.
Eaton et al. (1992) Physicians Assisting Smoker	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported

Table B.1 (continued)

Source (Year)	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Evers et al. (2001) Condom Use	Single question 5 choice response format	SS	Not intending to use condoms in the next 6 months	Planning to use condoms in the next 6 months	Intending to use condoms every time they have sex in the next 30 days	Have been using condoms every time they have sex for less than 6 months	Using condoms every time they have sex for more than 6 months
Evers et al. (2001) Waiting to have sex	Single question 5 choice response format	SS	Not intending to have sex in the next 6 months	Planning to have sex in the next 6 months	Intending to have sex in the next 30 days	Not reported	Not reported
Evers et al. (2001) Decreasing Drug Use	Not reported	SS	Not intending to stop using the drug in the next 6 months	Planning to stop using the drug in the next 6 months	Intending to stop using the drug in the next 30 days	Have stopped using the drug in the last 6 months	Have stopped using the drug more than 6 months ago
Evers et al. (2003) Stress Management	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
Fahrenwald et al. (2003) Exercise	5-question (Yes/No)	SS	Those not participating in regular exercise activity and not intending to change in the next 6 months	Those not participating in regular physical activity but intending to do so in the next 6 months	Those not participating in regular physical activity but actively making small changes to do so	Those who have actively engaged in regular physical activity for less than 6 months	Those who have actively engaged in regular physical activity for 6 months or more
Fava et al. (1995) Smoking Cessation	Not reported	SS	A smoker has no intention to change behavior in the next six months	A smoker is seriously considering a change within the next six months	A smoker is seriously considering to quit within the next 30 days and has made at least one quit attempt in the past year	A former smoker has been continuously quit for less than 6 months	A former smoker has been continuously quit for more than 6 months

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Frenn et al. (2003) Dietary Fat Reduction	7-item with restaging (per Rossi et al. 1994)	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
Galavotti et al. (1995) Contracep- tion - General	2 questions; 7-pt scale	SS	Neutral or negative intention to start using a contraceptive method every time or all the time	Positive intention (above the neutral point) to start using contraception every time or all the time in the next 6 months	Positive intention to start using contraception every time or all the time in the next 30 days and some reported use (sometimes or almost every time/almost all the time)	Use of a method every time or all the time for less than 6 months	Use of a method every time or all the time for 6 months or longer
Galavotti et al. (1995) Condom Use - Main	3 questions; 7-pt scale	SS	Neutral or negative intention to start using a contraceptive method all the time or every time	Positive intention (above the neutral point) to start using contraception all the time or every time in the next 6 months	Positive intention to start using contraception all the time or every time in the next 30 days and some recorded use (sometimes or almost every time/almost all the time)	Use of a method all the time or every time for less than 6 months	Use of a method all the time or every time for six months or longer
Galavotti et al. (1995) Condom Use - Other	4 questions; 7-pt scale	SS	Neutral or negative intention to start using a contraceptive method all the time or every time	Positive intention (above the neutral point) to start using contraception all the time or every time in the next 6 months	Positive intention to start using contraception all the time or every time in the next 30 days and some recorded use (sometimes or almost every time/almost all the time)	Use of a method all the time or every time for less than six months	Use of a method all the time or every time for six months or longer

Table B.1 (continued)

Source (Year)	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Gazabon (2000)	2-item algorithm	SS	Sometimes, not always, or never use condoms and do not plan to start using condoms when they have sex	Sometimes, not always, or never use condoms, but plan to start using condoms when having sex within the next six months	Sometimes, not always, or never use condoms but plan to start using condoms when having sex within the next 30 days	Started always using condoms either 1 month or 3-5 months ago	Started always using condoms 6 months ago or longer
Giebel (1999)	Single question 5 choice response format	TTM	No, and I am not thinking about starting within the next 6 months	No, but I am planning to start to always use them within the next 6 months	No, but I am planning to start within the next 30 days	Yes, and I have been doing so for 6 months or less	Yes, and I have been doing so for 6 months or longer
Giebel (1999)	Single question 5 choice response format	TTM	No, and I am not thinking about starting within the next 6 months	No, but I am planning to start to always use them within the next 6 months	No, but I am planning to start within the next 30 days	Yes, and I have been doing so for 6 months or less	Yes, and I have been doing so for 6 months or longer
Giebel (1999)	Single question 5 choice response format	TTM	No, and I am not thinking about starting within the next 6 months	No, but I am planning to start to always use them within the next 6 months	No, but I am planning to start within the next 30 days	Yes, and I have been doing so for 6 months or less	Yes, and I have been doing so for 6 months or longer
Giebel (1999)	Single question 5 choice response format	TTM	No, and I am not thinking about starting within the next 6 months	No, but I am planning to start to always use them within the next 6 months	No, but I am planning to start within the next 30 days	Yes, and I have been doing so for 6 months or less	Yes, and I have been doing so for 6 months or longer

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Grimley et al. (1995) Contraception - General	4-item staging	SS	Not using contraception and had no intention to start doing so every time in the next 6 months.	Not currently using contraception, but intend to start doing so every time in the next 6 months	Intend to start using contraception every time within the next month and are currently using contraception almost every time	Have been using contraception every time for less than 6 months	Have been using contraception every time for more than 6 months.
Grimley et al. (1995) Condom Use-Main	5-item staging	SS	Not using condoms with their main partners and had no intention to start doing so every time in the next 6 months.	Not currently using condoms with their main partners, but intend to start doing so every time in the next 6 months	Intend to start using condoms every time within the next month and are currently using condoms almost every time with their main partner	Have been using condoms every time for less than 6 months	Have been using condoms with their main partners every time for more than 6 months.
Grimley et al. (1995) Condom Use-Other	5-item staging	SS	Not using condoms with their other partners and had no intention to start doing so every time in the next 6 months.	Not currently using condoms with their other partners, but intend to start doing so every time in the next 6 months	Intend to start using condoms every time within the next month and are currently using condoms almost every time with their other partners	Have been using condoms every time for less than 6 months	Have been using condoms with their other partners every time for more than 6 months.
Happel (2002) Fruit & Vegetable Consumption	Single question 5 choice response format	TTM	No, and I am not thinking about starting within the next 6 months	No, but I am planning to start to always use them within the next 6 months	No, but I am planning to start within the next 30 days	Yes, and I have been doing so for 6 months or less	Yes, and I have been doing so for 6 months or longer
Hempelmann (2003) Tooth-	Single question 5 choice response format	TTM	No, and I am not thinking about starting within the next 6 months	No, but I am planning to start to always use them within the next 6 months	No, but I am planning to start within the next 30 days	Yes, and I have been doing so for 6 months or less	Yes, and I have been doing so for 6 months or longer

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
friendly Diet							
Henderson (1998) Breast Self- Examination	5-item algorithm (Yes/No)	SS	Not currently performing monthly BSEs; no plan for performing BSEs	Not currently performing monthly BSEs; planning one within the next six months	Not currently performing monthly BSEs; planning one in the next 30 days	Performed a monthly BSE for less than six consecutive months	Performed BSEs each month for at least the past 12 months
Herrick et al. (1997) Dietary Fat Reduction	Single question 5 choice response format	TTM	No intention to change behavior in the next six months	Intention to change within the next 6 months.	Small and/or inconsistent changes	Actively engaging in the new behavior for less than six months	Sustained behavior change for more than six months
Herrick et al. (1997) Exercise	Single question 5 choice response format	TTM	No intention to change behavior in the next six months	Intention to change within the next 6 months.	Small and/or inconsistent changes	Actively engaging in the new behavior for less than six months	Sustained behavior change for more than six months
Herrick et al. (1997) Smoking Cessation	Single question 5 choice response format	TTM	No intention to change behavior in the next six months	Intention to change within the next 6 months.	Small and/or inconsistent changes	Actively engaging in the new behavior for less than six months	Sustained behavior change for more than six months
Herrick et al. (1997) Sun Protection/Re duction	Single question 5 choice response format	TTM	No intention to change behavior in the next six months	Intention to change within the next 6 months.	Small and/or inconsistent changes	Actively engaging in the new behavior for less than six months	Sustained behavior change for more than six months

