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BASELINE PREDICTORS OF SINGULAR ACTION AMONG PARTICIPANTS WITH MULTIPLE HEALTH BEHAVIOR RISKS

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BY

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ABSTRACT

Most multiple behavior change interventions treat behaviors separately, rather than simultaneously. The present study assessed whether (1) baseline Stage of Change, (2) Effort, and (3) Severity are predictors of singular Action among participants at risk for pairs of behaviors (sun protection &cigarette smoking; high- fat diet &cigarette smoking; high- fat diet & sun protection). Additionally, the study assessed which of the three effects (Stage of Change, Effort, Severity) contributed most to predicting singular Action and examined demographic effects in the context of participants at risk for multiple health behaviors. Pooled data were analyzed (using Logistic Regressions) from three randomized controlled trials (RCTs) for cancer prevention using Transtheoretical Model (TTM) tailored interventions (N = 9,079) that assessed the effectiveness of school, worksite, medical, and home-based prevention programs for multiple cancer risk behavior reduction. The sample was 43.9 years old (SD= 10.7), 90.8% White, and 62.8% female. Analyses included a series of logistic regressions to assess Stage of Change, Effort, and Severity as predictors of health behavior change. Across all 3 behaviors, Stage of change, Effort, and Severity were consistently related to behavior change at 24 months. Interestingly, taking Action on one behavior was related to change on another. For example, among those in the smoking and diet pair, Smoking Habit Strength and Negative Affective Temptations were significant predictors of change on Diet at 24 months. Baseline Sun Pros and Cons were significant predictors of singular Action on Diet. Further, baseline Smoking Severity was related to change on Diet at 24 months. Baseline Sun Severity was related to change on Diet only.

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Data used for this project were drawn from a National Cancer Institute (NCI) funded project grant (P01; #CA27821, Principle Investigator, Prochaska) assessing the effectiveness of medical, school, home, and worksite practice-based prevention programs devised to reduce multiple behavior cancer risks. I would like to thank my major professor, Dr. James Prochaska for his guidance and support throughout the writing of this thesis. I would also like to thank Dr. Andrea Paiva for granting me access to the data set used for this thesis and for her assistance with statistical analyses. Additionally, I would like to thank Drs. Bryan Blissmer, Yinjiao Ye, and Elizabeth Fallon, the rest of my thesis committee, for their contributions to this project.

As a secondary data analysis that did not access participant personal health information (PHI), the Institutional Review Board (IRB) granted this project an exemption. All statistical procedures were conducted with SPSS, and all literature was accessed through the URI library reference databases.

PREFACE

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Baseline Predictors of Singular Action among Participants with Multiple Health Behavior Risks

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INTRODUCTION

Modifiable behaviors make a substantial contribution to preventable deaths in the United States. Each year, approximately half of all deaths that occur in the U.S. are preventable (Mokdad, Marks, Stroup, Gerberding, 2004). Causes of such deaths include excessive alcohol consumption, unsafe sex practices, illicit drug use, cigarette smoking, physical inactivity, unhealthy diet, and sun exposure (Mokdad et al., 2004). Most conditions and terminal illnesses have several causes and factors. For example, physical inactivity and an unhealthy diet contribute to obesity on a population basis. Effectively changing multiple health risk behaviors can decrease the incidence of disease and preventable death.

In the year 2000, approximately 71 percent of preventable deaths in the United States were related to four vital and modifiable behaviors: physical inactivity, tobacco use, alcohol use, and unhealthy diet (Mokdad et al., 2004; Berrigan et al., 2003, Doll et al., 1981; McGinnis et al., 1993). This data suggests that it may be important to develop new paradigms of change to accommodate multiple behavior risks (e.g. lack of physical activity and high-fat diet). In response to gaps in our knowledge, a 2009 National Institutes of Health summary report on the Science of Behavior Change identified simultaneous multiple behavior change as a top NIH priority (Blissmer et al., 2010). As a result, there has been a growth in multiple behavior change research, in order to simultaneously treat multiple problem behaviors that contribute to chronic disease and premature death.

Since preventable risk factors for chronic disease and premature death are commonly problem behaviors (Noar, Benac, Harris, 2007), health promotion via

behavior change could contribute to a substantial reduction in United States health care costs, suffering, disability and death.More specifically, multiple behavior change is valuable because most medical conditions have multiple potential behavioral causes. For example, excessive alcohol use, unhealthy diet, physical inactivity, and smoking are four lifestyle factors that contribute to the development of chronic conditions, including Type II Diabetes, cardiovascular disease, and various cancers (Poortinga, 2007). Examining changes in co-occurring behaviors may contribute to prevention of modifiable causes of morbidity and mortality.

The presence of multiple risk factors has also demonstrated to have interactive or negative synergistic influence on health. For example, the combination of a poor diet and physical inactivity multiplies the risk of various cancers to an extent greater than the sum of the two individual risks (USDHHS, 1996). The clustering of health risk factors is associated with possible synergistic health effects. Specifically, previous research demonstrates that combinations of risk factors are more harmful than the interactive individual effects alone, suggesting that health risk factors are multiplicative rather than additive (Breslow&Enstrom, 1980). This suggests that examining the clustering of health risk factors can aid in the design of more effective intervention strategies.

Sufficient evidence exists to support interventions for individual health behaviors (e.g. cigarette smoking, high-fat diet). One of the greatest challenges facing health behavior change is how to effectively change multiple health behavior risks to prevent cancer, cardiovascular disease, and various other chronic diseases. Populations with co-occurring behavioral risks suffer greater morbidity and disability (Doll et al.,

2004).For example, having an unhealthy diet and being physically inactive increases the likelihood of cardiovascular disease (Djousse et al., 2009). Consequently, multiple modifiable health risks (e.g. cigarette smoking, physical inactivity, high-fat diet) are associated with increases in health expenses. Finally, the clustering of risk factors and their synergistic effects demonstrate that multiple behavior change research will have a greater impact on public health than single behavior interventions (Poortinga, 2007).

Health promotion is recognized as a valuable strategy for preventing health problems at the individual- and population–level. Australia has recently implemented health promotion as a strategy for improving the health of its population (Musich, Hook, Barnett, Edington, 2001). Generally, individuals with a greater number of health behavior risks are associated with higher health care costs. Therefore, more research needs to be done in the field of multiple health behavior change. In order to develop multiple behavior interventions, current individual behavior change models may need tobe adapted to fit the requirements for multiple health behavior change.

The Transtheoretical Model (TTM) (Prochaska &DiClemente, 1983) has been demonstrated to be effective in intervening on individualhealth behavior risks. The TTM provides individualized and tailored interventions based on the individual's Stage of Change (Norcross, Krebs & Prochaska, 2011).For example, Computer Tailored Interventions (CTIs) have been applied to simultaneously treat multiple behaviors with parents and adolescents (Prochaska et al., 2004). TTM is a model of behavior change organized around the five Stages of Change: Precontemplation (i.e. not intending to change within the next 6 months), Contemplation (i.e. intending to change within the next 6 months), Preparation (i.e. intending to take Action within the

next 30 days), Action (i.e. having successfully altered the problem behavior in the past 6 months), and Maintenance (i.e. having successfully altered the behavior for more than 6 months).

There are additional constructs central to the TTM that can predict an individual's potential to move through the Stages of Change. Self-efficacy (SE) is a TTM construct that describes the confidence that an individual has to cope with difficult situations and temptations (Velicer, DiClemente, Rossi & Prochaska, 1990) related to a particular health behavior risk. For example, attending a social gathering at which people are smoking may serve as a temptation for an individual to smoke a cigarette. Self-efficacy is related to movement through the Stages of Change (SOC), such that higher self-efficacy is related to greater movement in the SOC. Individuals in Precontemplation or Contemplation (earlier SOC) report lower confidence regarding the behavior change than individuals in Action or Maintenance (later SOC). Velicer, DiClemente, Rossi & Prochaska (1990) suggest that individuals' Self-Efficacy increases with advancement in the TTM Stages of Change.

