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Identifying Cluster Subtypes for Acquisition of Sun Protection Habits Within Stages of Change an Exploratory Analysis

Marimer Santiago Rivas
University of Rhode Island

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IDENTIFYING CLUSTER SUBTYPES FOR ACQUISITION OF SUN PROTECTION
HABITS WITHIN STAGES OF CHANGE:
AN EXPLORATORY ANALYSIS
BY
MARIMER SANTIAGO RIVAS

THESIS SUBMITTED IN PARTIAL FULLFILLMENT OF THE REQUIREMENTS
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IN
PSYCHOLOGY

UNIVERSITY OF RHODE ISLAND

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Abstract

Data from 1,042 participants in a home-based expert system intervention were analyzed to explore subgroup profiles based on the measures from the Transtheoretical Model of behavior change: (1) Pros, (2) Cons, and (3) Self-Efficacy measures of attitudes towards sun protection habits. Independent studies were performed within the first three stages of change: Study 1- Precontemplation (N = 570); Study 2- Contemplation (N = 213); and Study 3- Preparation (N = 259). Replication across a series of randomly drawn data sets from the same general population was conducted for each stage. Variables external to the initial analysis were used to evaluate agreement among solutions. Study 1: A four-cluster solution replicated well across subsamples, and was retained for the analysis of the Precontemplation. Significant differences among clusters on the nine Processes of Change, and on all behavioral measures (Sun Protection Behavior Scale, use of sunscreen, SPF of sunscreen, and use of tanning booth/sun lamps) were found. Study 2: A four-cluster solution replicated well across subsamples, and was retained for the analysis of the Contemplation stage. Significant differences among clusters on eight of the nine Processes of Change, and on three of four behavioral measures were found. Study 3: A four-cluster solution replicated well across subsamples, and was retained for the analysis of the Preparation stage. Significant differences among clusters on eight of nine Processes of Change, and on two of four behavioral measures were found. The subtypes for sun protection habits within three of the stages of behavior change closely replicated the subtypes found for smoking cessation and strong evidence of external validity was found.

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Introduction

The Transtheoretical Model of behavior change has been applied to the study and modification of a range of health-related behaviors, such as smoking, high-risk alcohol consumption, physical inactivity, sun exposure, and diet, among others (Burbank, Reibe, Padula, & Nigg, 2002; Fava, Velicer, & Prochaska, 1995; Prochaska et al., 2001; Prochaska et al., 2005; Prochaska et al., 1994; Prochaska et al., 2004). Stage of change is the central organizing construct of the model. Stage of change represents the temporal dimension, and serves to organize the processes people use to quit problem behaviors or acquire healthy behaviors (Prochaska et al., 2005; Velicer, Prochaska, Fava, Rossi, Redding, & Laforge, 2000). The five stages are Precontemplation, Contemplation, Preparation, Action, and Maintenance.

The incidence and mortality of skin cancers have increased rapidly in the past few decades (Jemal, Devesa, Hartge, & Tucker, 2001; McLaughlin, et al., 2005). Few prevention studies have been effective at reducing sun exposure behaviors (Rossi, Blais, Redding, & Weinstock, 1995). Rossi et al. (1995) described that one of the strong point of applying the Transtheoretical model is that it not only provides customized advice to those who are ready to change, but also to the vast majority of people who are neither prepared or motivated to change. Individualized and stage based interventions have been developed to personalize participants' awareness and evaluation of their overexposure to solar ultraviolet radiation and their risk of skin cancer.

Prochaska et al. (2004), and Prochaska et al. (2005) demonstrated, in multiple behavior interventions implemented on a population-basis (with a population of parents and primary care patients, respectively), that stage-tailored expert system interventions

produced significant improvement in sun protective behaviors. The intervention group performed significantly better on the use of sunscreens and avoiding sun exposure than the group of comparison. Weinstock, Rossi, Redding, and Maddock (2002) also examined the effect of a stage-tailored expert system intervention to increase sun protection among beachgoers. They demonstrated that in the treatment group, those who were in preaction stages at baseline were more likely than control to reduce unprotected sun exposure, to use sunscreen, and to progress to more advanced stages of change at 12-month and 24-month assessments.

Studies have also explored the existence of distinctive subgroups within each stage, corresponding to different profiles based on the Pros and Cons of the Decisional Balance Inventory and the Situational Temptations or Self-efficacy Inventory (Anatchkova, Velicer & Prochaska, 2005, 2006a, 2006b; Norman, Velicer, Fava, & Prochaska, 2000; Velicer, Hughes, Fava, & Prochaska, 1995; Velicer, Redding, Anatchkova, Fava, & Prochaska, 2007).

Stages of Change and Profiles of Subtypes

Precontemplation is the stage in which people are not intending to change or modify their behavior in the near future, usually measured as the next six months (Velicer et al., 2000). People in this stage tend to avoid reading, talking, or thinking about their high risk behaviors. In relation to the key constructs of the Transtheoretical Model, it has been found that, among people in the Precontemplation stage, the Cons of changing the problem behavior (e.g. smoking cessation) outweighed the Pros of modifying the behavior (Prochaska et al., 1994; Velicer, Rossi, Prochaska, & DiClemente, 1996). In this stage, for the acquisition of a healthy behavior, the Pros scores are a standard deviation

below average, and the Cons are a standard deviation above average. Studies suggest that to help the people who are in the Precontemplation stage to make observable modifications in their life, interventions should be developed to increase the Pros of a healthy behavior change by about one standard deviation (Prochaska, 1994; Velicer, Norman, Fava & Prochaska, 1999). In terms of the level of temptation to continue smoking, it was higher at the Precontemplation stage when compared to people in the Contemplation and Preparation stages (DiClemente et al., 1991).

A limited number of distinct subtypes have been found and identified among smokers in the Precontemplation stage and the results have been replicated across multiple samples (Anatchkova et al., 2006a; Norman et al., 2000; Velicer et al., 1995; Velicer et al., 2007). High scatter and a pattern of very high scores on the Pros of smoking and the Temptations to smoke characterized one of the subtypes, which was labeled as the *Immotive* group. Below average scores were reported for the Cons of smoking (Norman et al., 2000; Velicer et al., 1995). A second subtype, labeled as the *Progressing* group, showed a profile very similar to what would be expected of participants in the subsequent stage, Contemplation. The scores were above average across all measures. A third subtype, labeled as the *Disengaged* group, had a relatively low and undifferentiated profile. This cluster was characterized by having scores average or below average on the Pros and Cons of smoking, and on the Temptations to smoke across a variety of situations. Norman et al. (2000), and Anatchkova et al. (2006a) identified an additional cluster (labeled as *Disengaged 2* cluster). The profile for this group showed an even lower level than the previously described Disengaged group (the scores on all scales were about a standard deviation below average).

Contemplation is the stage in which people are intending to change in the next six months (Velicer et al., 2000), or twelve months (depending on the targeted behavior). People in this stage are more aware of both the benefits and costs of changing (Velicer et al., 1996). The scores on the Pros and Cons for the acquisition of a healthy behavior are both high (above average) and about equal in the Contemplation stage (Velicer et al., 2000). This shows that the Pros of changing the problem behavior are higher for participants in this stage than for those in the Precontemplation stage, suggesting that the progress from the earlier stage to Contemplation involves an increase in the evaluation of the benefits of changing (Prochaska et al., 1994).

When comparing participants that are in the Precontemplation, Contemplation, and Preparation stages of change to evaluate the process of smoking cessation, those in the later stage reported significantly higher levels of confidence to stop or maintain nonsmoking and efficacy to abstain from smoking across various cues to smoke (less tempted), followed by Contemplators and Precontemplators, representing a monotonically increasing function of self-efficacy across the stages (DiClemente et al., 1991; Velicer et al., 2000).