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Herzog et al. (1999) Smoking Cessation	5-item measure (format unclear; DiClemente, 1991)	SS	Not seriously thinking about quitting smoking in the next 6 months	Seriously thinking about quitting in the next 6 months and were not seriously thinking about quitting in the next 30 days and had not made at least one 24 hour quit attempt in the past year, or both	Seriously thinking about quitting within the next 30 days and had at least one 24 hour quit attempt in the past year	The first 6 months of smoking abstinence	Abstinence beyond 6 months
Hulton (2001) Sex Decision Making/ Abstinence (Non Virgins)	9-item	SS	Has had sexual intercourse and is not thinking about stopping	Has had sexual intercourse and doesn't want to stop, but may stop in the future	Has had sexual intercourse but is planning to stop	Has had sexual intercourse, but has made attempts to stop in the past 6 months	Has had sexual intercourse but has now stopped for more than 6 months
Hulton (2001) Sex Decision Making/ Abstinence (Virgins)	9-item	SS	Has not had sexual intercourse and is not considering learning abstinence skills	Has not had sexual intercourse but is thinking about needing skills to remain abstinent	Has not had sexual intercourse and is making plans to learn skills to remain abstinent	Has not had sexual intercourse and is currently using skills to stay abstinent until marriage	Not reported
Jeffries (2000) Exercise	Single question 5 choice response format	SS	No, I do not currently engage in regular exercise for 20 minutes or longer for 3 times or more per week, and I do not intend to in the next 6 months	No, I do not currently engage in regular exercise for 20 minutes or longer for 3 times or more per week, but I intend to in the next 6 months	No, I do not currently engage in regular exercise for 20 minutes or longer for 3 times or more per week, but I intend to in the next 30 days	Yes, I currently engage in regular exercise for 20 minutes or longer for 3 times or more per week, and have been for less than 6 months	Yes, I currently engage in regular exercise for 20 minutes or longer for 3 times or more per week, and have been for more than 6 months

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Johnson, J.L. et al. (2002) Bone Density Testing	Single question 5 choice response format	SS	Have you had a BDT in the past three years? No, and I do not intend to in the next 12 months	Have you had a BDT in the past three years? No, but I have one scheduled for the next 12 months	Have you had a BDT in the past three years? Yes, I have had one and intend to have another one within the next 3 years	Have you have a BDT in the past three years? Yes, I have had more than one and intend to have another within the next three years	Have you had a BDT in th past three years? Yes, I have had one, but I do not intend to have another one within the next three years
Johnson, J.L. et al. (2002) Calcium Intake	Single question 5 choice response format	SS	Adequate calcium intake for postmeno-pausal women (1200- 1500md/day) through some combination of food and supplement: "No, and I don't intend to in the next six months"	Adequate calcium intake for postmeno-pausal women (1200- 1500md/day) through some combination of food and supplement: "No, but I intend to in the next six months"	Adequate calcium intake for postmeno-pausal women (1200- 1500md/day) through some combination of food and supplement: "No, but I intend to in the next 30 days"	Adequate calcium intake for postmeno-pausal women (1200- 1500md/day) through some combination of food and supplement: "Yes, I have been but for less than six months"	Adequate calcium intake for postmeno-pausal women (1200- 1500md/day) through som combination of food and supplement: "Yes, I have been for more than six months"
Johnson, S.S. et al. (2002) Participat-ing in Decision Making for Medication	Single question 5 choice response format	SS	Working w/your Dr. to decide if you need medication and which medication is right for you and discussing w/ your Dr. any concerns you have about taking medications: "No, and I don't intend to in the next six months"	Working w/your Dr. to decide if you need medication and which medication is right for you and discussing w/ your Dr. any concerns you have about taking medications: "No, but I intend to in the next six months"	Working w/your Dr. to decide if you need medication and which medication is right for you and discussing w/ your Dr. any concerns you have about taking medications: "No, but I intend to in the next 30 days"	Working w/your Dr. to decide if you need medication and which medication is right for you and discussing w/ your Dr. any concerns you have about taking medications: "Yes, I have been but for less than six months"	Working w/your Dr. to decide if you need medication and which medication is right for you and discussing w/ your Dr. any concerns you have about taking medications: "Yes, I have been for more than six months"
Johnson et al. (2002) Smoking Cessation	Not reported	SS	Smoking and not intending to quit smoking within the next 6 months	Smoking, but are considering quitting smoking in the next 6 months	Smoking, but planning to quit smoking in the next 30 days, and have made a previous quit attempt	Have quit smoking in the past 6 months	Have quit smoking

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Jordan (2001) Anorexia- Recovery From	Single question 5 choice response format	SS	Not thinking about and not planning to recover from anorexia/bulimia in the next 6 months	Thinking about trying to recover in the next 6 months	Intended to start trying to recover in the next 30 days	Had been actively recovering from their eating disorder for fewer than 6 months	Had been in active recovery for more than 6 months
Jordan (2001) Bulimia- Recovery From	Single question 5- choice response format	SS	Not thinking about and not planning to recover from anorexia/ bulimia in the next 6 months	Thinking about trying to recover in the next 6 months	Intended to start trying to recover in the next 30 days	Had been actively recovering from their eating disorder for fewer than 6 months	Had been in active recovery for more than 6 months
Jordon et al. (2002) Exercise	5-question (Yes/No)	SS	Participants who did not exercise regularly and had no intention to begin in the next 6 months	Those who did not exercise regularly, but intended to start within the next 6 months, not the next 30 days	Those who did not exercise regularly, but intended to start in the next 30 days	Participants who did exercise regularly, but had not done so for a minimum of six months	Those who had been exercising regularly for more than six months
Katlin (2001) Drug treatment	Single question 5 choice response format	SS	No intention to stop alcohol or drug use.	Plans to stop alcohol or drug use in the next 6 months.	Plans to stop alcohol or drug use in the next month and has made one quit attempt in the past year (lasting 24 hours or longer).	Has completely stopped using alcohol or drugs less than 6 months ago.	Has completely stopped using alcohol or drugs more than 6 months ago.
Keller et al. (2000) Back Pain	5-item w/ restaging in Cont.; Prep restaged into Cont. if no previous attempt to change	SS	I do not intend to change my behavior	I intend to change my behavior in the next 6 months	I intend to change my behavior in the next 30 days (and in the last 6 months, have made steps to actively deal with the topic of good body posture, like reading a book or watching a TV program about it	I have kept a good body posture for less than 6 months	I have kept a good body posture for more than 6 months

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Keller et al. (2001) Fruit and Vegetable Consumption	Single question 5 choice response format	TTM	No, and I am not thinking about starting within the next 6 months	No, but I am planning to start to always use them within the next 6 months	No, but I am planning to start within the next 30 days	Action/ Maintenance	Action/ Maintenance
Keller et al. (2002) Oral Hygiene	Single question 5- choice response format	TTM	No, and I am not thinking about starting within the next 6 months	No, but I am planning to start to always use them within the next 6 months	No, but I am planning to start within the next 30 days	Yes, and I have been doing so for 6 months or less	Yes, and I have been doing so for 6 months or longer
Keller et al. (2003) Stress Manage- ment	Single question 5 choice response format	TTM	No, and I am not thinking about starting within the next 6 months	No, but I am planning to start to always use them within the next 6 months	No, but I am planning to start within the next 30 days	Yes, and I have been doing so for 6 months or less	Yes, and I have been doing so for 6 months or longer
Keller et al. (1998) Healthy Diet	Single question 5 choice response format	TTM	No, and I am not thinking about starting within the next 6 months	No, but I am planning to start to always use them within the next 6 months	No, but I am planning to start within the next 30 days	Yes, and I have been doing so for 6 months or less	Yes, and I have been doing so for 6 months or longer
Keller et al. (1999) Smoking Cessation	Single question 5 choice response format	SS	Are you currently smoking cigarettes? Yes, and I do not intend to quit	Are you currently smoking cigarettes? Yes, but I intend to quit in the next 6 months	Are you currently smoking cigarettes? Yes, but I intend to quit in the next 30 days (Restage PR to C if zero for "How often in the last 6 months have you deliberately tried not to smoke for at least 24 hours?")	Are you currently smoking cigarettes? No, I quit in the last 6 months	Are you currently smoking cigarettes? No, I quit more than 6 months ago

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
King et al. (1996) Exercise	4-item algorithm	SS	Has not engaged in exercise with no intention of exercising in the next 6 months	Has not engaged in exercise and is thinking about exercising in the next 6 months	Has participated in occasional exercise	Action/ Maintenance	Action/ Maintenance
King et al. (1996) Smoking Cessation	4-item algorithm	SS	Not considering changing their smoking behavior	Considering changing smoking behavior	Recently taken steps to reduce or quit smoking	Currently sticking to a smoking cessation plan	Not reported
Kraft et al. (1999) Smoking Cessation	Not reported	SS	Participants were smoking and had no intention to quit within the next 6 months	Participants who were smoking but seriously considering quitting within the next 6 months	Participants who were smoking but who were seriously considering quitting within the next 30 days and had made at least one quit attempt during the past year	Not reported	Not reported
Kremers et al. (2001) Smoking Acquisition	3-Precontem- plation stages	SS	3 Precontem-plation Stages	Never smoked but there is an interest in acquiring behavior in next six months	Never smoked but there is an interest in acquiring behavior in next month	Smoked cigarettes regularly, less than 6 months	Not reported
Lauby et al. (1998) Contraceptio n - General	Not reported	SS	No intention of using birth control or condoms in next 6 months	Intends to consistently use birth control or condoms in next 6 months	Intends to start using birth control or condoms consistently in the next month	Used birth control or condoms consistently for less than 6 months	Used birth control or condoms consistently for the last 6 months