Decisional Balance (DB) is a TTM construct that identifies an individual's perceptions of the Pros and Cons of engaging in a particular behavior change (Velicer, DiClemente, Prochaska & Brandenburg, 1985). The benefits of the behavior change are categorized as Pros and the costs of the behavior change are Cons. Velicer et al. (1985) identified various pros and cons of cigarette smoking. A 24-item decisional balance measure was constructed to examine the relationship between decision-making and progress along the Stages of Change, within the context of smoking cessation. Cons of smoking include being embarrassed about having to smoke and

cigarettes being hazardous to one's health. Pros include feeling relaxation and pleasure when smoking, as well as liking the image of a cigarette smoker. DB is an important construct within various problem behaviors, including unhealthy diets, condom use, and sunscreen use (Hall & Rossi, 2008). Furthermore, it is a strong predictor of movement through the Stages of Change (Velicer et al., 1985).

In studying additional predictors of successful change in a set of multiple behaviors, Blissmer et al. (2010) and Redding et al. (2012) examined the consistency of four effects (severity, stage, effort, and treatment) on each behavior separately. These studies examined the relationship of these effects to long-term changes across separate multiple behaviors (e.g. smoking, diet, sun exposure).

Stage effects are related to an individual's TTM Stage of Change, such that individuals in a later SOC (e.g. Preparation) at baseline are likely to make greater progress to Action and Maintenance at long-term follow-up than individuals in an earlier stage (e.g. Precontemplation).Effort effects demonstrate how well individuals are working to change their problem behavior (Blissmer et al., 2010). The TTM Processes of Change, Decisional Balance, and Self-Efficacy reflect individuals' efforts.Blissmeret al. (2010)& Redding et al. (2012)found that individuals making better efforts on at least one of the TTM dynamic variables at baseline are likely to progress to a later SOC at follow-up.

Treatment effects have been another potential common predictor of successful maintenance of behavioral change. We would expect that individuals assigned to treatment at baseline are more likely to progress to a later Stage of Change (Blissmer et al., 2010). Previous studies support treatment effects for single behaviors.

However, there was a recent surprising discovery that treatment had minimal or no effect on singular Action (i.e. individuals only changing on a single behavior). Further, recent research on individuals with pairs of problem behaviors (e.g. smoking and unhealthy diet) found that treatment did have strong effects on Paired Action (i.e. individuals changing both behaviors in a pair). This study will examine whether the other three effects (Stage, Severity, and Effort) are predictors of singular Action in treatment and control groups.

Severity effects reflect the degree of the problem behavior. For example, in the context of smoking, number of cigarettes smoked and time to first cigarette would reflect severity of the addiction to cigarette smoking (Farkas et al., 1996). Redding et al. (2012) found that for both addiction variables, significant differences were observed between treatment and control groups. Specifically, those who reached Action or Maintenance at follow-up exhibited less severity at baseline.

Multiculturalism is an important consideration in examining multiple health behavior change, given serious health disparities. However, no consistent demographic effects were observed across Action in behaviors analyzed separately (Blissmer et al., 2010, Redding et al., 2012) in previous research, in part because dynamic (rather than static) variables are better predictors of long-term behavior change. Perhaps consistent effects may be observed in changes in co-occurring risk factors. Exploring demographiceffects within multiple behavior change may contribute to identifying and positing implications for health disparities.

The major limitations to the stated problem are associated with the challenges facing multiple health behavior change. The action paradigm is presented with several

emerging challenges. For example, many health behavior scientists expressed that it is difficult enough for patients to engage in individual behavior change, let alone multiple behavior change. Specifically, individuals' Self-Efficacy may be compromised because they would be overwhelmed (Nigg, 2002). This limitation presents challenges for developing interventions for simultaneous multiple behavior change. Additionally, the present research addresses only one intervention. Further, only three pairs of behaviors (smoking & sun, smoking & diet, diet & sun) are being addressed.

The specific aims for this project are to:

H1) Examine the consistency and significance of Stage of Change at baseline as a predictor of singular Action at follow up for each behavior.

H2) Examine the consistency and significance of Effort at baseline as a predictor of singular Action at follow up for each behavior.

H3) Examine the consistency and significance of Severity at baseline as a predictor of singular Action at follow up for each behavior.

H4) Examine which of the 3 effects (Stage, Severity, Effort) contribute most to predicting singular Action.

H5) Examine theconsistencyof demographic effects in the context of participants at risk for multiple health behaviors.

This research will examine one of the challenging emergent phenomena, namely singular Action, in multiple health behavior change (MHBC). This phenomenon can be observed at more complex levels (i.e. pairs of behaviors), rather

than at simpler levels (i.e. separate behaviors). Previous research has examined co-action, or the extent to which taking action on one behavior increases the odds of taking action on a second behavior (Prochaska, 2008). Recent research examined the amount of multiple behaviors that were produced by treatment and control individuals who changed both behaviors in a pair (paired action) versus the individuals who changed only one of the behaviors in a pair (singular action). Comparisons were made in individuals with pairs of behaviors that were positively linked, such as energy balance behaviors (observed change greater than predicted) and individuals with negatively linked pairs of cancer prevention behaviors (observed rates less than predicted)(Prochaska et al., N.d.)

Previous research examined predictors of successful changes in a set of multiple behaviors and analyzed the consistency of four effects (Treatment, Stage, Effort, and Severity) on each behavior separately, rather than on the combination of behaviors (Blissmer et al., 2010; Redding et al., 2012). Specifically, there is an emerging paradigm for changing combined sets of multiple health behaviors (e.g. cigarette smoking and physical inactivity). Prochaska et al. (1994) identified that an individual's Stage of Change serves as a predictor of successful maintenance of a changed behavior (i.e. smoking cessation). Interestingly, recent research demonstrated that treatment effects had minimal effects on singular Action, whereas they had relatively strong effects on paired Action (smoking and diet).

The proposed research is important because it is a response to the prediction that multiple behavior change represents an important future for preventative medicine (Prochaska, 2008). Multiple health behavior risks are prevalent. For example,

smoking, physical inactivity, excessive alcohol use, and unhealthy diet are the "big four" modifiable causes of morbidity and mortality that account for 71 percent of preventable deaths.Further, lifestyle risks are typically not randomly distributed but rather occur in combination with other risk factors (Poortinga, 2007).

Combined multiple health behavior change is a relatively new area of study. With the emerging literature and knowledge in this field, the present study aims to: 1) examine a new paradigm of health behavior change; and 2) understand the underlying mechanisms of multiple behavior change by examining commonalities between factors related to successful singular Action across several behaviors. This present study will advance the current literature in multiple health behavior change research, while expanding on an established theory of behavior change.

METHODS

The present study is a secondary data analysis that investigates the three of the four effects (Stage, Effort, Severity, Treatment) of the TTM within multiple health behavior change. Data used for this project were drawn from a National Cancer Institute (NCI) funded center grant (P01; CA27821, Principle Investigator, Prochaska) assessing the effectiveness of school, worksite, medical, and home-based prevention programs intended for multiple cancer risk behavior reduction. Furthermore, this study evaluated the effectiveness of stage-matched, tailored interventions designed to advance individuals through the five Stages of Change for various multiple health behavior risks. Such risks included sun exposure, high-fat diets, and cigarette smoking in each project. Therefore, the present study focuses analyses on three pairs combining smoking, diet, and sun.