A limited number of distinct subtypes have been found among smokers in the Contemplation stage (Anatchkova et al., 2005; Norman et al., 2000; Velicer et al., 1995). One cluster corresponded to the expected profile of the stage (labeled as the *Classic Contemplators* group). The scores of the Pros and Cons of smoking were about equal for this cluster. A second subtype (labeled as the *Progressing* cluster) showed a profile very similar to what would be expected of participants in the subsequent stage, which is characterized by a cognitive shift in the balance in the Pros and Cons of smoking: the

disadvantages of smoking outweigh the benefits of smoking. A third subtype, labeled as the *Disengaged* group, had a relatively low and undifferentiated profile. This cluster was characterized by having scores average or below average on the Pros and Cons of smoking, and on the Temptations to smoke across a variety of situations. Different from the solution described for the Precontemplation stage, an additional cluster represented a profile that resembled the previous stage (Anatchkova et al., 2005; Norman et al., 2000; Velicer et al., 1995). This subtype was labeled as the *Early Contemplators* group. This finding shows that a subtype may be at risk for relapsing to an earlier stage (the perceived benefits of smoking outweigh the negative effects of doing so). After comparing clusters, it was found that participants in the Classic Contemplators subtype reported higher number of cigarettes per day than participants in the Progressing cluster (Anatchkova et al., 2005; Norman et al., 2000). This finding suggests that even within stages, differences in the pattern of the Pros, the Cons, confidence levels and behaviors could be reported, reflecting variability within stage.

Preparation is the stage in which people are intending to take action in the immediate future, usually measured as the next month. This suggests that individuals have typically taken some significant initiative to modify their behavior in the past year (Velicer et al., 2000). Within the Preparation stage, the Pros of quitting an unhealthy behavior (e.g., smoking) or acquiring a healthy one (e.g., exercising) outweigh the Cons of doing so (Velicer et al., 2000). Prochaska and colleague (1994) found that in 7 of 12 problem behaviors, a crossover between the Pros and the Cons occurred in early stages, but with behaviors like sunscreen use, high fat diets, and mammography screening, the crossover was evident during more advanced stages. Among smokers, it has been found

that the Preparation group was the least addicted when compared to the previous stages (DiClemente et al., 1991; Fava et al., 1995). Smokers in this stage were more actively modifying their behavior, reporting more quit attempts in the year prior to the study and in lifetime (DiClemente et al., 1991; Fava et al., 1995). Those in the Preparation stage also reported higher levels of confidence to stop or maintain nonsmoking and efficacy to abstain from smoking across various cues to smoke (less tempted) than individuals in the previous stages (Fava et al., 1995, DiClemente, 1991).

A limited number of distinct subtypes have been found among smokers in the Preparation stage (Anatchkova et al., 2006a; Norman et al., 2000; Velicer et al., 1995). One cluster corresponded to the expected profile of that stage, with low scatter and high level of elevation (labeled as the *Classic Preparation* group). This cluster was characterized by above average scores across the Pros and Cons of smoking, and on the level of temptations to smoke. A second subtype showed a profile very similar to what would be expected of participants in a more advanced stage (labeled as the *Progressing* group). This profile was characterized by below average scores on the Pros and on the Temptations to smoke, and above average scores on the Cons of smoking (Norman et al., 2000; Velicer et al., 1995). This pattern is expected of individuals in more advanced stages for the cessation of unhealthy behaviors (Action, Maintenance). Participants in the Classic Preparation subtype, with a profile correspondent to the expected profile of the Preparation stage, reported smoking higher number of cigarettes per day than participants in the Progressing group (Anatchkova et al., 2005; Norman et al., 2000). This finding indicates that people in progressing clusters would need different strategies to promote change of behavior as their profile suggests a readiness to quit smoking that is not

apparent among participants in other clusters. A third cluster (labeled as the *Disengaged* group) was characterized by well below average scores on all the measures (Anatchkova et al., 2006a; Norman et al., 2000; Velicer et al., 1995). A fourth cluster (labeled as the *Early Preparation* group) represented a profile that resembles previous stages. This subtype is characterized by higher scores on the Pros compared to the Cons of smoking (a “V” shaped profile), and above average scores for the temptations to smoke (Norman et al., 2000; Velicer et al., 1995).

Norman et al. (2000) described a second *Disengaged* group (labeled as the *Disengaged 2* cluster; a five cluster solution was reported for the study). Different from the previous *Disengaged* subtype, the second group shows a shift between the scores for the Cons and the Pros, and the scores for the temptations are far lower than in the first subtype.

Stages of Change and Sun Protection Habits

Participants in the Precontemplation stage for sun protection habits are currently not exhibiting sun protection habits, and are not thinking about acquiring those habits in the next 12 months. In this stage, it is expected for participants to display a profile with below-average scores on the Pros of acquiring sun protection habits and the Self-efficacy measure, and high scores on the Cons of acquiring sun protection habits (both constructs from the Decisional Balance measure).

Participants in the Contemplation stage are currently not exhibiting sun protection habits, but are seriously thinking about starting to do so within the next 12 months. In this stage, it is expected for individuals to display a profile with about equal and above

average scores with regard to the Pros and Cons of acquiring sun protection habits, but below average scores with regard to the level of Self-efficacy.

Preparation is the stage in which people intend to acquire sun protection habits in the next month. In this stage, participants report above average (but not equal) scores with regard to the Pros and Cons of acquiring sun protection habits, and below average scores with regard to the level of confidence to cope with high-risk situations without relapsing to unhealthy habits. The increase of the Pros of acquiring sun protection habits, when compared to the scores from the Cons measure, suggests readiness of participants to change, but action may be delayed by a reduced engagement in healthy behaviors when in the midst of difficult situations.

Cluster Analysis

Clustering methods have been recognized as a multivariate statistical technique widely used within the social sciences. It starts with a data set containing information about a sample of individuals and attempts to classify individuals that share certain properties into relatively homogeneous subgroups that are different in some respects from the individuals in other subgroups (Aldenderfer & Blashfield, 1984; Everitt, Landau, & Leese, 2001).

Aims of the Study

Aim 1. To explore the existence of distinctive, interpretable, internally consistent and externally valid subtypes across a series of data sets drawn from samples representing three of the theoretically identified stages of behavior change of sun protection habits: Study1- Precontemplation; Study 2- Contemplation; and Study 3- Preparation. This will be followed in order to conduct a critical assessment of the model

and to evaluate its application to different behaviors. Analysis of subgroup profile will be based on (1) the Pros, (2) the Cons, and (3) Self-Efficacy measures of sun protection habits.

Aim 2. To explore the existence of distinctive, interpretable, internally consistent and externally valid subtypes across general samples that represent three of the theoretically identified stages of behavior change of sun protection habits. Analysis of subgroup profile will be based on (1) the Pros, (2) the Cons, and (3) Self-Efficacy measures of sun protection habits.

Aim 3. To validate the clustering solution for three of the identified stages of behavior change for the acquisition of sun protection habits using three sets of variables external to the initial analysis: (1) Processes of Change scales; (2) variables assessing skin protection habits; and (3) demographic variables.

Previous research has applied the analysis of subtypes within the framework of the Transtheoretical Model of behavior change, supporting the consistency of the model. It is expected that, given the relevance of this model in the study of healthy and unhealthy behaviors, and given that it has been applied in the sun exposure and protection context, the clustering solution will be consistent with the model.

Method

Participants

The sample used in this secondary data analysis is a portion of a sample collected from a larger, multiple behavior intervention study to guide a population of primary care patients to quit smoking, eat healthier, prevent skin cancer, and receive regular mammograms. Outcome analyses conducted with the sample from the larger home-based expert system intervention can be found elsewhere (Prochaska et al., 2005). A total of 12384 respondents were contacted by phone. A total of 3820 patients refused to participate. A total of 8564 subjects agreed to participate, but 3157 were screened out because they did not have at least one of the three health risk behaviors (sun, diet, & smoking) targeted for the intervention. At baseline, the larger sample included 5407 participants with complete data. The participants were then randomly assigned to either the home-based expert system intervention or comparison condition for control. The expert system treatment participants were mailed intervention materials for each of their at-risk behaviors (Prochaska et al., 2005). Mailed materials included the baseline feedback report and an integrated multiple risk behavior stage-matched self-help guide. The reply to the phone survey produced the expert system report for the intervention group. As part of the larger intervention, participants were assessed at 6, 12, and 24 months after the initial assessment.