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Lauby et al. (1998) Condom Use - Main	Not reported	SS	No intentions of consistently using birth control or condoms in the next 6 months	Intended to consistently use birth control or condoms in the next 6 months, but had not yet made a commitment to do so	Had intentions to start using birth control or condoms consistently in the next month and had used them inconsistently in the past 6 months	Had used birth control or condoms consistently for less than 6 months	Had used birth control or condoms consistently for 6 months or more
Lauby et al. (1998) Condom Use - Other	Not reported	SS	No intentions of consistently using birth control or condoms in the next 6 months	Intended to consistently use birth control or condoms in the next 6 months, but had not yet made a commitment to do so	Had intentions to start using birth control or condoms consistently in the next month and had used them inconsistently in the past 6 months	Had used birth control or condoms consistently for less than 6 months	Had used birth control or condoms consistently for 6 months or more
Lerner (1990) Delinquent Behavior	4-item (4 stages); single-choice format	SS	I don't need to change to stay out of trouble	I think I need to change to stay out of trouble, but I haven't done anything yet	Not used	I know I need to change to stay out of trouble, and I am doing something about it right now	I have already made the changes I need to stay out of trouble
Levesque et al. (2000) Administra- tive Change	Not reported	SS	Not intending to get involved in the next 6 months	Intending to get involved in the next 6 months	Intending to get involved in the next 30 days	Involved, but for less than 6 months	Involved for more than 6 months
Levesque (1998) Domestic Violence	3-component staging algorithm (intentional, cognitive, behavioral)	SS	Considered relationship fine the way it is or only planned to change in the distant future; and/or not considering to put an end to their violent behavior	Seriously considering ending their violent behavior in next 6 months	Seriously considering ending their violent behavior in next 30 days	Currently doing something to end violent behavior	Not reported

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Levesque et al. (1999) Collaborative Delivery Service	Single question 5 choice response format	SS	No intention of getting involved in Collaborative Service Delivery in the next 6 months	Intended to get involved in Collaborative Service Delivery in the next 6 months	Intended to get involved in Collaborative Service Delivery in the next 30 days	Been involved in Collaborative Service Delivery, but for less than 6 months	Been involved in Collaborative Service Delivery 6 months or longer
Levesque et al. (1999) Depression Prevention	Single question 5 choice response format	SS	Does not consistently use strategies to prevent depression, and does not intend to within the next 6 months	Does not consistently use strategies to prevent depression, but intends to within the next 6 months	Does not consistently use strategies to prevent depression, but intends to within the next 30 days	Does consistently use strategies to prevent depression, but for less than 6 months	Does consistently use strategies to prevent depression, and has for more than 6 months
Lowry (2000) Smokeless Tobacco Use	Missing	Missing	Missing	Missing	Missing	Missing	Missing
Maier (2002) Exercise	Single question 5 choice response format	TTM	No, and I am not thinking about starting within the next 6 months	No, but I am planning to start to always use them within the next 6 months	No, but I am planning to start within the next 30 days	Yes, and I have been doing so for 6 months or less	Yes, and I have been doing so for 6 months or longer
Ma et al. (2002) Fruit Intake	3-item algorithm	SS	No intention to eat more in the next 6 months	Intending to increase intake in the next 6 months	Intending to increase intake in the next 30 days	Has consumed 2 or more servings per day, for less than 6 months	Has consumed 2 or more servings per day for more than 6 months
Ma et al. (2002) Vegetable Intake	3-item algorithm	SS	No intention to eat more in the next 6 months	Intending to increase intake in the next 6 months	Intending to increase intake in the next 30 days	Has consumed 2 or more servings per day, for less than 6 months	Has consumed 2 or more servings per day for more than 6 months

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Maleszka (2002) Smoking Cessation	Single question 5 choice response format	TTM	No, and I am not thinking about starting within the next 6 months	No, but I am planning to start to always use them within the next 6 months	No, but I am planning to start within the next 30 days	Yes, and I have been doing so for 6 months or less	Yes, and I have been doing so for 6 months or longer
Manne et al. (2002) Colorectal Cancer Screening	Not reported	SS	Has not had screening and has no plan for any in the next year	(Relapse/Risk for Relapse) Has had one or more screening tests in the past year but is now off schedule and does not plan to have a screening test in the next year or is presently on schedule but does not plan to have a test that would place them on schedule in the next year	(Contemplation) Has not had a prior screening test but intends to have one in the next year or is off schedule after having prior screening but intends to have one in the next year	Has had a colonoscopy on schedule and plans on having another in a time- frame that would keep the person on schedule; or has had an FOBT and a sigmoidoscopy on schedule and plans to have both tests in the time period that would keep the person on schedule	Has had two or more colonoscopies on a regular schedule and plans to have another on schedule; or has had two or more FOBTs and two or more sigmoid- oscopies on a regular schedule and plans to have both tests in the time period that would keep the person on schedule
Marcus et al. (1992) Exercise	Contempla- tion Ladder (11pt)	SS	I currently do not exercise and do not intend to start exercising in the next 6 months	I currently do not exercise, but am thinking of starting to exercise in the next 6 months	I currently exercise some, but not regularly	I currently exercise regularly, but have only begun doing so within the last 6 months	I currently exercise regularly, but have only begun doing so within the last 6 months
Marcus et al. (1994) Exercise	Contempla- tion Ladder (11pt)	SS	I currently do not exercise and do not intend to start exercising in the next 6 months	I currently do not exercise, but am thinking of starting to exercise in the next 6 months	I currently exercise some, but not regularly	I currently exercise regularly, but have only begun doing so within the last 6 months	I currently exercise regularly and have done so for longer than 6 months
Mauriello (2001) Stress Manage- ment	4-item staging	SS	Not intend to effectively practice stress management in the next 6 months	Intend to effectively practice stress management in the next 6 months	Intend to effectively practice stress management in the next 30 days	Effectively practicing stress management for less than 6 months	Effectively practicing stress management for more than 6 months

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Mettler et al. (2000) Exercise	Contemplan- tion Ladder (11pt)	SS	I currently do not exercise and do not intend to start exercising in the next 6 months	I currently do not exercise, but am thinking of starting to exercise in the next 6 months	I currently exercise some, but not regularly	I currently exercise regularly, but have only begun doing so within the last 6 months	I currently exercise regularly and have done so for longer than 6 months
Migneault et al. (1997) Binge Drinking Acquisition	5-question (Yes/No)	TTM	Not intending to change	Considering changing their behavior in the next six months	Getting ready to change in the next 30 days	Having recently changed the behavior	Sustaining the change over time
Migneault et al. (1997) Binge Drinking Cessation	5-question (Yes/No)	TTM	Not intending to change	Considering changing their behavior in the next six months	Getting ready to change in the next 30 days	Having recently changed the behavior	Sustaining the change over time
Moll (2001) Physical activity	Single question 5 choice response format	TTM	No, and I am not thinking about starting within the next 6 months	No, but I am planning to start to always use them within the next 6 months	No, but I am planning to start within the next 30 days	Yes, and I have been doing so for 6 months or less	Yes, and I have been doing so for 6 months or longer
Morrison- Beedy et al. (2001) Condom Use-Main	4-item staging	SS	Never use condoms when having sex, and do not plan on starting to use condoms every time when having sex in the next 6 months	Never or almost never use condoms when having sex, but plan to start using condoms every time when having sex in the next 6 months	May use condoms sometimes when having sex, and plans on using condoms within the next 30 days	Uses condoms every time when having sex, and has been doing so for less than 6 months	Uses condoms every time when having sex, and has been doing so for more than 6 months