The overarching objectives of the project are: 1) to determine whether TTM Stage of Change, Effort, and Severitycan account for singular Action and 2) to examine singular Action among pairs of behaviors (sun & smoking, smoking & diet, diet & sun).This research seeks to explorethe underlying mechanisms of multiple health behavior change,in contrast to the standard practice of exploring separate behavior change.

Participants

Participants were U.S. adults recruited via telephone. They were screened for inclusion and exclusion criteria. The sample consisted of 2,460 parents of adolescents who participated in a school-based study, employees from a total of 22 worksites, and

5,382 patients from a health insurance provider. The majority of the sample (*N*=9,079) was middle-aged (*X*= 43.90, *SD*=10.74), White (90.8%), and female (*n*=5,938; 62.8%).

Measures

Demographics

Gender, age, race, ethnicity, marital status, and health status were the available baseline demographics.

Stages of Change

1= Precontemplation (PC- no intention to change behavior in the next 6 months), 2= Contemplation (C- intending to change in the next six months), 3= Preparation (PR- intending to change in the next thirty days), 4= Action, (A- individual has modified the problem behavior), 5= Maintenance (M- individual has maintained behavior change for at least 6 months).

Severity

Baseline Severity was measured for each behavior separately. Number of cigarettes smoked per day and time until first cigarette were items from Fagerstrom's (Fagerstrom, Heatherton, & Kozlowski, 1990) scale of severity of addiction to smoking. Number of past quit attempts and longest quit attempts were also included as severity measures.Diet severity was measured by total score on healthy eating behaviors, with lower scores reflecting a less healthy diet (Prochaska et al., 2004b, 2005). Sun exposure severity was measured by seven items assessing protection used

when exposed to the sun and amount of time spent in the sun, with lower scores reflecting riskier sun exposure (Weinstock et al., 2002).

Effort

BaselineEffort was measured for each behavior separately. Smoking Effort variables were Pros of engaging in smoking, Cons of engaging in smoking, Positive/Social (PS) Temptations, Negative/Affective (NA) Temptations, and Habit Strength (HS) Temptations. Sun protection Effort variables were Pros of engaging in Sun protection, Cons of engaging in Sun protection, and Confidence related to Sun protection. Diet Effort variables were Pros of engaging in a high-fat diet, Cons of engaging in a high- fat diet, Positive/Social (PS) Temptations, Negative/Affective (NA) Temptations, and Difficult Situations (DS) Temptations.

Outcome Measures

Outcomes will be determined for individuals who take singular Action (e.g. changing just one behaviorwithin a pair of behaviors that they are at risk for), compared to those who do not, as well as individuals who take singular Actionon the other (e.g. diet), compared to those who do not. Changes in each behavior in a pair are an outcome to be predicted. Change 'within behaviors'will refer to outcomes in which the effects predict Action on their respective behaviors (e.g., Smoking cons related to Action on Smoking; Sun Confidence related to Action on Sun). Change 'between behaviors' will refer to outcomes in which the effects predict Action on different behaviors (e.g., Diet Severity related to Action on Sun; Smoking Effort related to Action on Diet).

Planned Analyses

The primary and secondary aims of this study were achieved by the following analyses. The first set of planned analyses is to run descriptive statistics to determine whether assumptions have been met, and to determine any abnormal data including skewness and kurtosis, as well as missing data.Each set of analyses will be conducted with participants who are at risk at baseline for pairs of behaviors (sun & smoking; diet & smoking; diet & sun). Participants who changed both behaviors in a pair will beomittedfrom analyses.

H1: Examine the consistency and significance of Stage of Change at baseline as a predictor of singular Action at follow up for each behavior.

Analysis 1: A series of logistic regressions will be conducted to determine whether baseline Stage of Change is a predictor of singular Action among participants at risk for each behavior pair. As an example, among those participants at risk for both sun and smoking, two dichotomous dependent variables (DVs) will be created for changing on sun only (yes/no) and changing on smoking only (yes/no). Two logistic regressions will be run for this pair, including baseline Stage of Change for each behavior as the IV's. Equivalent analyses will be completed for each behavior pair.

H2:Examine the consistency and significance of Effort at baseline as a predictor of singular Action at follow up for each behavior.

Analysis 2: A series of logistic regressions will be conducted to determine whether baseline Effort is a predictor of singular Action among participants at risk for each behavior pair. As an example, among those participants at risk for both sun and smoking, two dichotomous dependent variables (DVs) will be created for changing on

sun only (yes/no) and changing on smoking only (yes/no). Two logistic regressions will be run for this pair, both including baseline Effort for each behavior as the IV's. Equivalent analyses will be completed for each behavior pair.

H3: Examine the consistency and significance of Severity at baseline as a predictor of singular Action at follow up for each behavior.

Analysis 3: A series of logistic regressions will be conducted to determine whether baseline Severity is a predictor of singular action among participants at risk for each behavior pair. As an example, among those participants at risk for both sun and smoking, two dichotomous dependent variables (DVs) will be created for changing on sun only (yes/no) and changing on smoking only (yes/no). Two logistic regressions will be run for this pair, both including baseline Severity as the IV. Equivalent analyses will be completed for each behavior pair.

H4: Examine which of the 3 effects (Stage of Change, Severity, Effort) contribute most to predicting singular Action.

Analysis 4: a logistic regression will be conducted to examine Stage, Severity and Effort as predictors of singular Action for each behavior within each behavior pair.

H5: Examine the consistency of demographic effects in the context of multiple behavior change.

Analysis 5: Aseries of logistic regression analyses will be conducted to assess any differences on singular action between races (i.e. White/Non-White) and gender (i.e. male/female).

RESULTS

H1: Examine the relationship of Stage of Change at baseline to singular action at follow- up for each behavior.

At risk forSmoking and Sun at Baseline.

Singular Action on *Smoking* at 24 months: Baseline **Smoking** Stage of Change was a significant predictor of singular action on Smoking withthose in Preparation being1.94 times more likely to change Smoking only, compared to those in Precontemplation for Smoking at baseline, OR= 1.94 [1.22, 3.09], $p = .005$. Participants in Contemplation for Smoking were not any more likely to change on Smoking only, compared to those in Precontemplation at baseline, $p > .05$. Baseline **Sun** Stage of Change was not a significant predictor of singular action on Smoking at 24 months.

Singular Action on *Sun* at 24 months: Baseline **Sun** Stage of Change was a significant predictor of singular action with those in Contemplation for Sun being 2.51 times more likely to change Sun only, compared to those in Precontemplation at baseline, OR = 2.51 [1.21, 5.20], $p = .014$ and those in Preparation were 7.89 times more likely to change Sun only compared to those in Precontemplation at baseline, OR = 7.89 [4.36, 14.27], $p < .01$. Baseline **Smoking** Stage of Change was not a significant predictor of singular action on Sun at 24 months.

At risk for Smoking and Diet at Baseline.

Singular Action on *Smoking* at 24 months: Baseline **Smoking** Stage of Change was a significant predictor of singular action with those in Preparation being

2.51 times more likely to change Smoking only, compared to those in Precontemplation at baseline, OR = 2.51 [1.55, 4.04], $p < .01$. Participants in Contemplation for Smoking were not any more likely to change on Smoking only, compared to those in Precontemplation at baseline, $p > .05$. Baseline **Diet** Stage of Change was not a significant predictor of singular action on Smoking at 24 months.