The University's Institutional Review Board approved this study as it met the University and Federal guidelines for research involving human subjects.

Eligibility for this analysis included being at risk for sun exposure. The measures required for this analysis were only collected from the treatment group. Only baseline information from the sun protection segment of the intervention was included in the

analysis, which was conducted on only the treatment group. The participants were in either the Precontemplation, Contemplation, or Preparation stage of change for sun exposure at baseline. The number of participants for this study is 1,042 subjects. The stage distribution of the sample was Precontemplation (PC), 570 (54.70%); Contemplation (C), 213 (20.44%); and Preparation (PR), 259 (24.86%).

In the Precontemplation stage, most subjects were female (68.8%) and were White (96.6%). The subjects' mean age was 47.46 ($SD = 13.10$). Most subjects reported a good health status (39.2%), and 65.5% were married.

In the Contemplation stage, most subjects were female (71.2%) and were White (98.8%). The subjects' mean age was 46.68 ($SD = 12.74$). Most subjects reported a good health status (43.0%), and 67.3% were married.

In the Preparation stage, most subjects were female (67.1%) and were White (98.1%). The subjects' mean age was 46.61 ($SD = 12.95$). Most subjects reported a good health status (39.5%), and 71.2% were married.

Materials

Stages of Change. The stages of change for general sun exposure and for sunscreen use were evaluated, using algorithms developed to assess intentions and behaviors for reducing sun exposure (Rossi, Blais, Redding & Weinstock, 1995; Maddock, Redding, Rossi & Weinstock, 2005; Prochaska et al., 2005). The general sun protection algorithm classified subjects by stage based on questions that measured their behaviors, and intentions to protect themselves by avoiding sun exposure, using sunscreen, and by wearing protective gear whenever they know they would be out in the sun for a prolonged period of time during the summer.

A 4-item algorithm assessing baseline intentions and actions was used to evaluate the classification of the participants. If participants report that they do not protect themselves from exposure to the sun consistently (that is, whenever they know they will be out in the sun for more than 15 minutes), and they haven't done so in the past 12 months, they were included in the staging procedure. Subjects were in: (1) the Precontemplation stage if they were not intending to protect themselves from exposure to the sun in the next 12 months; (2) the Contemplation stage if they were intending to protect themselves from the sun in the next 12 months; and (3) the Preparation stage if they were intending to protect themselves in the following month. Items applied for the staging algorithm and other measures were included as Appendix A.

Decisional Balance. The Decisional Balance construct derives from Janis and Mann's model of decision-making (Janis & Mann, 1977). This construct includes categories of Pros, or advantages related to the behavior. The categories include questions about instrumental gains for self and others that can be identified from modifying the targeted behavior- or from keeping the behavior-and approval from self and others because of the behavior or the modification of the behavior. Also, it includes for categories of Cons, or disadvantages related to the behavior. The categories include questions about instrumental costs for self and others that can be identified from modifying the same behavior- or in some cases, from keeping the behavior-, and disapproval from self and others because of the behavior or modifications in it (terminology can reverse direction depending whether the problem involves cessation or acquisition). It has been found that this instrument reliably differentiated participants in different stages of change after being modified and applied within the framework of the

Transtheoretical Model of behavior change (Velicer, DiClemente, Prochaska, & Brandenburg, 1985). Its reliability for sun protection and exposure habits has been assessed in previous studies (Maddock et al, 2005; Prochaska et al., 1994). The decisional balance instrument that will be used in this study consists of 4 items assessing the pros of sun protection ($\alpha = 0.78$) and 4 items assessing the cons of sun protection ($\alpha=0.74$). The instrument asked participants to rate how important each item is in deciding whether or not to protect themselves from too much sun exposure on a 5-point Likert scale from non important (=1) to extremely important (=5).

Self-Efficacy. The Self-efficacy construct is related to the way the individual will cope with difficult situations in where the risk of relapsing or engaging in the unhealthy behavior is higher. The self-efficacy instrument consists of 7 items measuring confidence to use sun protection ($\alpha = 0.84$). The participants were asked to rate how confident they were in protecting themselves from the sun in a variety of situations on a 5-point Likert scale from not at all confident (=1) to extremely confident (=5). It has been applied in previous research, and its predictive ability has been evaluated (Maddock et al, 2005).

Processes of Change. Processes of change are cognitive, emotional, and behavioral strategies that people use to change. These processes are independent variables that people need to apply, or be engaged in, to move from stage to stage (Velicer et. al., 2000). Nine of the 10 traditional processes of change were assessed using 2 items each. The processes included counter conditioning, consciousness raising, dramatic relief, environmental reevaluation, helping relationships, reinforcement management, self reevaluation, social liberation, and self-liberation. Respondents were asked to rate how often they used the processes of change in the past 30 days on a 5-

point Likert scale ranging from never (=1) to always (=5). Coefficient alphas ranged from 0.71 to 0.81 for the processes of change scales for sun protection habits in previous studies (Maddock et al, 2005).

Behavioral Measures. Behavioral and behavioral history measures have been previously identified as differentiating factors between stages of change (DiClemente et al., 1991; Fava et al., 1995) and between subtypes within stages (Anatchkova et al., 2006a; Norman et al., 2000; Velicer et al., 1995). The association between tan attractiveness and skin protection, and stages of change has been assessed (Maddock et al., 2005). Findings suggest that attitudes towards tan attractiveness decreased across stages while attitudes towards skin protection increased. Variables that were employed as validity measures for clustering solutions are: use of sunscreen and its SPF, and tanning booth use history -in the past (“have you ever used a tanning booth or sunlamp”), and in the previous year (“ have you used a tanning booth or sunlamp in the past year”).

The need to promote specific approaches to reduce sun exposure, as limiting the time under the sunlight, specially during the midday hours, covering up exposed skin area through the use of protective clothing (long sleeves, long pants, or wide-brimmed hats), and using waterproof sunscreen with a sun protection factor of at least 15, has been introduced in previous research (Rossi et al, 1995). The Sun Protection Behavior Scale (SPBS, $\alpha = 0.82$) is a brief inventory with three sub-scales that include some of these measures of sun protection (Weinstock, Rossi, Redding, Maddock, & Cottrill, 2000). Two of the three subscales were used: Sun Screen Use ($\alpha = 0.86$), and Sun Screen Avoidance ($\alpha = 0.82$). It is a 7-item scale; each item is a self-report of behavior on a 5-point Likert scale of frequency (never, rarely, sometimes, often, and always) “when in the

sun for more than about 15 minutes during the summer” (Weinstock et al., 2000). The composite score of this scale (minimum possible score = 7; maximum possible score = 35) was used.

Demographic Variables. Data regarding demographic variables (age, gender, health status, race and ethnicity, and marital status) were collected and the association between these variables and cluster subtypes was evaluated.

Procedure

Sample Selection. Only baseline information from the sun protection segment of the intervention was included in the analysis, which was conducted only on the treatment group. The participants were classified in the Precontemplation, Contemplation, or Preparation stage of change for sun exposure at baseline after conducting the staging algorithm. Independent clustering studies were conducted for each stage.

Development and Identification of Subtypes. Cluster analysis attempts to classify individuals that share certain properties into relatively homogeneous subgroups that are different in some respects from the individuals in other groups (Aldenderfer & Blashfield, 1984; Everitt, Landau, & Leese, 2001). The choice of the variables to be used with the clustering procedure is one of the most important steps of the analysis (Aldenderfer & Blashfield, 1984). Once the participants were assigned to the stages, the measures included in the Transtheoretical Model of behavior change were used for the development of subtypes within each stage. The Decisional Balance (Pros and Cons) and Self-efficacy measures were initially applied in the classification procedure. Processes of change, variables regarding skin protection and sun exposure habits, and demographic variables were used to conduct the validation procedure.