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Morrison- Beedy et al. (2001) Condom Use-Other	4-item staging	SS	Never use condoms when having sex, and do not plan on starting to use condoms every time when having sex in the next 6 months	Never or almost never use condoms when having sex, but plan to start using condoms every time when having sex in the next 6 months	May use condoms sometimes when having sex, and plans on using condoms within the next 30 days	Uses condoms every time when having sex, and has been doing so for less than 6 months	Uses condoms every time when having sex, and has been doing so for more than 6 months
Nigg et al. (1998) Exercise	5-item algorithm (Yes/No)	SS	Does not exercise regularly and has no intention of beginning in the next six months	Does not exercise regularly but intends to start within the next six months, but not 30 days	Does not exercise regularly but intends to start in next 30 days	Exercises regularly but not for the last six months	Exercised regularly for more than six months
Nigg et al. (1998) Exercise	5-item algorithm (Yes/No)	SS	Does not exercise regularly and has no intention of beginning in the next six months	Does not exercise regularly but intends to start within the next six months, but not 30 days	Does not exercise regularly but intends to start in next 30 days	Exercises regularly but not for the last six months	Exercised regularly for more than six months
Nigg & Courneya (1998) Exercise	5-item algorithm	SS	I currently do not engage in exercise in my leisure time and I am not intending to start	I currently do not engage in exercise in my leisure time but I intend to start within the next 6 months	I intend to exercise regularly within the next 30 days	I currently do engage in regular exercise in my leisure time, but have only begun to do so within the last 6 months	I currently do engage in regular exercise in my leisure time and I have done so for longer than 6 months
Noar et al. (1998) Condom Use - Vaginal Sex	4-question algorithm	SS	No intention to use condoms consistently in the next 6 months	Intentions to use condoms consistently in the next 6 months	Intentions to use condoms consistently in the next 30 days, and were currently using condoms almost every time they had sex	Consistently used condoms for less than 6 months	Consistently used condoms for 6 months or more
Norman et al. (2002) Sedentary Behavior	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Norman et al. (2002) Sedentary Behavior	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
O'Connell & Velicer (1988) Weight Loss	6-item algorithm	SS	Minimum of 5 lb. overweight and no thought of or action to lose weight	Acknowledgement of minimum 10 lb weight loss goal, but without consistently or successfully taking action	Not used	Recent success at losing 10 lb or more and continued action to lose additional weight	Minimum 10 lb loss in the past and current action being successfully taken to combat regaining weight
Otake & Shimai (2001) Smoking Acquisition	4-item algorithm (Yes/No)	SS	No interest in acquiring smoking behavior or intention of doing so in the future	Never smoked but there is an interest in acquiring behavior	Smoked in last year with a current interest in smoking	Smoking within the past month and exhibiting different dimensions of cigarette smoking	Not reported
Otake & Shimai (2001) Smoking Acquisition	4-item algorithm (Yes/No)	SS	No interest in acquiring smoking behavior or intention of doing so in the future	Never smoked but there is an interest in acquiring behavior	Smoked in last year with a current interest in smoking	Smoking within the past month and exhibiting different dimensions of cigarette smoking	Not reported
Pallonen et al. (1998) Smoking Acquisition	Current smoking status then 2- item algorithm with Yes/No responses	SS	No interest in acquiring smoking behavior or intention of doing so in the next six months	Never smoked but there is an interest in acquiring behavior in next six months	Never smoked but there is an interest in acquiring behavior in next month	Smoked cigarettes regularly, less than 6 months	Not reported

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Pallonen et al. (1998) Smoking Cessation	Current smoking status then 5- item algorithm with Yes/No responses	SS	Smokers who have smoked for more than six months with no immediate plans to quit	Smokers who have smoked for more than six months without history of serious quit attempts and are thinking about quitting	Smoked for more than six months with at least one serious quitting attempt and is thinking about quitting within the next 30 days	Has quit smoking within the last six months	Has quit smoking for more than six months
Park et al. (2003) Physicians Counseling Smokers	2-question algorithm	SS	Not yet active in providing SCIs to more than 80% of their patients who smoked and were not considering doing so in the next 6 months	Considering adopting SCIs for more than 80% of their patients who smoked within the next 6 months	Planning to adopt SCIs for more than 80% of their patients in the next month	Had been providing SCIs, for less than 6 months, to more than 80% of their patients who smoked	Had been providing SCIs to more than 80% of their patients who smoked, and had been doing so for more than 6 months
Perez (2001) Condom Use	Single question 5 choice response format	SS	No intention of consistently using condoms in the next 6 months	Thinking of consistently using condoms in the next 6 months	Planning to consistently use condoms in the next 30 days	Have been consistently using condoms for less than 6 months	Have been consistently using condoms for more than 6 months
Plummer et al. (2001) Smoking Acquisition	Past and Current smoking status then 3 item Yes/No response	SS	No interest in acquiring smoking behavior or intention of doing so in the next six months	Never smoked but there is an interest in acquiring behavior in next six months	Never smoked but there is an interest in acquiring behavior in next month	Not reported	Not reported
Plummer et al. (2001) Smoking Cessation	Past and Current smoking status then 3 item Yes/No response	SS	Smokers who have smoked for more than six months with no immediate plans to quit	Smokers who have smoked for more than six months without history of serious quit attempts and are thinking about quitting	Smoked for more than six months with at least one serious quitting attempt and is thinking about quitting within the next 30 days	Has quit smoking within the last six months	Has quit smoking for more than six months

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Prochaska, JJ et al. (2003) Smoking cessation	5-item measure (format unclear; DiClemente, 1991)	SS	Not seriously considering quitting within the next 6 months	Seriously considering quitting within the next 6 months, however they were not considering quitting within the next 30 days, had not made a quit attempt of 24 hours in past year, or both	Seriously considering quitting in the next 6 months and were planning to quit within the next 30 days, in addition they made a 24 hour quit attempt in past year	Not reported	Not reported
Prochaska et al. (1994) Condom Use -Anal Main	4- or 5- item algorithm	TTM	Reported the undesired status and did not intend to change in the next 6 months	Intended to change in the next 6 months	Not used	Had reached a particular criterion within the past 6 months	Had reached criterion more than 6 months prior to the study
Rakowski et al. (1992) Mammo- graphy	4-item(6 stages including Relapse Risk and Relapse)	SS	No prior mammogram and no plan for one in the coming year	No prior mammogram but planning for one in the next year, or one with no plans for the next year	Not used	One prior mammogram and planning for one in the next year	More than one prior mammogram and planning for one in the next year
Redding (1990) Safer Sex Decision Making	Not reported	TTM	Not considering changing or denying the need for it	Seriously thinking about changing	Not used	Action/ Maintenance	Action/ Maintenance
Redding (1993) Safer Sex Decision Making	4-item algorithm	SS	Participants who indicated that they had not changed their sexual behavior in response to AIDS and were not considering doing so	Participants who indicated that they were considering changing their sexual behavior	Not used	Participants who indicated that they had changed their sexual behavior in response to AIDS with consistency, but for less than 6 months	Participants who indicated that they had changed their sexual behavior in response to AIDS with consistency, but for 6 months or more

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Reed (1995) Exercise	Single question 5 choice response format	SS	No intention to start exercising in the next 6 months	Those not participating in regular physical activity but intending to do so in the next 6 months	Currently exercise, not regularly	Exercise regularly, for less than 6 months	Exercise regularly, for more than 6 months
Riley et al. (2000) Stress Manage- ment	Single question 5 choice response format	SS	Have you attempted to manage stress in your daily life? No, and I don't intend to for the next 6 month	Have you attempted to manage stress in your daily life? No, but I intend to in the next 6 month	Have you attempted to manage stress in your daily life? No, but I am planning to change in the next 30 days, and have perhaps made small steps toward that change	Have you attempted to manage stress in your daily life? Yes, but have been doing so for a period of less than 6 months	Have you attempted to manage stress in your daily life? Yes, and I am taking steps to sustain the change during a 6-month time frame and the prevention of relapse
Riley et al. (2003) Stress Manage- ment	Single question 5 choice response format	SS	Have you attempted to manage stress in your daily life? No, and I don't intend to for the next 6 month	Have you attempted to manage stress in your daily life? No, but I intend to in the next 6 month	Have you attempted to manage stress in your daily life? No, but I am planning to change in the next 30 days, and have perhaps made small steps toward that change	Have you attempted to manage stress in your daily life? Yes, but have been doing so for a period of less than 6 months	Have you attempted to manage stress in your daily life? Yes, and I am taking steps to sustain the change during a 6-month time frame and the prevention of relapse
Riley et al. (2003) Stress Manage- ment	Single question 5 choice response format	SS	Have you attempted to manage stress in your daily life? No, and I don't intend to for the next 6 month	Have you attempted to manage stress in your daily life? No, but I intend to in the next 6 month	Have you attempted to manage stress in your daily life? No, but I am planning to change in the next 30 days, and have perhaps made small steps toward that change	Have you attempted to manage stress in your daily life? Yes, but have been doing so for a period of less than 6 months	Have you attempted to manage stress in your daily life? Yes, and I am taking steps to sustain the change during a 6-month time frame and the prevention of relapse

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Robbins et al. (2001) Organ Donation	Not reported (Marcus et al., 1992; Velicer et al., 1985)	SS	I was opposed to organ donation for [name]; or I was not considering organ donation as an option for [name]	I was considering organ donation as an option for [name] but was not yet ready to make that decision	I was considering organ donation as an option for [name] and needed more information on the process to go ahead	I had already decided to donate [name's] and only needed to move the donation process along	Not reported
Robbins et al. (1999) Organ Donation	5-item algorithm with restaging based on behavioral intention	SS	Did not intend to become an organ donor in the next 6 months	Intended to become an organ donor in the next 6 months	Intended to become an organ donor in the next 30 days	Had been an organ donor for less than six months	Had been a donor for more than six months
Robbins et al. (2002) Organ Donation	Multiple question format	SS	Not thinking about making the decision to become an organ donor in the next 6 months	Planning on making the decision to become an organ donor in next 6 months or next 30 days	Made the decision to become an organ donor, but still have to document or tell their family	Action/ Maintenance	Action/ Maintenance
Robbins et al. (1999) Organ Donation	5-item algorithm with restaging based on behavioral intention	SS	Did not intend to become an organ donor in the next 6 months	Intended to become an organ donor in the next 6 months	Intended to become an organ donor in the next 30 days	Had been an organ donor for less than six months	Had been a donor for more than six months
Robbins et al. (2002) Organ	5-item algorithm with restaging based on	SS	Did not intend to become an organ donor in the next 6 months	Intended to become an organ donor in the next 6 months	Intended to become an organ donor in the next 30 days	Had been an organ donor for less than six months	Had been a donor for more than six months