Singular Action on *Diet* at 24 months: Baseline **Diet** Stage of Change was a significant predictor of singular action with those in Preparation being 2.04 times more likely to change Diet only, compared to those in Precontemplation at baseline, OR = 2.04 [1.32, 3.17], $p = .001$. Participants in Contemplation for Diet were not any more likely to change on Smoking only, compared to those in Precontemplation at baseline, $p > .05$.Baseline **Smoking** Stage of Change was not a significant predictor of singular action on Diet at 24 months.

At risk for Diet and Sun at Baseline.

Singular Action on *Diet* at 24 months: Baseline **Diet** Stage of Change was a significant predictor of singular Action with those in Preparation being 1.3 times more likely to change Diet only, compared to those in Precontemplation at baseline, OR = 1.27 [1.14, 1.43], $p < .001$. Participants in Contemplation for Diet were not any more likely to change on Smoking only, compared to those in Precontemplation at baseline, $p > .05$.Baseline **Sun** Stage of Change was not a significant predictor of singular Action among those in Contemplation or Preparation, compared to those in Precontemplation at baseline, $p > .05$.

Singular Action on *Sun* at 24 months: Baseline **Sun** Stage of Change was a

significant predictor of singular Action with those in Preparation being 5.41 times more likely to change on diet only, compared to those in Precontemplation at baseline, OR = 5.41 [3.98, 7.35], p = .022. Participants in Contemplation for Sun were not any more likely to change on Smoking only, compared to those in Precontemplation at baseline, p> .05.Baseline **Diet** Stage of Change was not a significant predictor of singular action among those in Contemplation, compared to those in Precontemplation at baseline, p> .05.

H2: Examine the relationship of Effort at baseline to singular action at follow- up for each behavior pair.

At risk for Smoking and Sun at Baseline.

Singular Action on *Smoking* at 24 months:Baseline**Smoking**Habit Strength (HS) Temptations were significant predictors of Smoking singular Action, with the likelihood of changing only Smoking decreasing as Smoking Habit Strength (HS) Temptations increase (OR = 0.80 [0.62, 1.00], p< .05). Baseline **Smoking** Pros, Cons, Positive/Social (PS) Temptations, Negative/Affective (NA) Temptations were not significant predictors of singular Action on Smoking only. Baseline **Sun** Pros, Cons, and Confidence were not significant predictors of singular Action on Smoking.

Singular Action on *Sun* at 24 months: Baseline **Sun** Pros were significant predictors of singular Action on Sun, with those reporting more Pros of Sun Protection being more likely to change on Sun only, OR = 1.10 [1.01, 1.19], p< .05. This is equivalent to a 10% increase in likelihood for each one unit increase in Sun Pros.

Baseline Cons were significant predictors of singular Action on Sun, with the likelihood of changing Sun only decreasing as the Sun Cons increase (OR = 0.93 [0.88, 1.00], $p < .05$). Baseline Sun Confidence was also a significant predictor of changing on Sun only, with those who reported more Sun Confidence being more likely to change on Sun only, OR = 1.14 [1.09, 1.20], $p < .001$.This is equivalent to a 14% increase in likelihood for each unit increase in Sun Confidence.Baseline**Smoking** Pros, Cons, Positive/Social (PS) Temptations, Negative/Affective (NA) Temptations, Habit Strength (HS) Temptations were not significant predictors of singular Action on Sun.

At risk for Smoking and Diet at Baseline.

Singular Action on *Smoking* at 24 months: Baseline **Smoking** Positive-Social (PS) Temptations were significant predictors of singular Action, with those who reported more Smoking PS Temptations being 1.38 times more likely to change on Smoking only, OR = 1.38 [1.07, 1.80], $p < .05$. This is equivalent to a 38 percent increase in likelihood for each unit increase in Smoking PS Temptations.Baseline Smoking Habit Strength (HS) Temptations were significant predictors of singular Action, with the likelihood of changing Smoking only decreasing as Smoking Habit Strength (HS) Temptations increase (OR = 0.72 [0.56, 0.92], $p < .01$). Baseline Smoking Pros, Cons, and Negative-Affective Temptations were not significant predictors of singular Action on Smoking. Baseline **Diet** Pros, Cons, Positive Social (PS) Temptations, Negative Affective (NA) Temptations, and Difficult Situations (DS) were not significant predictors of singular Action on Smoking.

Singular Action on *Diet* at 24 months: Baseline **Diet** Negative Affective (NA) Temptations were a significant predictor of singular Action on Diet only, with those who reported more Negative Affective (NA) Temptations being 1.12 times more likely to change on diet only, OR = 1.12 [1.04, 1.20], $p < .01$. This is equivalent to a 12% increase in likelihood for each unit increase in Negative Affective (NA) Temptations.Baseline Diet Pros, Cons, Positive Social (PS) Temptations, Difficult Situations (DS) Temptations were not significant predictors of singular Action on Diet only.Baseline **Smoking** Habit Strength (HS) Temptations were significant predictors of singular Action, with the likelihood of changing only Diet decreasing as Smoking Habit Strength (HS) Temptations decrease(OR = 0.71 [0.53, 0.94], $p < .05$). Baseline Smoking Pros, Cons, Positive/Social (PS) Temptations, Negative/Affective (NA) Temptations were not significant predictors of singular Action on Diet.

At risk for Diet and Sun at Baseline.

Singular Action on Diet at 24 months: Baseline **Diet** Pros were significant predictors of Diet singular Action, with the likelihood of changing only Diet decreasing as Diet Pros increase, (OR = 0.92 [0.88, 0.96], $p < .001$). Baseline Diet Cons were significant predictors of singular Action on Diet only, with those who reported more Cons being 1.04 times more likely to change on Diet only, OR = 1.04 [1.00, 1.08], $p < .05$. This is equivalent to a 4% increase in likelihood for each unit increase in Cons.Baseline Diet Negative Affective (NA) Temptations were significant predictors of singular Action on Diet only, with those who reported more NA

Temptations being 1.05 times more likely to change on diet only, OR = 1.05 [1.02, 1.09], $p < .01$. This is equivalent to a 5% increase in likelihood for each unit increase in NA Temptations.Baseline Diet Positive Social (PS) Temptations and Difficult Situations (DS) Temptations were not significant predictors of singular Action on Diet. Baseline **Sun** Pros were significant predictors of singular Action on Diet, with those who reported more Pros being 1.05 times more likely to change on Diet only, OR = 1.05 [1.02, 1.09], $p < .01$.This is equivalent to a 5% increase in likelihood for each unit increase in Sun Pros. Baseline Sun Cons were significant predictors of singular Action on Diet, with those who reported more Sun Cons being 1.03 times more likely to change on Diet only, OR = 1.03 [1.00, 1.06], $p < .05$. This is equivalent to a 3% increase in likelihood for each unit increase in Sun Cons. Baseline Sun Confidence was not a significant predictor of singular Action on Diet.

Singular Action on Sun at 24 months: Baseline **Sun** Pros were significant predictors of singular Action on Sun, with those who endorsed Sun Pros being 1.11 times more likely to change on Sun only, OR = 1.11 [1.10, 1.16], $p < .001$. This is equivalent to an 11% increase in likelihood for each unit increase in Sun Pros.Baseline Sun Cons were significant predictors of singular Action on Sun, with the likelihood of changing only Sun decreasing as Sun Cons increase OR = (0.94 [0.91, 0.97], $p < .001$). Baseline Sun Confidence was a significant predictor of singular Action on Sun, with those who endorsed Sun Confidence being 1.15 times more likely to change on Sun only, OR = 1.15 [1.12, 1.18], $p < .001$. This is equivalent to a 15% increase in likelihood for each unit increase in Sun Confidence.Baseline **Diet** Pros, Cons, Positive Social (PS)

Temptations, Negative Affective (NA) Temptations, Difficult Situations (DS) Temptations were not significant predictors of singular Action on Sun.