Random subsamples were drawn from the general sample to determine whether a cluster structure could be replicated across samples. The cluster analysis was performed independently on each subset (Milligan & Cooper, 1987). The consensus between solutions was then evaluated. If the same cluster solution is found across different samples, it is plausible that the discovered solution has a high level of generalizability, and could be found in any general sample (Everitt, Landau, & Leese, 2001).

Random multiple samples were drawn from within each stage of change to conduct the evaluation of the consistency of the clustering solutions. The number of samples was based on the number of participants in the stage. Three random samples of 190 participants were selected without replacement (each observation in the data set has an equivalent chance of being chosen; once chosen it can not be selected again for following procedures) from the Precontemplation stage (N=570). Two random samples ranging of 106 to 107 participants were selected without replacement from the Contemplation stage (N= 213). Two random samples ranging of 129 to 130 participants were selected without replacement from the Preparation stage (N=259). The clustering solutions were compared.

Standardization of Variables. Variables are routinely standardized to a comparable metric prior to any analysis to equalize the contribution of each variable to the outcome of each study (Aldenderfer & Blasfield, 1984). This procedure has been used in comparable cluster analysis studies (Anatchkova, et al., 2005, 2006a, 2006b; Norman et al., 2000; Velicer et al., 1995). For our study, all the variables to be included in cluster identification procedures (Decisional Balance –Pros and Cons-, and Self efficacy) were

standardized to *T*- scores ($M = 50$, $SD = 10$) for the general sample from each stage, and for each independent subsample drawn from each stage.

Data Analysis

Similarity measures have been developed to estimate the level of proximity between the individuals. The most commonly used is the squared *Euclidean distance* (Everitt, Landau, & Leese, 2001), which was employed in this study. The squared Euclidean distance metric was calculated on the three standardized variables: Pros, Cons, and Self-efficacy.

Ward's minimum variance method (Ward, 1963) was employed in this study. Several indices were used to determine the number of clusters: the cubic clustering criterion (CCC), the pseudo *F* test (Calinski & Harabasz, 1974), and the pseudo t^2 test. Values of the CCC greater than 2 or 3 indicate good clusters. A local peak, followed by a drop in the value of the CCC, indicates an appropriate number of clusters for the data (SAS Institute Inc., 1999). The pseudo *F* statistics, where large values indicate a stopping point, and the pseudo t^2 (SAS Institute Inc., 1999) were also used. Following the results from the three indices, visual inspection of the cluster profiles was also performed with a focus on the shape (configuration of the scores; pattern of dip and rises), level (the mean score of the case over all the variables), and scatter (the standard deviation; dispersion of the scores around own average) of the profiles. The profiles for each of the solutions were evaluated to determine the similarities of solutions across samples.

External Validation. One of the basic steps that characterize all cluster analysis studies is the validation of the resulting cluster solution (Milligan & Cooper, 1987). There are different ways to follow this basic rule, including replication across a series of

data sets from the same general population, and Monte Carlo procedures. Also, significance tests on variables external to the creation of the clusters are among the most appropriate ways to validate a clustering solution (Aldenderfer & Blashfield, 1984).

Processes of Change. For each stage, multivariate analysis of variance was performed using the cluster membership as grouping variable, and the 9 Processes of Change measures as dependent variables. The most common macro summary index for MANOVA is *Wilks' lambda*, and it's associated *F*- test (Harlow, 2005). A common multivariate effect size for MANOVA is eta-squared (η^2), which represents the proportion of linear combination of dependent variables that is explained by the grouping variables. An effect size is a quantity that measures the size of an effect in a way that is independent of certain details of the study, as sample size and normality of the distribution (Keppel & Wickens, 2004). Eta-squared can be interpreted with the multivariate guidelines used to interpret multivariate shared variance, where 0.02, 0.13, and 0.26 indicate small, medium, and large effect sizes, correspondingly (Harlow, 2005).

Following a significant difference for group on the MANOVA, separate ANOVAs were performed on each of the dependent measures. The Tukey HSD post-hoc test was employed as the follow-up procedure for tests where significant main effects were found. Effect sizes were also calculated to determine and compare differences in the use of specific Processes of Change between clusters within each of the stages. The partial eta-squared statistic describes the proportion of total variability attributable to a continuous factor; an adjustment is calculated to adjust for sample size and number of predictors, providing a more accurate estimate of the population value. Guidelines for

univariate effects (*partial eta-squared*) would apply here: 0.01 for a small effect, 0.06 for a medium effect, and 0.13 or more for a large effect (Harlow, 2005).

Behavioral Measures. The relation between behavioral variables and cluster membership was assessed to evaluate if specific variables are distinctive of specific profiles of clusters. It was evaluated if subtypes with similar profiles across stages share similar behavioral outcomes. Chi-square evaluation, and an analysis of variance approach (the Tukey HSD post-hoc test was employed as the follow-up procedure for tests where significant main effects are found) were applied to assess if behavioral information can help determine and validate stage and cluster structure. Effect sizes were calculated to determine and compare differences in the incidence of specific behaviors between clusters within each of the stages. For ANOVA, the values of η^2 were interpreted with multivariate guidelines for small effect size when equal to about 0.02, a medium effect size when equal to about 0.13, and a large effect size when greater than or equal to about 0.26 (Harlow, 2005).

Demographic Variables. It was evaluated if subtypes with similar profiles across stages share similar demographic characteristics. Chi-square and analysis of variance approaches were applied to assess if demographic information could help determine and validate stage and cluster structure.

Study 1. Precontemplation

Results

Solutions with three to five clusters were found that described the data best. A four cluster solution replicated well across the three samples. The cluster profiles for Sample 1 (N= 182; 8 participants were not clustered), after applying the four-cluster solution, are presented in Figure 1. The cluster profiles for Sample 2 (N= 187; 3 participants were not clustered) are presented in Figure 2. The cluster profiles for Sample 3 (N= 186; 4 participants were not clustered) are presented in Figure 3. These 15 participants were excluded because they reported incomplete information. A cluster analysis was then performed on the total sample of 555 participants, and this analysis served as the basis for the external validity. The cluster profiles for the general sample are presented in Figure 4.

Cluster 1: The first cluster (N = 142) was labeled *Immotive*, and was characterized by an inverted “V” shape with medium scatter and average level. This profile corresponds to what is expected for people in the Precontemplation stage. The means for Pros and Self-efficacy scores were below average, while the mean for the Cons scale was above average. This pattern is expected among people not considering modifying their behavior given the importance assigned to the disadvantages of consistently protect their skin from sun damage. Participants in this group consider the Cons of consistently protecting themselves from sun exposure more important than the Pros of doing so.

Cluster 2: The second cluster (N = 197) was labeled *Progressing*, and had a “V” shape with high scatter and above average level. This subgroup had average scores on the Cons scale, and above average scores on the Pros and Self-efficacy scales. This

pattern seems to indicate that these individuals may be ready to progress to a more advanced stage. They are considering both the benefits and the disadvantages of acquiring a healthier lifestyle regarding sun exposure. Self-efficacy scores are higher than what would be expected from people that are not currently performing skin protection habits.

Cluster 3: The third cluster (N = 57) was labeled *Disengaged* and had a slightly inverted “V” shape, low to medium scatter, and low level. This subtype consists of participants with Pros, Cons, and Self-efficacy scores all around a standard deviation below average. This was the smallest group within the overall sample.

Cluster 4: The fourth cluster (N = 159) was labeled *Early Progressing* and had a shallow “V” shape (almost a flat shape) with medium-to-high scatter, and low level. The mean for the Self-efficacy scale is around average, while the scores for the Pros and Cons scales are below average.