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Donation	behavioral intention						
Rossi (1990) Radon Testing	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
Rossi (1990) Sunscreen Use	4- or 5-item algorithm	TTM	Do not currently use sunscreen and do not intend to change in the next 6 months	Do not currently use sunscreen, but intend to change in the next 6 months	Planning to use sunscreen in the next month or had made some changes but were not at a particular criterion	Began using sunscreen within the past 6 months	Have used sunscreen for more than 6 months prior to the study
Rossi et al. (2001) Cocaine Use	Not reported	SS	Not planning to quit using cocaine in the next 6 months	Planning to quit cocaine use within the next 6 months	Not used	Stopped using cocaine within the past 6 months	No use of cocaine for 6 months or more
Rossi, SR et al. (2001) Dietary Fat Reduction	3 step algorithm (Green & Rossi 1998)	TTM	Not ready and thus have no intention of changing behavior	Seriously considering changing behavior in the next 6 months	Not only ready to change, but intend to do so sometime in the immediate future	Recently changed their behavior, typically for 6 months or less	Have sustained the behavioral change, usually for more than 6 months
Rossi, SR et al. (2001) Dietary Fat Reduction	3 step algorithm (Green & Rossi 1998)	TTM	Individuals who are not ready and thus have no intention of changing behavior	Individuals who are seriously considering changing behavior in the next six months	Not only ready to change, but intend to do so sometime in the immediate future	Recently changed their behavior, typically for 6 months or less	Have sustained the behavioral change, usually for more than 6 months

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Rossi, SR et al. (2001) Fruit & Vegetable Consumption	Two-step, 4- question algorithm	SS	Individuals who are not ready to eat five fruits and vegetables a day and have no intentions of doing so in the next six months	Thinking about eat five fruits and vegetables a day and intend to do so in the next six months	Ready to eat five fruits and vegetables a day and intend to do so in the next thirty days	Have recently begun to eat five fruits and vegetables a day, but have been doing so for six months or less	Have sustained consumption of five fruits and vegetables daily for more than six months
Rossi, SR et al. (1993) Dietary Fat Reduction	Not reported	Not reported	Not reported	Not reported	Not used	Not reported	Not reported
Ruggiero et al. (2000) Smoking Cessation	Single question 5 choice response format	SS	No intention to quit smoking in the next 6 months or during pregnancy	Seriously considering quitting in the next 6 months or during pregnancy	Considering quitting in the next 30 days, has attempted to quit in the last 24 hours during current pregnancy or the past year	Not reported	Not reported
Ruggiero et al. (2003) Glucose Testing	Not reported	TTM	Not intending to change in the foreseeable future	Seriously intending to take action in the foreseeable future	Seriously intending to take action in the immediate future	Recently reached the goal behavior	Continued the goal behavior for at least 6 months
Sarkin et al. (2001) Exercise	Single question 5 choice response format	SS	Does not exercise and has no intention to do so in the next 6 months	Does not exercise but intends to do so in next 6 months	Does not exercise but intends to in next 30 days	Does exercise, but for less than the last 6 months	Does exercise and has been for more than the last 6 months

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Schorling (1995) Smoking cessation	Not reported	SS	Did not plan to quit smoking in the next 6 months.	Planned to quit smoking in the next 6 months, but not in the next 30 days or planned to quit in the next 30 days, but had not made a serious cessation attempt.	Planned to quit in the next 30 days, and has had a serious cessation attempt.	Not reported	Not reported
Schorling (1995) Smoking cessation	Not reported	SS	Did not plan to quit smoking in the next 6 months.	Planned to quit smoking in the next 6 months, but not in the next 30 days or planned to quit in the next 30 days, but had not made a serious cessation attempt.	Planned to quit in the next 30 days, and has had a serious cessation attempt.	Not reported	Not reported
Schumann et al. (2003) Smoking Cessation	4-item algorithm	SS	Not intending to quit smoking within the next 6 months	Intending to quit smoking within the next 6 months	Intending to quit smoking within the next 4 weeks and reporting a serious quit attempt in the past year	Reporting abstinence from smoking for less than 6 months	Reporting abstinence from smoking for more than 6 months
Shulze (2003) Daily Use of Dental Floss	Single question 5 choice response format	Not reported	No, and I am not thinking about starting within the next 6 months	No, but I am planning to start to always use them within the next 6 months	No, but I am planning to start within the next 30 days	Yes, and I have been doing so for 6 months or less	Yes, and I have been doing so for 6 months or longer
Silverman (1995) Condom Use	Single question 5 choice response format	SS	No, (I do not always use condoms when I have sex) and I am not thinking about starting within the next 6 months	No, (I do not always use condoms when I have sex) but I am planning to start to always use them within the next 6 months	No, (I do not always use condoms when I have sex) but I am planning to start within the next 30 days	Yes, (I do not always use condoms when I have sex) and I have been doing so for 6 months or less	Yes, (I do not always use condoms when I have sex) and I have been doing so for 6 months or longer

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Silverman (1995) Condom Use	Single question 5 choice response format	SS	No, (I do not always use condoms when I have sex) and I am not thinking about starting within the next 6 months	No, (I do not always use condoms when I have sex) but I am planning to start to always use them within the next 6 months	No, (I do not always use condoms when I have sex) but I am planning to start within the next 30 days	Yes, (I do not always use condoms when I have sex) and I have been doing so for 6 months or less	Yes, (I do not always use condoms when I have sex) and I have been doing so for 6 months or longer
Snow et al. (1992) Smoking Cessation	3-item algorithm	SS	Not seriously considering quitting smoking in the next 6 months	Intending to quit within the next 6 months	Intention to quit within the next 30 days	Not reported	Not reported
Stark et al. (1998) Condom use- Main	3-question algorithm	SS	Neither used condoms consistently nor intended to use them consistently within 6 months	Intended consistent condom use within the next 6 months	Were not using condoms consistently, but intended to do so within the next month	Using condoms consistently, but for 6 months or less	Reported using condoms consistently (every time they had intercourse) for more than 6 months
Stark et al. (1998) Condom Use-Other	3-question algorithm	SS	Neither used condoms consistently nor intended to use them consistently within 6 months	Intended consistent condom use within the next 6 months	Were not using condoms consistently, but intended to do so within the next month	Using condoms consistently, but for 6 months or less	Reported using condoms consistently (every time they had intercourse) for more than 6 months
Susenbeth (1999) Condom Use	Single question 5 choice response format	TTM	No, and I am not thinking about starting within the next 6 months	No, but I am planning to start to always use them within the next 6 months	No, but I am planning to start within the next 30 days	Yes, and I have been doing so for 6 months or less	Yes, and I have been doing so for 6 months or longer
Tseng (2000) Exercise	Single question 5 choice response	SS	Currently do not exercise and do not intend to start exercise in the next 6 months	Currently do not exercise, but am thinking about starting to exercise in the next 6 months	Currently exercise some, but not regularly	Currently exercise regularly but have only begun doing so within the last 6 months	Currently exercise regularly and have done so for longer than 6 months

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
	format (Marcus & Simkin 1993)						
Tsoh (1993) Quitting Drugs	Single question 5 choice response format	SS	I do not intend to stay off drugs completely in the next 6 months	I intend to stay off drugs completely in the next six months but not in the next 30 days	I intend to stay off drugs completely in the next 30 days	I have stayed off any drug use for less than 6 months	I have stayed off any drug use for more than 6 months
Van Marter et al. (2003) Bullying Prevention	Single question 5 choice response format (w/ 6- item behavior identifier)	SS	Involved in at least one role related to bullying and not intending to change their behavior in the next 6 months	Involved in at least one role related to bullying and intending to change their behavior in the next 6 months	Involved in at least one role related to bullying and intending to change in the next 30 days	Not involved in any of the three roles of bullying	Not involved in any of the three roles of bullying
Velicer et al. (1985) Smoking Cessation	Not reported	SS	No intention of quitting in the near future	Currently smoking and intending to quit in the next year	Currently smoking, but had quit for a period of at least 24 hours within the last 6 months	Currently not smoking, but had smoked within the last 6 months	Currently not smoking, and had not smoked for at least 6 months
Wakui et al. (2002) Exercise	Single question 5 choice response format	SS	"I presently do not exercise and do not plan to start exercising in the next six months"	"I presently do not exercise but I have been thinking about starting to exercise within the next six months"	"I presently get some exercise, but not regularly"	"I presently exercise on a regular basis, but I began only within the past six months"	"I presently get some exercise and have been exercising regularly for longer than six months"

Table B.1 (continued)