H3: Examine the relationship of Severity at baseline to singular Action at follow- up for each behavior pair.

At risk for Smoking and Sun at Baseline.

Singular Action on Smoking at 24 months: Baselinenumber of cigarettes smoked per day was a significant predictor of Smoking singular Action,with the likelihood of changing Smoking only decreasing as Smoking baseline number of cigarettes per day increases, OR = 0.97 [0.95, 0.99], p = .009. Baseline Smoking time until first cigarette, number of past quit attempts, and longest quit attempt were not significant predictors of singular Action on Smoking. Baseline **Sun** severity was not a significant predictor of singular Action on Smoking.

Singular Action on Sun at 24 months: Baseline**Sun** severity was a significant predictor of singular Action on Sun, with those who reportedless severity being 1.23 times more likely to change on Sun only, OR = 1.23 [1.16, 1.28], p< .001. This is equivalent to a 23% increase in likelihood for each unit increase in Sun severity.Baseline**Smoking** severity was not a significant predictor of singular Action on Sun**.**

At risk for Smoking and Diet at Baseline.

Singular Action on Smoking at 24 months: Baseline number of cigarettes per day was a significant predictor of singular Action on **Smoking**, with the likelihood of changing Smoking only decreasing as baseline number of cigarettes per day increases (OR = 0.95 [0.93, 0.97], $p < .001$). Baseline Smoking time until first cigarette, number of past quit attempts, and longest quit attempt were not significant predictors of singular Action on Smoking. Baseline **Diet**severity was not a significant predictor of singular Action on Sun.

Singular Action on Diet at 24 months: Baseline**Diet** was a significant predictor of singular Action on Diet, such that those who reported less Diet severity were more likely to change on Diet only, OR = 1.07 [1.05, 1.09], $p < .001$. This is equivalent to a 7% increase in likelihood for each unit increase in Diet severity.Baseline**Smoking** number of past quit attempts was a significant predictor of singular Action on Diet, with the likelihood of changing only Diet decreasing as number of past quit attempts increases(OR = 0.90 [0.82, 0.99], $p = .04$).Baseline Smoking number of cigarettes per day, time until first cigarette, and longest quit attempt were not significant predictors of singular Action on Diet.

At risk for Diet and Sun at Baseline.

Singular Action on Diet at 24 months: Baseline **Diet** severity was a significant predictor of singular Action on Diet, such that those who reported less Diet severity were more likely to change on Diet only, OR = 1.07 [1.06, 1.08], $p < .001$. This is equivalent to a 7% increase in likelihood for each unit increase in Diet severity.

Baseline **Sun** severity was a significant predictor of singular Action on Diet, with the likelihood of changing Diet only decreasing as Sun severity increases, OR = 0.98 [0.95, 1.00], $p = .02$.

Singular Action on Sun at 24 months: Baseline**Diet** severity was not a significant predictor of singular Action on Sun. Baseline **Sun** severity was a significant predictor of singular Action on Sun, such that those who reported less Sun severity were more likely to change on Sun only, OR = 1.28 [1.24, 1.32], $p < .001$. This is equivalent to a 28% increase in likelihood for each unit increase in Sun severity.

H4: Examine which of the 3 effects (Stage of Change, Severity, Effort) contribute most to predicting singular Action.

At risk for Smoking and Sun at Baseline.

Singular Action on Smoking at 24 months.: Significant baseline predictors from Hypotheses 1-3 were included in this analysis including: Smoking Stage of Change, Habit Strength Temptations, and Number of cigarettes per day. Smoking Stage of Change (OR = 1.32 [1.03, 1.68], $p = .03$) and Number of cigarettes smoked per day (OR = 0.98 [0.96, 1.00], $p = .04$) were significant predictors of singular Action on Smoking at 24 months in this combined model.

Singular Action on Sun at 24 months: Significant baseline predictors from Hypotheses 1-3 were included in this analysis including: Smoking Stage of Change,

Pros of Sun, Cons of Sun, Sun Confidence, and Sun Severity. SunStage of Change, (OR = 1.49 [1.04, 2.12], p = .03), Sun Pros (OR = 1.10 [1.01, 1.19], p = .03), and Sun Confidence (OR = 1.09 [1.04, 1.15], p< .001) were significant predictors of singular Action on Sun at 24 months in this combined model.

At risk for Smoking and Diet at Baseline.

Singular Action on Smoking at 24 months. Significant baseline predictors from Hypotheses 1-3 were included in this analysis including: Smoking Stage of Change, Habit Strength Temptations, Positive Social Temptations, and Number of cigarettes per day.Smoking Stage of Change (OR = 1.58 [1.21, 2.04], p = .001), Smoking Positive/Social (PS) Temptations (OR = 1.39 [1.08, 1.78], p = .011), and Number of cigarettes smoked per day (OR = 0.96 [0.93, 0.98], p< .001) were significant predictors of singular Action on Smoking at 24 months in this combined model.

Singular Action on Diet at 24 months. Significant baseline predictors from Hypotheses 1-3 were included in this analysis including: Smoking Habit Strength, Smoking Number of Past Quit Attempts, Diet Stage of Change, Diet Negative/Affective Temptations, and Diet Severity. Smoking number of past quit attempts (OR = 0.89 [0.80, 0.98], p = .02) and Diet Severity (OR = 1.07 [1.04, 1.09], p< .001) were significant predictors of singular Action on Diet at 24 months in this combined model.

At risk for Diet and Sun at Baseline.

Singular Action on Diet at 24 months. Significant baseline predictors from Hypotheses 1-3 were included in this analysis including:Diet Stage of Change, Diet Negative/Affective Temptations, Diet Pros, Diet Cons, Diet Severity, Sun Stage of Change, Sun Pros, Sun Cons, and Sun Stage of Change. Diet Stage of Change (OR = 1.16 [1.02, 1.31], p = .02),Diet Severity (OR = 1.07 [1.06, 1.08], p< .001), and **Sun** Severity (OR = 0.97 [0.94, 1.00], p = .05) were significant predictors of singular Action on Diet at 24 months in this combined model.

Singular Action on Sun at 24 months. Significant baseline predictors from Hypotheses 1-3 were included in this analysis including:Diet Stage of Change, Sun Stage of Change, Sun Pros, Sun Cons, Sun Confidence, and Sun Severity. Sun Stage of Change (OR = 1.20 [1.01, 1.43], p = .04), Sun Pros (OR = 1.06 [1.01, 1.11], p = .02), Sun Cons (OR = 0.96 [0.93, 0.99],p = .01), Sun Confidence (OR = 1.10 [1.07, 1.13], p< .001, and Sun Severity (OR = 1.16 [1.11, 1.20], p< .001) were significant predictors of singular Action on Sun at 24 months in this combined model.

H5: Assess any differences on singular Action between races (i.e. White/Hispanic/Black) and gender (i.e. male/female).

At risk for Smoking and Sun at Baseline.

Singular Action on Smoking at 24 months: Significant baseline predictors from Hypotheses 1-3 were included in this analysis including: Smoking Stage of

Change, Habit Strength Temptations, and Number of cigarettes per day. Results were identical to Analysis 4, with the exception of females (OR = 1.58 [1.15, 2.17], $p < .01$).

Singular Action on Sun at 24 months. Significant baseline predictors from Hypotheses 1-3 were included in this analysis including: Smoking Stage of Change, Pros of Sun, Cons of Sun, Sun Confidence, and Sun Severity. Results were identical to Analysis 4.