External Validation: Processes of Change. A Multivariate Analysis of Variance was performed and indicated significant multivariate effects for the 9 Processes of Change (Wilks’ Lambda = .591, $p < .001$). A large effect size ($\eta^2 = .409$) was estimated. Descriptive statistics, univariate F values, Tukey patterns and values for partial eta-squared for the clusters are presented in Table 1.

Following a significant difference for group on the MANOVA, separate ANOVAs were performed on each of the dependent measures. The Tukey HSD post-hoc test was employed as the follow-up procedure for tests where significant main effects were found. Effect sizes (partial eta-squared) were also calculated to determine and compare differences in the use of specific Processes of Change between clusters within

each of the stages. Guidelines for univariate effects apply here: 0.01 for a small effect, 0.06 for a medium effect, and 0.13 or more for a large effect (Cohen, 1977).

Follow up ANOVAs indicated significant differences among clusters on the nine processes of change: (1) Consciousness Raising, $F(3, 550) = 43.09$, $p < .001$, $\eta^2 = .186$; (2) Dramatic Relief, $F(3, 550) = 50.80$, $p < .001$, $\eta^2 = .213$; (3) Environmental Reevaluation, $F(3, 550) = 40.50$, $p < .001$, $\eta^2 = .176$; (4) Self Reevaluation, $F(3, 550) = 71.62$, $p < .001$, $\eta^2 = .277$; (5) Social Liberation, $F(3, 550) = 8.84$, $p < .001$, $\eta^2 = .041$; (6) Counter Conditioning, $F(3, 550) = 9.48$, $p < .001$, $\eta^2 = .044$; (7) Helping Relationships, $F(3, 550) = 13.67$, $p < .001$, $\eta^2 = .064$; (8) Reinforcement Management, $F(3, 550) = 11.74$, $p < .001$, $\eta^2 = .055$; and (9) Self Liberation, $F(3, 550) = 54.45$, $p < .001$, $\eta^2 = .217$.

The effect sizes ranged from small-to medium to large. Across all processes, significance follow up Tukey tests revealed that participants in the Progressing cluster are using the Processes of Change significantly more than the members of the other clusters, while participants in the Disengaged cluster are typically using the processes the least. Also, even when some variation in the patterns was detected across processes, the profiles displayed by the Immotiv and the Early Progressing clusters were similar. Effect sizes were larger across experiential Processes of Change when compared to behavioral processes.

External Validation: Behavioral Variables. A significant effect was found on scores of the Sun Protection Behavior Scale (SPBS) using ANOVA ($F(3, 551) = 64.63$, $p < .001$, $\eta^2 = .256$), indicating differences between clusters in this measure of sun protection habits. These descriptive statistics, F value and Tukey patterns for the clusters

are presented in Table 2. The effect size for this measure was in the large range. The follow up Tukey test revealed that participants in the Progressing cluster reported protecting their skin from exposure damage more than the participants assigned to the other clusters, while members of the Immotive and Disengaged clusters reported doing the least to avoid damaging their skin from the effect of the sunlight.

Chi-square analyses were conducted on various behavioral variables to examine the differences in cluster membership among these measures. These descriptive statistics, chi square values and percentage patterns for the clusters are presented in Table 3. Significant differences between clusters were found for the sunscreen use and SPF of the sunscreen measure, $\chi^2(15) = 107.58, p < .001$; Cramér's $\Phi^2 = .258$. A higher percentage of participants in the Disengaged cluster (75%) reported they never use sunscreen, while a lower percentage of participants in the Progressing subtype (11.6%) reported the same behavior. Members of the Immotive cluster reported similar behavioral profile as the Early Progressing cluster. In terms of SPF of sunscreen, among those subjects that use this article, a higher percentage of members of the Progressing and Early Progressing clusters (43.2% and 34.8%, respectively) reported using sunscreen with a protection factor of 15 to 29, in comparison to participants in the Immotive and Disengaged clusters (20% and 7.7%, respectively).

The use of tanning/sun lamps was also included as a behavioral measure to assess the difference between clusters. The respondents were asked to report if they ever used a tanning/sun lamp in the past, and if yes, to report the use of this item during the previous year. Chi-square analyses were conducted on these two variables. These descriptive statistics, chi-square values and percentage patterns for the clusters are also presented in

Table 3. Significant differences in cluster membership were found, $\chi^2 (15) = 37.42, p < .001$; Cramér's $\Phi^2 = .260$, and $\chi^2 (15) = 8.99, p < .05$; Cramér's $\Phi^2 = .198$, respectively. Most members of the Disengaged cluster reported that they've never visited a tanning booth or used a sun lamp at least once in their lives (87.7%), while around 50% of the members of the Immotive and Progressing clusters reported they've done so. Among those that reported positively to the previous inquiry, 50.7% of those classified in the Immotive cluster reported they've used these items at least once during the past year. The rest of the clusters were characterized by a lower prevalence of this behavior.

External Validation: Demographic Variables. Chi-square analyses were conducted on various demographic variables to examine the association of these variables with cluster membership for the Precontemplation stage: gender, age group, health status, race, ethnicity, and marital status. Table 4 presents frequencies, descriptive statistics, chi-square values and percentage patterns for clusters.

Only one chi-square analysis based on the four cluster groups was significant, the percentage of subjects in different age groups, $\chi^2 (15) = 8.99, p < .05$; Cramér's $\Phi^2 = .128$. Fifty-seven percent of participants in the Disengaged reported being 34-49 years old; this age group was smaller in the other clusters (38.6% in the Immotive cluster; 31.9% in the Progressing cluster; and 36.2% in the Early Progressing cluster).

Discussion

One of the findings of this exploratory study is the identification and replication of an initial four-cluster solution among three different samples that were drawn from the same initial sample of participants in the Precontemplation stage. Data were randomly divided into subsets and analyses of the profiles were performed on each subset.

Consensus on the subgroups profiles based on the scores from the Pros, Cons, and Self-efficacy scores was evaluated, resulting a cluster structure that could be similarly evaluated in more than one sample. These groups are of special interest because traditionally individuals in the Precontemplation stage of behavior change present the most serious challenge for the promotion of healthy behaviors, and for the prevention of risk behaviors.

Description of the clusters. The initial solution was applied to the general sample, and four clusters were labeled on the base of the shape, level and scatter of the profiles based on the scores from the Pros, Cons, and Self-efficacy measures. The evaluation of the clusters was supported by external validity information.

The Immotive cluster (25.59% of participants) was the subtype that most resembled the profile of classic Precontemplators, with high scores on the Cons of sun protection, and low scores on the Pros of sun protection and Self-efficacy measure. An inverted V shape with average level characterized this profile. At the same time, this cluster was the most stable across samples. The main intervention approach for these participants should aim to increase the Pros of sun protection, and to increase the confidence in their ability to change across difficult situations. When the Processes of Change were analyzed, results indicated that this group used these processes in the medium range, showing a profile similar to the one reported by the Early Progressing cluster. External validation was also provided by four behavioral variables. This cluster reported the lowest score in the Sun Protection Behavior Scale (SPBS), showing that this group is less effective in the implementation of specific strategies that reduce unprotected sun exposure. At the same time, compared to the other subtypes, less participants in this

group reported using sunscreen with a SPF 30 or greater. Within the cluster, most of the participants reported never using sunscreen. Half of the sample had ever used a tanning booth or sun lamp, and among these participants, half of them had used one in the past year. Also, in comparison with other clusters, most of the members of this subtype are younger (25.4% are 21-33 years old, and 64% are less than 50 years old).