Source (Year) Target Behavior	Type of Algorithm	TTM or Study Specific (SS)	Precontemplation	Contemplation	Preparation	Action	Maintenance
Whyte (2002) Dietary Fat Reduction	Multiple question format (5 questions; Curry et al., 1992)	SS	Not currently limiting dietary fat intake and have not thought about doing so in the past month	Not currently limiting dietary fat intake, but individuals have thought about doing so in the past month and are either mildly confident or not at all confident about making changes in the next month	Not currently limiting dietary fat intake, but individuals have thought about doing so in the past month and are somewhat or very confident that they will make some of these changes in the next month	Limiting dietary fat intake for 6 months or less	Limiting dietary fat intake for longer than 6 months
Wright et al. (2002) Weight Bearing Exercise	Single question 5 choice response format	SS	Engaging in any activity done on the feet with the bones supporting the body's weight for at least 30 min, a day, and at least three times per week: "No, and I don't intend to in the next six months"	Engaging in any activity done on the feet with the bones supporting the body's weight for at least 30 min, a day, and at least three times per week: "No, but I intend to in the next six months"	Engaging in any activity done on the feet with the bones supporting the body's weight for at least 30 min, a day, and at least three times per week: "No, but I intend to in the next 30 days"	Engaging in any activity done on the feet with the bones supporting the body's weight for at least 30 min, a day, and at least three times per week: "Yes, I have been but for less than six months"	Engaging in any activity done on the feet with the bones supporting the body's weight for at least 30 min, a day, and at least three times per week: "Yes, I have been for more than six months"

Table B.2

Supplemental Matrix of Coded Variables

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Acton et al. (2001)	205	Pros and Cons of Smoking	Reversed	Hedge's	NR	Cessation	Peer-Review Journal	English	Unhealthy	Daily	NA
Ahijevych et al. (1999)	95	Pros and Cons of Smoking	Reversed	Hedge's	How Important	Cessation	Peer-Review Journal	English	Unhealthy	Daily	NA
Bane et al. (1999)	281	Pros and Cons of Smoking	Reversed	Standard Score	How Important	Cessation	Peer-Review Journal	English	Unhealthy	Daily	PC-C
Banikarim et al. (2003)	135	Pros and Cons of STD Screening	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	English	Healthy	Situational	PR-A
Banikarim et al. (2003)	201	Pros and Cons of STD Screening	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	English	Healthy	Yearly +	Multiple
Basler et al. (1999)	451	Pros and Cons of Exercise	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	Non-English	Healthy	Daily	PR-A
Block et al. (1998)	127	Pros and Cons of Condom Use	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Situational	NA
Borland et al. (2000)	304	Pros and Cons of Smoking	Reversed	Hedge's	NR	Cessation	Peer-Review Journal	English	Unhealthy	Daily	NA

Table B.2 (continued)

Source (Year)	N/ data -set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Boudreaux et al. (1998)	554	Pros and Cons of Smoking	Reversed	Hedge's	How Important	Cessation	Peer-Review Journal	English	Unhealthy	Daily	C-PR
Buckworth et al. (2002)	57	Pros and Cons of Exercise	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Healthy	Daily	NA
Callaghan et al. (2002)	298	Pros and Cons of Exercise	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	Non-English	Healthy	Daily	NA
Chamot et al. (2001)	885	Pros and Cons of mammography screening	Actual	Standard Score	Agree / Disagree	Acquisition	Peer-Review Journal	Non-English	Healthy	Yearly +	PC-C
DiClemente et al. (1991)	1466	Pros and Cons of Smoking	Reversed	Hedge's	Agree / Disagree	Cessation	Peer-Review Journal	English	Unhealthy	Daily	C-PR
Dijkstra et al. (1996)	275	Pros and Cons of Quitting Smoking	Actual	Hedge's	Other	Cessation	Peer-Review Journal	Non-English	Unhealthy	Daily	C-PR
Dijkstra et al. (1998)	1540	Pros and cons of quitting smoking	Actual	Standard Score	Other	Cessation	Peer-Review Journal	Non-English	Unhealthy	Daily	OK

Table B.2 (continued)

Source (Year)	N/ data -set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Dryfoos (1996)	338	Pros and Cons of Glucose Testing	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Daily	PR-A
Dryfoos (1996)	1048	Pros and Cons of Medication	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Daily	A-M
Eaton et al. (1992)	165	Pros and Cons of Physicians Assisting Smokers	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Other	Situational	PC-C
Evers et al. (2001)	270	Pros and Cons of Condom Use	Actual	Standard Score	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Situational	PR-A
Evers et al. (2001)	293	Pros and Cons of Cessation of Drug Use	Actual	Hedge's	How Important	Cessation	Non-Peer-Review Journal	Non-English	Unhealthy	Daily	Multiple
Evers et al. (2001)	602	Pros and Cons of Waiting to Have Sex	Reversed	Standard Score	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Situational	PC-C

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Evers et al. (2003)	241	Pros and Cons of Managing Stress	Actual	Hedge's	NR	Acquisition	Non-Peer-Review Journal	English	Unhealthy	Daily	PC-C
Fahrenwald et al. (2003)	30	Pros and Cons of Exercise	Actual	Hedge's	Agree / Disagree	Acquisition	Peer-Review Journal	English	Healthy	Daily	C-PR
Fava et al. (1995)	4144	Pros and Cons of Smoking	Reversed	Hedge's	How Important	Cessation	Peer-Review Journal	English	Unhealthy	Daily	PC-C
Frenn et al. (2003)	74	Pros and Cons of Eating a Diet w/30% or fewer calories from fat	Actual	Hedge's	NR	Cessation	Peer-Review Journal	English	Healthy	Daily	C-PR
Galavotti et al. (1995)	233	Pros and Cons of General Contraception	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	English	Healthy	Situational	C-PR
Galavotti et al. (1995)	233	Pros and Cons of Condom Use with Main Partner	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	English	Healthy	Situational	C-PR

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Galavotti et al. (1995)	122	Pros and Cons of Condom Use with Other Partners	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	English	Healthy	Situational	Multiple
Gazabon (2000)	340	Pros and cons of using condoms	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Situational	C-PR
Giebel (1999)	235	Pros and Cons of Quitting Smoking	Actual	Hedge's	How Important	Cessation	Non-Peer-Review Journal	Non-English	Unhealthy	Daily	Multiple
Giebel (1999)	361	Pros and Cons of Healthy Diet	Actual	Hedge's	How Important	Cessation	Non-Peer-Review Journal	Non-English	Healthy	Daily	PC-C
Giebel (1999)	361	Pros and Cons of Exercising	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	Non-English	Healthy	Daily	A-M
Giebel (1999)	244	Pros and Cons of Stress Reduction	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	Non-English	Unhealthy	Daily	PR-A

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Grimley et al. (1995)	244	Pros and Cons of General Contraception	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Healthy	Situational	PR-A
Grimley et al. (1995)	78	Pros and Cons of Condom Use with Main Partner	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Healthy	Situational	C-PR
Grimley et al. (1995)	134	Pros and Cons of Condom Use with Other Partners	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Healthy	Situational	C-PR
Happel (2002)	255	Pros and Cons of Fruit and Vegetable Consumption	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	Non-English	Healthy	Daily	C-PR
Hempelmann (2003)	448	Pros and Cons of Tooth-Friendly Diet	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	Non-English	Healthy	Daily	PR-A

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Henderson (1999)	214	Pros and Cons of Breast Self-Examination	Actual	Hedge's	Agree / Disagree	Acquisition	Non-Peer-Review Journal	English	Healthy	Daily	PR
Herrick et al. (1997)	392	Pros and Cons of Reducing Dietary Fat Consumption	Reversed	Hedge's	Agree / Disagree	Cessation	Peer-Review Journal	English	Healthy	Daily	PR-A
Herrick et al. (1997)	389	Pros and Cons of Exercise	Actual	Hedge's	Agree / Disagree	Acquisition	Peer-Review Journal	English	Healthy	Daily	PR-A
Herrick et al. (1997)	393	Pros and Cons of Smoking	Reversed	Hedge's	Agree / Disagree	Cessation	Peer-Review Journal	English	Unhealthy	Daily	PR-A
Herrick et al. (1997)	392	Pros and Cons for Protection from Sun Exposure	Actual	Hedge's	Agree / Disagree	Acquisition	Peer-Review Journal	English	Healthy	Situational	PR-A
Herzog et al. (1999)	1390	Pros and Cons of Smoking	Reversed	Hedge's	How Important	Cessation	Peer-Review Journal	English	Unhealthy	Daily	NA
Hulton (2001)	103	Pros and Cons of Abstinence	Reversed	Hedge's	NR	Acquisition	Peer-Review Journal	English	Healthy	Situational	No Cross

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Hulton (2001)	622	Pros and Cons of Abstinence	Reversed	Hedge's	NR	Acquisition	Peer-Review Journal	English	Healthy	Situational	PC-C
Jeffries (2001)	537	Pros and Cons of Exercising	Actual	Standard Score	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Daily	PC-C
Johnson, J.L. et al. (2002)	465	Pros and Cons of Bone Density Testing	Actual	Standard Score	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Daily	C-PR
Johnson, J.L. et al. (2002)	419	Pros and Cons of Calcium Intake	Actual	Standard Score	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Daily	Multiple
Johnson, S.S. et al. (2002)	185	Pros and Cons of Participating in Decision Making for Medication	Actual	Standard Score	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Situational	PC-C
Johnson, S.S. et al. (2002)	296	Pros and Cons of Smoking	Reversed	Hedge's	How Important	Cessation	Peer-Review Journal	English	Unhealthy	Daily	PC-C