At risk for Smoking and Diet at Baseline.

Singular Action on Smoking at 24 months. Significant baseline predictors from Hypotheses 1-3 were included in this analysis including: Smoking Stage of Change, Habit Strength Temptations, Positive Social Temptations, and Number of cigarettes per day. Results were similar to Analysis 4, with the exception of females on Smoking Stage of Change (OR = 1.93 [1.37, 2.72], $p < .01$) and males on Smoking Positive/Social Temptations (OR = 1.70 [1.11, 2.59], $p < .01$)

Singular Action on Diet at 24 months. Significant baseline predictors from Hypotheses 1-3 were included in this analysis including: Smoking Habit Strength, Smoking Number of Past Quit Attempts, Diet Stage of Change, Diet Negative/Affective Temptations, and Diet Severity. Results were identical to Analysis 4, with the exception of males on Diet Stage of Change (OR = 1.88 [1.08, 3.29], $p < .05$).

At risk for Diet and Sun at Baseline.

Singular Action on Diet at 24 months. Significant baseline predictors from Hypotheses 1-3 were included in this analysis including:Diet Stage of Change, Diet Negative/Affective Temptations, Diet Pros, Diet Cons, Diet Severity, Sun Stage of Change, Sun Pros, Sun Cons, and Sun Stage of Change. Results were identical to Analysis 4.

Singular Action on Sun at 24 months. Significant baseline predictors from Hypotheses 1-3 were included in this analysis including: Diet Stage of Change, Sun Stage of Change, Sun Pros, Sun Cons, Sun Confidence, and Sun Severity. Results were identical to Analysis 4, with the exception of Non-Whites on Sun Cons (OR = 0.80 [0.67, 0.96], $p<.05$ and Sun Pros (OR = 1.08 [1.01, 1.15].

DISCUSSION

The results demonstrate more consistency among predictors of health behavior change within the three health behaviors but less significance between behaviors. Specifically, there is support for Stage of Change, Effort, and Severity effects for Sun protection, Diet, and Smoking.Although the odds ratios were not large, they provide compelling evidence for the factors that underlie singular Action among those with multiple health behavior risks. The Stages of Change effect demonstrated the greatest consistency and significance. The Effort effect demonstratedless consistency but more significance, while Severity demonstrated the least consistency among the three effects.

*Stage of Change.*Table 2 demonstrates that21 out of 24 outcomes (87.5 percent) were the in the direction predicted by the Stage of Change effect, 7 of which were significant (33.33 percent) and were within behaviors.Of the 3 outcomes that were not predicted by the Stage of Change effect, all 3 were between behaviors (100 percent). These findings provide support for Stage of Change as a baseline predictor of singular Action within behaviors, as well as between behaviors.

Effort. Table 3 demonstrates that29 out of 52 outcomes (55.77 percent) were in the direction predicted by the Effort effect, 12 of which were significant (41.38 percent). Of the 52 total outcomes, 16 were significant (30.77). Of the 23 outcomes that were not predicted by the Effort effect, 15 were between behaviors (65.22 percent),while only 8 were within behaviors (34.78 percent).

*Severity.*Table 4 demonstrates that10 out of 24 outcomes (41.67 percent) were in the direction predicted by the Severity effect, 6 of which were significant. Of the 24

total outcomes, 8 were significant (33.33 percent).Interestingly, time until first cigarette and longest quit attemptwere not related to predicted outcomes (all 8 outcomes had odds ratios of 1), perhaps suggesting that these two Severity measures were the worst of the four total Smoking measures included in the analysis. Of the remaining 6 outcomes that were not predicted by the Severity effect, all 6 were between behaviors (100 percent).

*Smoking and Sun.*Among participants who were at risk for Smoking and Sun, 8/8 outcomes (100 percent) were predicted by the Stage of Change effect, with 37.5 percent of outcomes being significant. 10/16 outcomes (62.5 percent) were predicted by the Effort effect, with 40 percent being significant. 4/10 outcomes (40 percent) were predicted by the Severity effect, with 50 percent of outcomes being significant.Among the significant baseline predictors of singular Action (Hypotheses 1-3), Smoking Stage of Change, Smoking Severity (number of cigarettes per day), Sun Stage of Change, Sun Effort (Pros), and Sun Confidence were the best predictors of singular Action among those at risk for Smoking and Sun.

*Smoking and Diet.*Among participants who were at risk for both, Smoking and Diet, 7/8 outcomes were predicted by the Stage of Change effect,with 28.6 percent of outcomes being significant.12/20 outcomes (60 percent) were predicted by the Effort effect, with 16.67 percent being significant.4/10 outcomes (40 percent) were predicted by the Severity effect, with 50 percent of outcomes being significant. Interestingly, among participants who were at risk for Smoking and Diet, Smoking Effort (Habit Strength Temptations) was a significant predictor of change on Diet at 24 months. Among the significant baseline predictors of singular Action (Hypotheses 1-3),

Smoking Stage of Change, Positive/Social Temptations, and Smoking Severity (number of cigarettes per day and number of past quit attempts) were the best predictors of singular Action among those at risk for Smoking and Diet.

Diet and Sun. Among participants who were at risk for Diet and Sun, 6/8 outcomes were predicted by the Stage of Change effect, with 33.3 percent of outcomes being significant. 7/16 outcomes (43.8 percent) were predicted by the Effort effect, with 85.7 percent being significant. 2/4 outcomes (50 percent) were predicted by the Severity effect, with 100 percent of outcomes being significant.Sun Effort (Pros) was a significant predictor of change on Diet. Among the significant baseline predictors of singular Action (Hypotheses 1-3), Diet Stage of Change, Diet Severity, Sun Severity, Sun Stage of Change, Sun Effort (Pros and Cons), Sun Confidence, and Sun Severity were the best predictors of singular Action among those at risk for Diet and Sun.

Across three health behaviors, findings demonstrate that Stage, Severity, and Effort effects are related to behavior change among participants with multiple health behavior risks. The effects are more consistent within behaviors than they are between behaviors. Findings suggest a lack of strong effects between behaviors, with the exception of a consistent signal in the Stages of Change effect. However, the consistency suggests that there may be an effect between behaviors, but not strong enough to demonstrate significance. The present study did not find support for consistent demographic effects. Results show demographic effects for females on Smoking Stage of Change and males on Positive/Social Temptations.

The homogeneity of the combined samples may be viewed as a limitation. The study is also limited because of its use of only one type of treatment: printed TTM-

tailored interventions. One future direction for this study may include examining baseline predictors of singular Action for energy balance behaviors: emotional eating, physical activity, and diet.Further, future research can examine diet and sun in the context of "appearance concerns", given the present study's findings. Additionally, future research may combine measures in the pair to examine potential significant Stages of Change, Severity, and Effort effects between behaviors.