The largest subtype was the Progressing (35.49% of participants), which had almost the opposite profile of the previous subtype, and was characterized by a V shape. Compared to the Immotive group, this cluster was less stable across samples. This pattern, with very high scores on the Pros of sun protection and the Self-efficacy measure, but still above average scores on the Cons, describes a group of individuals that considers both the importance and disadvantages of sun protection. This may lead to a cognitive dissonance by the above average levels of the Pros and Cons, complicated by the high level of confidence in their ability to avoid sun exposure on the skin in different situations that would prevent them of doing so. The scores from the Self-efficacy measure are higher than what would be expected from individuals that are not intending to practice sun protective behaviors. Intervention efforts for this cluster of participants in the Precontemplation stage need to concentrate on reducing the Cons. When the Processes of Change were analyzed, results indicated that people in the Progressing cluster reported using all the process the most. In relation to the behavioral variables, the Progressing cluster reported the highest score on the SPBS, showing that this group is the most effective in the implementation of specific strategies that reduce unprotected sun exposure. At the same time, in comparison to the other subtypes, more participants in this group are using sunscreen with a SPF 15 or greater, and less participants are not using

sunscreen at all. Within the cluster, most of the participants reported using sunscreen with a SPF 15-29. Half of the sample had ever used a tanning booth or sun lamp, and among these participants, around a third had used one in the past year.

The Early Progressing (28.65% of all participants) was characterized by a shallow V shape, and with similar and below average scores for the Pros and Cons measures of sun protection. This may indicate a very minimal engagement with the conscious acquisition of sun protective behaviors. Regarding the shape of the profile, their pattern is similar to the Progressing group, but efforts should focus on the increase of the Pros (as with the Immotive cluster). Individuals in this group are minimizing the positive aspects of the acquisition of healthy habits. This was the second largest group overall, and was less stable than the previous groups across samples. When the Processes of Change were analyzed, results indicated that this group used these processes in the medium range, showing a profile similar to the one reported by the Immotive cluster in 6 of the 9 processes. This cluster reported a relatively high score in the Sun Protection Behavior Scale (SPBS), showing that this group is moderately effective in the implementation of specific strategies that reduce unprotected sun exposure. One third of the participants categorized in this cluster never use sunscreen, and also one third reported using sunscreen with a SPF 15-29. Most of the members of this subtype had never used a tanning booth or sun lamp. Among participants you've used one or both of these items, most of them had not used one in the past year. Also, most of the older participants were members of this cluster (age range 50+).

The smallest cluster was the Disengaged cluster (10.27% of all participants), which was characterized by a V shape similar to the Immotive cluster. All three scores

were below average, but the scores of the Cons of sun protection behavior are higher than the scores from the other measures. This may represent that even when neither the benefits nor disadvantages of acquiring healthy habits, or feeling convinced that sun protection would be used in a variety of challenging situations, are perceived as important processes, a need to clarify the significance of these concepts for the prevention of skin cancer should be addressed. This group was stable across samples. When the Processes of Change were analyzed, results indicated that people in the Disengaged cluster reported using all the process the least. In regard to the behavioral variables, this cluster reported the lowest score on the SPBS (similar pattern as the Immotive subtype), showing that this group is also the least effective in the implementation of specific strategies that reduce unprotected sun exposure. At the same time, in comparison to the other subtypes, more participants in this group are not using sunscreen at all. Only 12% of the members of this cluster reported previous use of a tanning booth/sun lamp. Among these participants, most of them had not used one in the past year. Also, most of participants in this cluster were young adults (age range 34-49).

Conclusion

This study provides additional evidence for the presence of within-stage differences for the Precontemplation stage of change across different behaviors (Anatchkova et al., 2006a; Norman et al., 2000; Velicer et al., 1995; Velicer et al., 2007). The Immotive cluster was the group that most clearly exemplified the Precontemplation stage, and the Progressing group exhibits a profile that resembles more advanced stages. These two groups had average, and above average level. The Disengaged subtype (which resembles the Immotive cluster, but with a below average level) was the one that reported

more risk behaviors, and was the least effective in the implementation of specific strategies that reduce unprotected sun exposure. The Disengaged and the Early Progressing clusters groups had a below average level. The Early Progressing subtype was intermediate between the Progressing cluster and the Immotive cluster. The results of this study add to our understanding of adults that are not thinking in acquiring sun protection habits in the next year.

Study 2. Contemplation

Results

Three to five clusters were found to describe the data best for Sample 1 ($N = 103$; 3 participants were not clustered) and Sample 2 ($N = 103$; 4 participants were not clustered). The values for the Pros, the Cons, and the Self-efficacy measures for sun protection habits were plotted and evaluated in detail for each solution. A four-cluster solution replicated well across the two subsamples. This solution was retained for the analysis of the general sample. The cluster profiles for Sample 1 are presented in Figure 5. The cluster profiles for Sample 2 are presented in Figure 6. Eight participants were excluded because they reported incomplete information. A cluster analysis was then performed on the total sample of 205 participants, and this analysis served as the basis for the external validity. The cluster profiles for the general sample are presented in Figure 7.

Cluster 1: The first cluster ($N = 59$) was labeled *Progressing*. It is characterized by scores above average on the Pros scale, scores a standard deviation above average on the Self-efficacy measure, and scores about a standard deviation below average on the Cons scale. The mean on the Cons measure are lower than what would be expected for participants in the Contemplation stage. Also, the mean on the Self-efficacy scale is higher than would be expected of subjects in the same stage; this profile is more similar to stages where actual skin protection behavior is taking place. The overall elevation of the group is average. The shape is a “V” expected of participants progressing to a more advanced stage. The scatter was medium-to-high.

Cluster 2: The second cluster ($N = 47$) was labeled *Classic Contemplators*. Members within this cluster are characterized by a profile that is similar to the profile expected for people in the Contemplation stage. It was generally flat with low scatter and

high level. The scores are almost a standard deviation above the mean on Pros and Cons scales, showing the evaluation of both the benefits and the negative aspects of acquiring the targeted behavior. This represents a possible conflict between current sun exposure status and the harmful effects of this habit. The mean score on the Self-efficacy scale is also above average, something expected of subjects in more advanced stages.

Cluster 3: The third cluster (N = 78) was labeled *Early Contemplators*. Subjects in this cluster are characterized as having average scores on the Cons of acquiring skin protection habits, and below average scores regarding the Pros and Self-efficacy measures. This was the largest group within the overall sample. An inverted “V” shape with medium scatter and average level distinguished this subtype. This shape resembles the profile of Precontemplators more than that of Contemplators. Participants in this group still consider the Cons of constantly protect themselves from sun exposure significantly more than the Pros of doing so.

Cluster 4: The fourth cluster (N = 21) was labeled *Disengaged*. An inverted “V” shape, high scatter and low-level pattern characterized this cluster. The scores for the Cons scale are less than a standard deviation below average, while the scores for the Pros and Self-efficacy measures are more than a standard deviation below average. This group was the smallest group within the sample.

External Validation: Processes of Change. A Multivariate Analysis of Variance indicated significant multivariate effects for the Processes of change (Wilks’ Lambda = .646, $p < .001$). A multivariate large effect size ($\eta^2 = .354$) was reported. Descriptive statistics, univariate F values, Tukey patterns and values for partial eta-squared for the clusters are presented in Table 5.

Following a significant difference for group on the MANOVA, separate ANOVAs were performed on each of the dependent measures. The Tukey HSD post-hoc test was employed as the follow-up procedure for tests where significant main effects were found. Effect sizes (partial eta-squared) were also calculated to determine and compare differences in the use of specific Processes of Change between clusters within each of the stages. Guidelines for univariate effects apply here: 0.01 for a small effect, 0.06 for a medium effect, and 0.13 or more for a large effect (Cohen, 1992).