Table B.2 (continued)

Source (Year)	N/ data -set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Jordan (2002)	276	Pros and Cons of Recovering from Anorexia	Actual	Hedge's	How Important	Cessation	Non-Peer-Review Journal	English	Unhealthy	Daily	C-PR
Jordan (2002)	148	Pros and Cons of Recovering from Bulimia	Actual	Hedge's	How Important	Cessation	Non-Peer-Review Journal	English	Unhealthy	Daily	Multiple
Jordan et al. (2002)	223	Pros and Cons of Exercise	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Healthy	Daily	C-PR
Katlin (2001)	114	Pros and Cons of Using Drugs/Alcohol	Reversed	Standard Score	How Important	Cessation	Non-Peer-Review Journal	English	Unhealthy	Daily	A-M
Keller et al. (2001)	149	Pros and Cons of Keeping Body Posture	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	Non-English	Healthy	Daily	PR-A
Keller et al. (2001)	282	Pros and Cons of Fruit and Vegetable Consumption	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	Non-English	Healthy	Daily	PC-C

Table B.2 (continued)

Source (Year)	N/ data -set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Keller et al. (2002)	276	Pros and Cons of Oral Hygiene	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	Non-English	Healthy	Daily	C-PR
Keller et al. (2003)	665	Pros and Cons of Stress Management	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	Non-English	Unhealthy	Daily	PC-C
Keller (1998)	405	Pros and Cons of Healthy Eating	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	Non-English	Healthy	Daily	PC-C
Keller (1998)	407	Pros and Cons of Healthy Eating	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	Non-English	Healthy	Daily	No Cross
Keller et al. (1999)	401	Pros and Cons of Quitting Smoking	Actual	Hedge's	How Important	Cessation	Peer-Review Journal	Non-English	Unhealthy	Daily	C-PR
King et al. (1996)	332	Pros and Cons of Exercise	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Healthy	Daily	Multiple
King et al. (1996)	296	Pros and Cons of Smoking	Reversed	Hedge's	How Important	Cessation	Peer-Review Journal	English	Unhealthy	Daily	PC-C

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Kraft et al. (1999)	421	Pros and Cons of Smoking	Reversed	Standard Score	How Important	Cessation	Peer-Review Journal	Non-English	Unhealthy	Daily	PC-C
Kremers et al. (2001)	21535	Pros and Cons of Smoking	Actual	Standard Score	NR	Acquisition	Peer-Review Journal	Non-English	Prevention	Situational	OK
Lauby et al. (1998)	2361	Pros and Cons of General Contraception	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	English	Healthy	Situational	C-PR
Lauby et al. (1998)	2925	Pros and Cons of Condom Use with Main Partner	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	English	Healthy	Situational	PC-C
Lauby et al. (1998)	1213	Pros and Cons of Condom Use with Other Partners	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	English	Healthy	Situational	PR-A
Lerner (1990)	159	Pros and Cons of Changing Delinquent Behavior	Actual	Hedge's	How Important	Cessation	Non-Peer-Review Journal	English	Other	Situational	C-A

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Levesque et al. (2000)	134	Pros and Cons of getting involved in the change-over to PeopleSoft	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Other	Situational	PC-C/PR
Levesque (1999)	256	Pros and Cons of Ending Violence	Actual	Hedge's	Agree / Disagree	Cessation	Non-Peer-Review Journal	English	Other	Situational	Multiple
Levesque et al. (1999)	31	Pros and Cons of Collaborative Service Delivery	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	English	Other	Situational	C-A
Levesque et al. (1999)	181	Pros and Cons of Using Depression Prevention Strategies	Actual	Standard Score	How Important	Acquisition	Non-Peer-Review Journal	English	Other	Daily	Multiple
Lowry (2000)	99	Pros and Cons of Using Smokeless Tobacco	Reversed	Hedge's	How Important	Cessation	Non-Peer-Review Journal	English	Unhealthy	Daily	NA

Table B.2 (continued)

Source (Year)	N/ data -set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Maier (2002)	251	Pros and Cons of Exercise	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	Non-English	Healthy	Daily	PR-A
Ma et al. (2002)	1545	Pros and Cons of Fruit Intake	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	English	Healthy	Daily	C-PR
Ma et al. (2002)	1545	Pros and Cons of Vegetable Intake	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	English	Healthy	Daily	C-PR
Maleszka (2002)	216	Pros and Cons of Quitting Smoking	Actual	Hedge's	How Important	Cessation	Non-Peer-Review Journal	Non-English	Unhealthy	Daily	C-PR
Manne et al. (2002)	480	Pros and Cons of Colorectal Cancer Screening	Actual	Hedge's	Agree / Disagree	Acquisition	Peer-Review Journal	English	Healthy	Yearly +	OK
Marcus et al. (1992)	717	Pros and Cons of Exercise	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Healthy	Daily	C-PR
Marcus et al. (1994)	431	Pros and Cons of Exercise	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Healthy	Daily	PR-A

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Mauriello (2001)	294	Pros and Cons of Managing Stress	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Unhealthy	Daily	PC-C
Mettler et al. (2000)	690	Pros and Cons of Exercise	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Healthy	Daily	NA
Migneault et al. (1997)	421	Pros and Cons of Alcohol Use	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Prevention	Situational	PC-C
Migneault et al. (1997)	255	Pros and Cons of Alcohol Use	Reversed	Hedge's	How Important	Cessation	Peer-Review Journal	English	Unhealthy	Situational	PR-A
Moll (2001)	287	Pros and Cons of Exercise	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	Non-English	Healthy	Daily	C-PR
Morrison-Beedy et al. (2001)	254	Pros and Cons of Condom Use with Main Partners	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	English	Healthy	Situational	NA
Morrison-Beedy et al. (2001)	110	Pros and Cons of Condom Use With Other Partners	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	English	Healthy	Situational	NA

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Nigg et al. (1998)	240	Pros and Cons of Exercise	Actual	Standard Score	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Daily	C-PR
Nigg et al. (1998)	346	Pros and Cons of Exercise	Actual	Standard Score	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Daily	PR-A
Nigg & Courneya (1998)	819	Pros and Cons of Exercise	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Healthy	Daily	PR-A
Noar et al (1998)	168	Pros and Cons of Condom Use	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Situational	C-PR
Norman et al. (2002)	178	Pros and Cons of sedentary behavior	Actual	Standard Score	How Important	Cessation	Non-Peer-Review Journal	English	Unhealthy	Daily	C-PR
Norman et al. (2002)	254	Pros and Cons of sedentary behavior	Actual	Standard Score	How Important	Cessation	Non-Peer-Review Journal	English	Unhealthy	Daily	C-PR
O'Connell & Velicer (1988)	123	Pros and Cons of Weight Loss	Actual	Hedge's	How Important	Cessation	Peer-Review Journal	English	Unhealthy	Daily	PC-C

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Otake & Shimai (2001)	556	Pros and Cons of Smoking	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	Non-English	Prevention	Situational	PC-C
Otake & Shimai (2001)	1002	Pros and Cons of Smoking	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	Non-English	Prevention	Situational	PC-C
Pallonen et al. (1998)	505	Pros and Cons of Smoking	Actual	Hedge's	Agree / Disagree	Acquisition	Peer-Review Journal	English	Prevention	Situational	NA
Pallonen et al. (1998)	254	Pros and Cons of Smoking	Reversed	Hedge's	Agree / Disagree	Cessation	Peer-Review Journal	English	Unhealthy	Daily	NA
Park et al. (2003)	259	Pros and Cons of Providing Smoking Cessation Interventions	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Other	Situational	C-PR
Perez (2001)	828	Pros and Cons of Condom Use	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Situational	C-PR
Plummer et al. (2001)	2010	Pros and Cons of Smoking	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Prevention	Situational	NA

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Plummer et al. (2001)	798	Pros and Cons of Smoking	Reversed	Hedge's	How Important	Cessation	Peer-Review Journal	English	Unhealthy	Daily	Multiple
Prochaska, JJ et al. (2003)	322	Pros and Cons of Smoking	Reversed	Hedge's	How Important	Cessation	Non-Peer-Review Journal	English	Unhealthy	Daily	C-PR
Prochaska et al. (1994)	325	Pros and Cons of Condom Use for Anal Sex w/Main Partner	Actual	Standard Score	How Important	Acquisition	Peer-Review Journal	English	Healthy	Situational	PC-C
Rakowski et al. (1992)	141	Pros and Cons of Obtaining a Mamogram	Actual	Hedge's	Agree / Disagree	Acquisition	Peer-Review Journal	English	Healthy	Yearly +	C-A
Redding (1990)	213	Pros and Cons of Safer Sex	Actual	Standard Score	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Situational	PC-C
Redding (1993)	305	Pros and Cons of Safer Sex	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Situational	C-A