Table 1. *Baseline Demographics*

Variables		Smoking N (%)	Diet N (%)	Sun N (%)
Stage				
	PC	811 (35.8)	3451 (52.1)	2333 (32.3)
	C	983 (43.4)	981 (14.8)	1717 (23.8)
	Prep	469 (20.7)	2188 (33.1)	3169 (43.9)
Gender				
	Male	664 (30.3)	2374 (36.5)	2694 (39.0)
	Female	1526 (69.7)	4122(63.5)	4216 (61.0)
Age				
	34 and younger	128 (18.6)	1156 (17.9)	316 (16.8)
	35-49	399 (57.9)	3620 (56.0)	988 (52.5)
	50-64	134 (19.4)	1403 (21.7)	483 (25.7)
	65 and older	28 (4.1)	287 (4.4)	96 (5.1)
Race				
	White	2078(94.9)	6150 (94.8)	6510 (94.3)
	Black	47 (2.1)	121 (1.9)	135 (2.0)
	Asian, Pacific Islander	5 (0.2)	59 (0.9)	69 (1.0)
	American Indian Alaskan	22 (1.0)	33 (0.5)	39 (0.6)
	Other	37 (1.7)	124 (1.9)	149 (2.2)
Marital Status				
	Married	1327 (60.7)	4629 (71.4)	4902 (71.1)
	Not Married/Living with Partner	115 (5.3)	231 (3.6)	237 (3.4)
	Not Married	263 (12.0)	646 (10.0)	743 (10.8)
	Separated	69 (3.2)	132 (2.0)	144 (2.1)
	Divorced	333 (15.2)	664 (10.2)	684 (9.9)
	Widowed	79 (3.6)	182 (2.8)	186 (2.7)
Health Status				
	Poor	60 (2.7)	96 (1.5)	81 (1.2)
	Fair	340 (15.5)	796 (12.3)	744 (10.8)
	Good	909 (41.5)	2603 (40.1)	2634 (38.1)
	Very Good	708(32.3)	2277 (35.1)	2577 (37.3)
	Excellent	173 (7.9)	721 (11.1)	872 (12.6)

Table 2. *Likelihood of Being in A/M for Each Behavior by Baseline Stage of Change (PC = reference group)*

	Baseline Stage					
	Smoking		**Sun**		**Diet**	
	(*n*= 2263)		(*n*= 7214)		(*n*= 6620)	
	C vs. PC	PR vs. PC	C vs. PC	PR vs. PC	C vs. PC	PR vs. PC
24 month Outcome	OR [95% Confidence Interval]					
Smoking & Sun						
A/M -- *Smoking*	1.20 [0.79, 1.81]	1.94** [1.22, 3.09]	1.42 [0.91, 2.21]	1.00 [0.67, 1.50]		
A/M -- *Sun*	1.22 [0.75, 1.98]	1.15 [0.64, 2.08]	2.51** [1.21, 5.20]	7.89*** [4.36, 14.27]		
Smoking & Diet						
A/M -- *Smoking*	1.33 [0.86, 2.04]	2.51***[1.55, 4.04]			1.38 [0.86, 2.22]	0.80 [0.53, 1.23]
A/M -- *Diet*	1.11 [0.71, 1.75]	1.04 [0.59, 1.83]			1.28 [0.71, 2.31]	2.05*** [1.32, 3.17]
Diet & Sun						
A/M -- *Diet*			1.06 [0.81, 1.40]	0.95 [0.75, 1.21]	1.05 [0.76, 1.45]	1.63*** [1.30, 2.04]
A/M -- *Sun*			1.39 [0.93, 2.08]	5.42*** [3.98, 7.36]	0.92 [0.66, 1.28]	1.00[0.78, 1.78]

*p< .05, **p< .01,***p< .001

Table 3. Likelihood of Being in Action or Maintenance (A/M) for Each Behavior by Baseline Effort Variables

	Baseline Effort												
	Smoking					**Diet**					**Sun**		
	Pros of Smoking (n = 2487)	Cons of Smoking (n = 2474)	P/S (n = 2497)	N/A (n = 2507)	H/S (n = 2492)	Pros of Diet (n = 6416)	Cons of Diet (n = 6449)	P/S (n = 6527)	N/A (n = 6531)	D/S (n = 6432)	Pros of Changing (n = 7101)	Cons of Changing (n = 7105)	Self-Efficacy (n = 7076)
A/M @ 24 month	OR [95% Confidence Interval]												
Smoking	0.92 [0.71, 1.19]	0.94 [0.76, 1.16]	1.20 [0.94, 1.52]	0.95 [0.77, 1.18]	0.78* [0.62, 0.98]						0.99 [0.93, 1.05]	1.01 [0.96, 1.06]	1.01 [0.98, 1.05]
Sun	0.94 [0.68, 1.30]	1.20 [0.91, 1.58]	0.77 [0.58, 1.03]	1.27 [0.95, 1.68]	1.07 [0.81, 1.42]						1.10* [1.01, 1.19]	0.93* [0.88, 1.00]	1.14*** [1.09, 1.20]
Smoking	0.97 [0.74, 1.26]	1.03 [0.83, 1.27]	*1.38 [1.07, 1.80]	0.86 [0.69, 1.08]	0.72** [0.56, 0.92]	0.99 [0.92, 1.07]	1.02 [0.95, 1.09]	0.98 [0.91, 1.06]	0.96 [0.90, 1.03]	1.00 [0.93, 1.09]			
Diet	1.21 [0.89, 1.64]	1.24 [0.96, 1.60]	1.08 [0.80, 1.46]	1.19 [0.89, 1.59]	0.71* [0.53, 0.94]	0.95 [0.87, 1.04]	0.98 [0.91, 1.07]	0.98 [0.89, 1.07]	1.12** [1.04, 1.20]	1.01 [0.92, 1.11]			
Diet						0.92*** [0.88, 0.96]	1.04* [1.00, 1.08]	0.96 [0.92, 1.01]	1.05** [1.02, 1.09]	1.02 [0.98, 1.08]	1.05** [1.02, 1.09]	1.03* [1.00, 1.06]	0.99 [0.97, 1.01]
Sun						1.01 [0.96, 1.06]	0.98 [0.94, 1.01]	1.01 [0.96, 1.07]	1.01 [0.97, 1.05]	1.01 [0.95, 1.06]	1.11*** [1.07, 1.16]	0.94*** [0.91, 0.10]	1.15*** [1.12, 1.18]

*p<.05; ** p < .01; *** p < .001, P/S = Positive/Social Temptation; N/A = Negative/Affective Temptation; H/S = Habit Strength Temptation, D/S = Diffcult Situations Temptation

Table 4. *Likelihood of being in Action or Maintenance (A/M) for Each Behavior by Baseline Severity Variables*

	Baseline Stage					
	Smoking				**Sun**	**Diet**
	Number of cigarettes (n = 2510)	time until first (n = 2503)	number of quit attempts (n = 2504)	longest quit attempt (n = 2438)	behavior items 1-7 (n = 7212)	total behaviors (n = 6620)
24 month Outcome	OR [95% Confidence Interval]					
Smoking & Sun						
A/M -- *Smoking*	0.97** [0.95, 0.99]	1.00 [1.00, 1.00]	1.02 [0.96, 1.09]	1.00 [1.00, 1.00]	1.01 [0.98, 1.04]	
A/M -- *Sun*	1.02 [1.00, 1.04]	1.00 [1.00, 1.00]	0.98 [0.90, 1.06]	1.00 [1.00, 1.00]	1.22*** [1.16, 1.28]	
Smoking & Diet						
A/M -- *Smoking*	0.95*** [0.93, 0.97]	1.00 [1.00, 1.00]	1.01 [0.94, 1.08]	1.00 [1.00, 1.00]		0.99 [0.98, 1.01]
A/M -- *Diet*	0.99 [0.97, 1.01]	1.00 [1.00, 1.00]	0.90* [0.82, 0.99]	1.00 [1.00, 1.00]		1.07*** [1.05, 1.09]
Diet & Sun						
A/M -- *Diet*					0.98* [0.95, 1.00]	1.07*** [1.06, 1.08]
A/M -- *Sun*					1.28*** [1.24, 1.32]	0.99 [0.98, 1.00]

*p< .05; ** p< .01, *** p< .001; Sun: pros and cons of changing; Smoking & Diet: pros and cons of behavior