Follow up ANOVAs indicated significant differences between clusters in eight of nine Processes of Change for the acquisition of sun protection habits: (1) Consciousness Raising, $F(3, 201) = 8.14, p < .001, \eta^2 = .095$; (2) Dramatic Relief, $F(3, 201) = 6.57, p < .001, \eta^2 = .076$; (3) Environmental Reevaluation, $F(3, 201) = 9.39, p < .001, \eta^2 = .110$; (4) Self Reevaluation, $F(3, 201) = 10.67, p < .001, \eta^2 = .124$; (5) Counter Conditioning, $F(3, 201) = 7.06, p < .001, \eta^2 = .082$; (6) Helping Relationships, $F(3, 201) = 8.04, p < .001, \eta^2 = .094$; (7) Reinforcement Management, $F(3, 201) = 2.70, p < .05, \eta^2 = .024$; and (8) Self Liberation, $F(3, 201) = 7.63, p < .001, \eta^2 = .089$. Differences between subtypes weren't significant for Social Liberation. The effect sizes ranged from medium to medium-to-large across all significant processes, with the exception of Reinforcement Management, which was small. Participants in the Early Contemplators and Disengaged groups typically used the processes the least. Effect sizes were larger across experiential processes when compared to behavioral processes.

External Validation: Behavioral Variables. A significant effect was found on scores of the Sun Protection Behavior Scale (SPBS) using ANOVA ($F(3, 202) = 22.76, p < .001, \eta^2 = .242$), indicating differences among clusters in this measures of sun

protection habits. These descriptive statistics, F value and Tukey patterns for the clusters are presented in Table 6. The effect size for this measure was in the large range. The follow up Tukey test revealed differences between clusters in the effectiveness of the implementation of specific strategies to reduce unprotected sun exposure.

Chi-square analyses were conducted on additional behavioral variables to examine the differences in cluster membership among these measures. Descriptive statistics, chi-square values and percentage patterns for the clusters are presented in Table 7. Significant differences between clusters were found for sunscreen use and SPF of sunscreen, $\chi^2(15) = 32.34, p < .01$; $\phi = .398$; Cramér's $\Phi^2 = .230$. The use of tanning/sun lamps was also included as a behavioral measure to assess the difference between clusters. The respondents were asked to report if they ever used a tanning/sun lamp, and if yes, to report the use of this item during the previous year. Chi-square analyses were conducted on these two variables. Significant differences in cluster membership were only found for the use of a tanning booth/sun lamp in the past year (this analysis was conducted among those who reported using this item at least once prior to the previous year), $\chi^2(3) = 9.10, p < .05$; Cramér's $\Phi^2 = .335$.

External Validation: Demographic Variables. Chi-square analyses were conducted on various demographic variables to examine the association of these variables with cluster membership: gender, age group, income, health status, employment status, and marital status. Descriptive statistics, chi square values and percentage patterns for the clusters are presented in Table 8. None of the chi-square analyses based on the four subtypes was significant.

Discussion

One of the findings of this exploratory study is the identification and replication of an initial four-cluster solution among two different samples that were randomly drawn from the same initial sample of participants in the Contemplation stage. Data was randomly divided into subsets and analyses of the profiles were performed on each subset. Consensus on the subgroups profiles based on the scores from the Pros, Cons, and Self-efficacy scores was evaluated, resulting a cluster structure that could be similarly evaluated in more than one sample. The understanding of cluster subtypes in this stage has the potential to guide the development of tailored interventions for the promotion of sun protection habits. Participants in the Contemplation stage are of special interest because it is in this stage where individuals start considering the benefits of change, but at the same time, they are still highly considering the disadvantages of modifying their behavior.

Description of the clusters. The initial solution was applied to the general sample, and four clusters were labeled on the base of the shape, level, and scatter of the profiles from the Pros, Cons, and Self-efficacy measures. The evaluation of the clusters was supported by information external to the initial analysis.

The Progressing cluster (28.78% of all participants) showed a profile that resembles the one for people in more advance stages of change. This cluster was stable across samples. The pattern followed by this group, with above average scores on the Pros of sun protection and the Self-efficacy measure, but below average score on the Cons, describes a group of individuals that are ready to move to the next stage (it was characterized by a V shape). This profile may represent subjects that are cautious about

declaring themselves members of the next stage. They may not be sure they are taking, or might consider taking, all the precautions necessary to protect themselves from sun exposure. But they are already thinking about taking those precautions. When the Processes of change were analyzed, results showed that participants in the Progressing clusters are using 4 of 8 processes more than members of the Early Contemplators and Disengaged clusters. In addition, the Progressing cluster is applying the Counter Conditioning process more than the Classic Contemplators group. In term of behavioral variables, participants in the Progressing cluster reported protecting their skin from sun damage more than the participants classified in the Early Contemplators and Disengaged subtypes. In terms of SPF of sunscreen, more than half of members of the Progressing cluster reported using sunscreen with a SPF of 15-29. Most of the participants reported they have never use a tanning booth/sun lamp, and none of them used it during the previous year. More participants in the Progressing cluster reported using sunscreen with SPF of 30 or more than members of the other subtypes. Subjects in this subtype could potentially benefit from interventions designed for the next stage rather than their currently stage classification.

The Classic Contemplators cluster (22.93% of all participants) was the subtype that most resembled the profile of individuals in the Contemplation stage, with above average scores on the Pros and Cons of sun protection. This profile was less stable than the Progressing group. This pattern describes a group of individuals that considers both the importance and disadvantages of constantly protect themselves of exposure to the sun. Scores from the Self-efficacy measure are higher than what would be expected of participants that are not currently considering protecting their skin in a regular basis in

the immediate future. Results showed that participants in the Progressing clusters are similarly using 4 of 8 processes more than members of the Early Contemplators and Disengaged clusters. In addition, this subtype is applying the Reinforcement Management process more than participants in the Disengaged cluster. Similarly to the Progressing cluster, this group reported higher scores in the SPBS measurement. All of the participants in the Classic Contemplators subtype reported using sunscreen. Most of them used sunscreen with SPF of 15-29. A little less than half of the members of this group have used a tanning booth/ sun lamp.

The largest subtype was the Early Contemplators cluster (38.05% of all participants). This cluster, which had the opposite profile of the Progressing subtype, and was characterized by an inverted V shape, was stable across samples. This profile, with scores above average on the Cons, and below average on the Pros and Self-efficacy scales, resembled the pattern typically followed by individuals in the Precontemplation stage. The main intervention approach for these participants should aim to increase the Pros of sun protection, and to increase their level of confidence in the ability to maintain healthier habits across difficult situations. When the Processes of Change were analyzed, results indicated that this group used 4 of 8 processes less than participants in the Classic Contemplation and Progressing clusters. This group reported a lower score in the Sun Protection Behavior Scale. Most of the participants in this cluster used sunscreen with a SPF 15-29, and were the second largest group that never uses sunscreen. At the same time, a higher proportion of people that reported they've used a tanning booth/sun lamp before, also reported they've used it at least once in the past year.

The smallest subtype was the Disengaged cluster (10.24% of all participants). The pattern followed by this group was stable across samples. All the three scores from the scales were below average. This may represent that neither the benefits nor the disadvantages of acquiring healthy habits, or feeling convinced that sun protection would be used in challenging situations, are perceived as important measures. A need to address the significance of these concepts for the prevention of skin cancer should be emphasized. Regarding the Processes of Change, participants in the Disengaged group used the processes the least. At the same time, similar to the Early Contemplators subtype, this group reported a lower score in the Sun Protection Behavior Scale, showing that both groups are the least effective in the implementation of specific strategies that reduce unprotected sun exposure. When additional behavioral variables were analyzed, it was found that more members of this cluster reported never using sunscreen, in comparison to the other clusters. Less members of this cluster use sunscreen of SPF 15-29, or 30 or more. At the same time, this group used a tanning booth/sun lamp in the previous year less than the Early Contemplators and Classic Contemplators groups. This may suggest that these individuals are less exposed to situations that may increase their awareness of skin protection or tanning.

Conclusion

This study supports the presence of important differences within the Contemplation stage of change across different behaviors (Anatchkova et al., 2006a; Norman et al., 2000; Velicer et al., 1995). The Classic Contemplators cluster was the group that most clearly exemplified the Contemplation stage, and the Progressing cluster exhibits a profile that resembles more advanced stages. The Early Contemplators group

was more similar to the previous stage. The Disengaged cluster, which resembles the Early Contemplators cluster but with a below average level, was the one that reported more risk behaviors across most of the variables included in the analysis. The results of this study add to our understanding of adults that are considering changing their sun protection behavior in the future, but haven't successfully taken action in the past.