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Reed (1996)	271	Pros and Cons of Exercise	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Daily	C-PR
Riley et al. (2000)	19	Pros and Cons of Managing Stress	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Unhealthy	Daily	Multiple
Riley et al. (2003)	42	Pros and Cons of Managing Stress	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Unhealthy	Daily	Multiple
Riley et al. (2003)	126	Pros and Cons of Managing Stress	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Unhealthy	Daily	Multiple
Robbins et al. (2001)	163	Pros and Cons of Organ Donation	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Other	Situational	C-PR
Robbins (1999)	280	Pros and Cons of Organ Donation	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Other	Yearly +	C-PR

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Robbins (2002)	333	Pros and Cons of Organ Donation	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Other	Yearly +	C-PR
Robbins (1999)	475	Pros and Cons of Organ Donation	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Other	Yearly +	C-PR
Robbins (2002)	2233	Pros and Cons of Organ Donation	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Other	Yearly +	Multiple
Rossi (1990)	698	Pros and Cons of Testing for Radon	Actual	Standard Score	How Important	Acquisition	Non-Peer-Review Journal	English	Other	Yearly +	PC-C
Rossi (1990)	136	Pros and Cons for Using Sunscreens	Actual	Standard Score	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Situational	C-PR
Rossi et al. (2001)	298	Pros and Cons of Cocaine Use	Reversed	Hedge's	How Important	Cessation	Non-Peer-Review Journal	English	Unhealthy	Daily	Multiple

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Rossi, SR et al. (2001)	2639	Pros and Cons of Reducing Dietary Fat Consumption	Reversed	Hedge's	How Important	Cessation	Peer-Review Journal	English	Healthy	Daily	C-PR
Rossi, SR et al. (2001)	1204	Pros and Cons of Reducing Dietary Fat Consumption	Reversed	Hedge's	How Important	Cessation	Non-Peer-Review Journal	English	Healthy	Daily	Multiple
Rossi, SR et al. (2001)	353	Pros and Cons of Fruit and Vegetable Consumption	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Daily	C-PR
Rossi, SR et al. (1993)	196	Pros and Cons of Reducing Dietary Fat Consumption	Reversed	Hedge's	How Important	Cessation	Non-Peer-Review Journal	English	Healthy	Daily	C-A
Ruggiero et al. (2000)	206	Pros and Cons of Smoking	Reversed	Standard Score	How Important	Cessation	Peer-Review Journal	English	Unhealthy	Daily	PC-C
Ruggiero et al. (2003)	668	Pros and Cons of Glucose Testing	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Daily	NA

Table B.2 (continued)

Source (Year)	N/ data -set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Sarkin et al. (2001)	670	Pros and Cons of Exercise	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	English	Healthy	Daily	C-PR
Schmalting et al. (2000)	53	Pros and cons of taking asthma medication as prescribed.	Actual	Standard Score	Agree / Disagree	Acquisition	Peer-Review Journal	English	Healthy	Daily	PR-A
Schorling (1995)	243	Pros and Cons of Smoking	Reversed	Hedge's	How Important	Cessation	Peer-Review Journal	English	Unhealthy	Daily	PC-C
Schorling (1995)	292	Pros and Cons of Smoking	Reversed	Hedge's	How Important	Cessation	Peer-Review Journal	English	Unhealthy	Daily	PC-C
Schumann et al. (2003)	877	Pros and Cons of Quitting Smoking	Actual	Hedge's	How Important	Cessation	Peer-Review Journal	Non-English	Unhealthy	Daily	NA
Shulze (2003)	453	Pros and Cons of Using Dental Floss	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	Non-English	Healthy	Daily	Multiple

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Silverman (1995)	223	Pros and Cons of Condom Use	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	Non-English	Healthy	Situational	Multiple
Silverman (1995)	230	Pros and Cons of Condom Use	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Situational	Multiple
Snow et al. (1992)	191	Pros and Cons of Smoking	Reversed	Standard Score	How Important	Cessation	Peer-Review Journal	English	Unhealthy	Daily	PC-C
Stark et al. (1998)	754	Pros and of Condom Use	Actual	Hedge's	Other	Acquisition	Peer-Review Journal	English	Healthy	Situational	NA
Stark et al. (1998)	822	Pros of Condom Use	Actual	Hedge's	Other	Acquisition	Peer-Review Journal	English	Healthy	Situational	NA
Susenbeth (2000)	96	Pros and Cons of Condom Use	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	Non-English	Healthy	Situational	Multiple
Tseng (2001)	154	Pros and Cons of Exercise	Actual	Hedge's	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Daily	PR-A

Table B.2 (continued)

Source (Year)	N/ data-set	Description of Pros and Cons	Direction of Pros and Cons	Calculation Method	Scale Instruct	Cess/ Acq	Publication Status	Language	Health Status	Frequency	Cross-over
Tsoh (1993)	169	Pros and Cons of Quitting Drugs	Actual	Hedge's	How Important	Cessation	Non-Peer-Review Journal	English	Healthy	Daily	C-PR
Van Marter et al. (2003)	473	Pros and Cons of treating self and others with respect	Actual	Hedge's	How Important	Cessation	Non-Peer-Review Journal	English	Other	Situational	C-PR
Velicer et al. (1985)	930	Pros and Cons of Smoking	Reversed	Hedge's	How Important	Cessation	Peer-Review Journal	English	Unhealthy	Daily	Multiple
Wakui et al. (2002)	450	Pros and Cons of Exercise	Actual	Hedge's	How Important	Acquisition	Peer-Review Journal	Non-English	Healthy	Daily	PC-C
Whyte (2003)	416	Pros and Cons of Healthy Eating	Actual	Standard Score	Agree / Disagree	Cessation	Non-Peer-Review Journal	English	Healthy	Daily	PR-A
Wright et al. (2002)	250	Pros and Cons of Weight-Bearing Exercise	Actual	Standard Score	How Important	Acquisition	Non-Peer-Review Journal	English	Healthy	Daily	PR-A

Appendix C

Figure C.1. Composite Pros and Cons Graphs for 33 Target Behaviors.

Note. Only target behaviors with data for all four transitions are included.

Binge Drinking Cessation (N=1)

Bone Density Testing (N=1)

Breast Self-Examination (N=1)

Bulimia – Recovery From (N=1)

Calcium Intake (N=1)

Condom Use - General (N=5)

Condom Use with Main Partner (N=5)

Condom Use with Other Partners (N=5)

Condom Use – Vaginal Sex (N=1)

Contraception – General (N=3)

Daily Use of Dental Floss (N=1)

Decreasing Drug Use (N=1)

Depression Prevention (N=1)

Dietary Fat Reduction (N=7)

Drug Treatment (N=1)

Exercise (N=20)

Fruit & Vegetable Consumption (N=2)

Fruit Intake (N=1)

Glucose Testing (N=2)

Healthy Diet (N=2)

Oral Hygiene (N=1)

Organ Donation – Intentions (N=4)

Participating in Decision Making for Medication (N=1)

Physicians Assisting Smokers (N=1)

Sedentary Behavior (N=2)

Smoking Cessation (N=24)

STD Screening (N=2)

Stress Management (N=7)

Sun Protection (N=1)

Vegetable Intake (N=1)

Weight Bearing Exercise (N=1)

Appendix D

Table D.1

Behavior Categories with Associated Target Behaviors

Behavior Category	Target Behaviors
Alcohol	Binge Drinking Acquisition Binge Drinking Cessation
Contraception	Birth Control General Contraception
Condom Use	Condom Use - General Condom Use – Main Partner Condom Use - Other Partner(s) Condom Use - Anal Sex w/ Main Partner Condom Use – Vaginal Sex
Delinquent Behavior	Delinquent Behavior Bullying
Diabetes	Glucose Testing Medication Management
Diet	Dietary Fat Reduction Fruit Intake Fruit and Vegetable Consumption Healthy Diet Vegetable Intake
Drugs	Cocaine Use Decreasing Drug Use Drug Treatment Quitting Drugs
Eating Disorders	Recovery From Anorexia Recovery From Bulimia
Exercise	Exercise Regularly

Behavior Category	Target Behaviors
	Weight Bearing Exercise
Medical Screening	Bone Density Testing Cancer Screening Colorectal Cancer Screening Mammography STD Screening
Oral Hygiene	Daily Use of Dental Floss Tooth-Friendly Diet
Osteoporosis	Calcium Intake
Sun	Sun Protection /Reduction Sunscreen Use
Smoking	Smoking Acquisition Smoking Cessation Smokeless Tobacco Use
Sex Decisions	Safer Sex Decision Making Sex Decision Making / Abstinence
Stress	Stress Management Stress Reduction
Other Behaviors:	
Administrative Change	
Back Pain/Keeping Body Posture	
Breast Self-Examination	
Collaborative Delivery Service	
Depression Prevention	
Domestic Violence	
Organ Donation	
Participating in Decision Making for Medication Management	
Physicians Assisting Smokers	

Behavior Category	Target Behaviors
Radon Testing	
Sedentary Behavior	
Weight Loss	

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