Table 5. *Significant Predictors of Singular Action (included from Hypotheses 1-3) at 24 months, by baseline demographics.*

	Baseline Stage				
	All participants (*n*=5938)	White (*n*=5568)	Non-White (*n* =370)	Male (*n* =2209)	Female (*n*=3729)
24 month Outcome	OR [95% Confidence Interval]				
Smoking & Sun					
Stage of Change -- *Smoking*	1.32* [1.03, 1.68]	1.32* [1.03, 1.70]	1.65 [0.49, 5.52]	0.98 [0.66, 1.45]	1.58** [1.15, 2.17]
H/S Temptations-- *Smoking*	0.90 [0.73, 1.11]	0.91 [0.73, 1.12]	0.80 [0.22, 2.91]	0.96 [0.68, 1.35]	0.95 [0.72, 1.25]
Cigarettes per day-- *Smoking*	0.98* [0.96, 1.00]	0.98* [0.96, 1.00]	0.96 [0.86, 1.07]	0.99 [0.96, 1.01]	0.96** [0.92, 0.99]
Stage of Change -- *Sun*	1.49* [1.04, 2.12]	1.49* [1.04, 2.14]	1.57 [0.20, 12.57]	2.75 [0.81, 9.36]	1.42 [0.98, 2.07]
Pros-- *Sun*	1.10* [1.01, 1.19]	1.11** [1.02, 1.21]	0.99 [0.73, 1.35]	1.09 [0.92, 1.30]	1.07 [0.98, 1.17]
Cons-- *Sun*	0.95 [0.90, 1.01]	0.95 [0.90, 1.01]	0.93 [0.67, 1.28]	0.88 [0.76, 1.02]	0.96 [0.90, 1.02]
Confidence-- *Sun*	1.09*** [1.04, 1.15]	1.11*** [1.05, 1.16]	0.95 [0.76, 1.19]	1.12 [0.99, 1.26]	1.09** [1.03, 1.15]
Severity-- *Sun*	1.05 [0.98, 1.12]	1.03 [0.96, 1.10]	1.37 [0.89, 2.12]	1.03 [0.85, 1.25]	1.04 [0.97, 1.11]
Smoking & Diet					
Stage of Change -- *Smoking*	1.57*** [1.21, 2.04]	1.55*** [1.19, 2.03]	11.08 [0.77, 160.22]	1.18 [0.77, 1.79]	1.93*** [1.37, 2.72]
H/S Temptations-- *Smoking*	0.85 [0.67, 1.08]	0.83 [0.65, 1.06]	3.86 [0.59, 25.23]	0.80 [0.54, 1.19]	0.94 [0.69, 1.28]
P/S Temptations-- *Smoking*	1.39** [1.08, 1.78]	1.43** [1.10, 1.86]	0.52 [0.09, 3.10]	1.70** [1.11, 2.59]	1.32 [0.95, 1.82]
Cigarettes per day-- *Smoking*	0.96*** [0.93, 0.98]	0.96*** [0.93, 0.98]	0.89 [0.74, 1.08]	0.98 [0.95, 1.01]	0.92*** [0.89, 0.96]
H/S Temptations-- *Smoking (Diet only)*	0.89 [0.69, 1.15]	0.86 [0.66, 1.10]	3.71 [0.33, 42.11]	1.16 [0.67, 2.02]	0.83 [0.62, 1.10]

Number of Past Quit Attempts-- *Smoking*	0.89* [0.80, 0.98]	0.88** [0.80, 0.97]	1.26 [0.68, 2.36]	1.02 [0.85, 1.23]	0.84** [0.74, 0.95]
Stage of Change-- *Diet*	1.21 [0.93, 1.56]	1.21 [0.93, 1.58]	0.65 [0.03, 12.87]	1.88* [1.08, 3.29]	1.04 [0.77, 1.40]
N/A Temptations-- *Diet*	1.06 [0.99, 1.14]	1.07 [1.00, 1.15]	0.80 [0.34, 1.86]	0.86 [0.69, 1.07]	1.10** [1.02, 1.19]
Severity-- *Diet*	1.07*** [1.04, 1.09]	1.06*** [1.04, 1.09]	1.21 [0.98, 1.48]	1.04 [0.99, 1.09]	1.07*** [1.05, 1.10]
Diet & Sun					
Stage of Change-- *Diet*	1.16* [1.02, 1.31]	1.16* [1.02, 1.31]	0.98 [0.53, 1.82]	1.13 [0.92, 1.40]	1.16* [1.00, 1.35]
N/A Temptations-- *Diet*	1.01 [0.98, 1.05]	1.02 [0.98, 1.05]	0.87 [0.71, 1.06]	1.01 [0.94, 1.08]	1.00 [0.97, 1.05]
Pros-- *Diet*	0.98 [0.93, 1.03]	0.97 [0.93, 1.02]	1.08 [0.86, 1.35]	0.92 [0.85, 1.01]	1.00 [0.95, 1.06]
Cons-- *Diet*	1.02 [0.99, 1.06]	1.02 [0.98, 1.06]	1.08 [0.91, 1.29]	1.05 [0.98, 1.12]	1.02 [0.97, 1.06]
Severity-- *Diet*	1.07*** [1.06, 1.08]	1.07*** [1.06, 1.08]	1.09** [1.03, 1.15]	1.07*** [1.05, 1.09]	1.07*** [1.05, 1.08]
Stage of Change-- *Sun*	0.96 [0.82, 1.12]	0.96 [0.81, 1.12]	1.02 [0.37, 2.79]	0.96 [0.71, 1.29]	0.96 [0.80, 1.17]
Pros-- *Sun*	1.03 [1.00, 1.07]	1.04 [1.00, 1.08]	0.99 [0.85, 1.15]	1.08* [1.01, 1.15]	1.00 [0.96, 1.05]
Cons-- *Sun*	1.01 [0.98, 1.04]	1.02 [0.99, 1.05]	0.80* [0.67, 0.96]	1.03 [0.98, 1.09]	1.00 [0.96, 1.03]
Severity-- *Sun*	0.97* [0.94, 1.00]	0.97 [0.94, 1.00]	0.92 [0.78, 1.09]	0.95 [0.90, 1.01]	0.98 [0.94, 1.01]
Stage of Change-- *Diet*	0.95 [0.84, 1.08]	0.97 [0.85, 1.10]	0.76 [0.45, 1.29]	0.92 [0.73, 1.15]	0.98 [0.83, 1.14]
Stage of Change-- *Sun*	1.20* [1.01, 1.43]	1.19 [0.99, 1.42]	1.24 [0.54, 2.83]	1.30 [0.93, 1.81]	1.15 [0.94, 1.42]
Pros-- *Sun*	1.06* [1.01, 1.11]	1.06* [1.01, 1.11]	1.07 [0.91, 1.24]	0.99 [0.92, 1.06]	1.10*** [1.04, 1.17]
Cons-- *Sun*	0.96* [0.93, 0.99]	0.95** [0.92, 0.99]	1.10 [0.96, 1.26]	0.96 [0.91, 1.02]	0.96* [0.92, 1.00]
Confidence-- *Sun*	1.10*** [1.07, 1.13]	1.11*** [1.07, 1.14]	1.02 [0.91, 1.14]	1.12*** [1.07, 1.18]	1.09*** [1.05, 1.13]
Severity-- *Sun*	1.16*** [1.11, 1.20]	1.17*** [1.12, 1.21]	1.11 [0.96, 1.29]	1.21*** [1.12, 1.30]	1.13*** [1.08, 1.18]

*$p < .05$, **$p < .01$, ***$p < .001$; Sun: pros and cons of changing; Smoking & Diet: pros and cons of behavior

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