Study 3: Preparation

Results

Three to five clusters were found to describe the data best for Sample 1 ($N = 128$; 2 participants were not clustered) and Sample 2 ($N = 128$; 1 participant wasn't clustered). The values for the Pros, the Cons, and the Self-efficacy measures for sun protection habits were plotted and evaluated in detail for each solution. A four-cluster solution replicated well across the two subsamples. This solution was retained for the analysis of the general sample. The cluster profiles for Sample 1 are presented in Figure 8. The cluster profiles for Sample 2 are presented in Figure 9. Eight participants were excluded because they reported incomplete information. A cluster analysis was then performed on the total sample of 256 participants, and this analysis served as the basis for the external validity. The cluster profiles for the general sample are presented in Figure 10.

Cluster 1: A shallow inverted “V” shape (almost a flat shape) with moderate to high scatter and high level characterized this cluster ($N = 78$), which was labeled *Early Preparation*. The mean for the Pros and Self-efficacy scales are slightly above average while the scores for the Cons are one standard deviation above average. This pattern is expected among participants that could consider or attempt to acquire sun protection habits, but the Cons of acquiring a healthier behavior still outweigh the benefits of doing so.

Cluster 2: The second cluster ($N = 39$) was labeled *Progressing* and had a “V” shape with medium to high level and medium scatter. The means for the Pros scores are one standard deviation above average, showing that the switch in the importance acknowledged to the benefits of acquiring healthier behaviors is important in the progress

to more advanced stages. Scores for the Self-efficacy measure are also one standard deviation above average. But the Cons scores are one standard deviation below average, which is lower than what would be expected from people that are not consistently protecting themselves from the sun in the present.

Cluster 3: The third cluster (N = 115) was labeled *Level Preparation*. It was characterized by low level, around average on the Pros and Cons measures, and below average on the Self-efficacy scale. The shape was flat with medium to high scatter. This profile is consistent with participants that may not be ready to acquire sun protection habits in the immediate future, even when they report that they feel ready to do so. This was the largest group within the overall sample.

Cluster 4: The fourth cluster (N = 24) was labeled *Disengaged*, and was characterized by scores around one standard deviation below average with regard to the Cons and Self-efficacy scales, and two standard deviations below average with regard to Pros measure. This group was the smallest group within the overall sample. The level of this group was well below average. The shape was relatively flat with a slight linear increase for Pros scores to Self-efficacy scores.

External Validation: Processes of Change. A Multivariate Analysis of Variance indicated a significant multivariate effect for 8 of 9 Processes of Change (Wilks' Lambda = .684, $p < .001$). A multivariate large effect size ($\eta^2 = .316$) was reported. Descriptive statistics, univariate F values, Tukey patterns and values for partial eta-squared for the clusters are presented in Table 9. One of the participants previously clustered didn't report enough information on the variables included in this analysis. Following a significant difference for group on the MANOVA, separate ANOVAs were performed on

each of the dependent measures. The Tukey HSD post-hoc test was employed as the follow-up procedure for tests where significant main effects were found. Effect sizes (partial eta-squared) were also calculated to determine and compare differences in the use of specific Processes of Change between clusters within each of the stages. Guidelines for univariate effects apply here: 0.01 for a small effect, 0.06 for a medium effect, and 0.13 or more for a large effect (Cohen, 1977).

Follow up ANOVAs indicated significant differences among clusters on eight processes of change: (1) Consciousness Raising, $F(3, 251) = 10.08, p < .001, \eta^2 = .097$; (2) Dramatic Relief, $F(3, 251) = 7.02, p < .001, \eta^2 = .066$; (3) Environmental Reevaluation, $F(3, 251) = 16.07, p < .001, \eta^2 = .151$; (4) Self Reevaluation, $F(3, 251) = 11.21, p < .001, \eta^2 = .108$; (5) Social Liberation, $F(3, 251) = 4.37, p < .05, \eta^2 = .038$; (6) Counter Conditioning, $F(3, 251) = 4.45, p < .05, \eta^2 = .039$; (7) Helping Relationships, $F(3, 251) = 5.15, p < .05, \eta^2 = .047$; and (8) Self Liberation, $F(3, 251) = 10.05, p < .001, \eta^2 = .097$.

The effect sizes ranged from small to large. Across 6 of 8 significant processes, significance follow up Tukey tests revealed that participants in the Progressing cluster are using the processes more than the members of other clusters. Participants in Disengaged 2 cluster are typically using the processes the least. Even when some variation in the patterns was detected across Processes of Change, the profiles displayed by the Early Preparation and Level Preparation clusters were similar in some aspects. Effect sizes were generally larger across experiential processes when compared to behavioral processes. The larger effect sized were reported for the Environmental Reevaluation and

Self-Reevaluation processes of change (0.151 and 0.108, respectively). Differences between clusters were not reported for the Reinforcement Management factor.

External Validation: Behavioral Variables. A significant effect was found on scores of the Sun Protection Behavior Scale (SPBS) using ANOVA ($F(3, 252) = 18.71, p < .001, \eta^2 = .182$), indicating differences between clusters in this measure of sun exposure behavior. Descriptive statistics, F value, and Tukey patterns for the clusters are presented in Table 10. The effect size for this measure was in the medium range. The follow up Tukey test revealed that participants in the Progressing subtype reported protecting themselves from sun exposure more than participants in the Early Preparation, Level Preparation, and Disengaged clusters

Chi-square analyses were conducted on additional behavioral variables to examine the differences in cluster membership among these measures. These descriptive statistics, chi-square values and percentage patterns for clusters are presented in Table 11. Significant differences between clusters were only found for the sunscreen use and SPF of sunscreen measure, $\chi^2(15) = 45.33, p < .001$; Cramér's $\Phi^2 = .248$). Almost half of the participants classified as in the Disengaged cluster (45.5%) reported never using sunscreen, while a lower percentage of participants in the Progressing cluster (5.1%) reported the same behavior. In terms of SPF of sunscreen, more than half of the participants classified as in the Progressing group (53.9%) reported using sunscreen with a protection factor of 15-29, and 28.2% of participants classified as in the same subtype reported using sunscreen with a protection factor of 30 or more. A lower percentage (9%) of members of the Disengaged reported using sunscreen with a protection factor of 30 or more.

The use of tanning booths or sun lamps was also included as a behavioral measure to assess the difference between clusters. The respondents were asked to report if they ever used a tanning booth or a sun lamp in the past, and if yes, to report the use of this item during the previous year. Chi-square analyses revealed no significant differences in cluster membership by the use of tanning booths/sun lamps in lifetime or during the previous year.

External Validation: Demographic Variables. Chi-square analyses were conducted on various demographic variables to examine the association between these variables and cluster membership for the Preparation stage: gender, age group, health status, race, ethnicity, and marital status. Table 12 presents frequencies, descriptive statistics, chi-square values, and percentage patterns for clusters.

Only one chi-square analysis based on the four cluster groups was significant. There was an association between cluster membership and marital status, $\chi^2(15) = 25.34$, $p < .05$; Cramér's $\Phi^2 = .198$. A large percentage of people in the Progressing cluster (26.7%) were not married when compared to the Early Progressing (9.7%), Level Preparation (9.6%), and Disengaged (0%) subtypes. Also, a smaller percentage of people in the Progressing group (60%) were married or divorced (0%) when compared to the rest of the clusters.

Discussion

One of the findings of this exploratory study is the identification and validation of an initial four-cluster solution among two samples that were drawn from the same initial sample of participants in the Preparation stage. Data was randomly divided into two subsets and an examination of the profile was performed on each subset. This

examination was based on the scores from the Pros, Cons, and Self-efficacy scores. This process resulted on a cluster structure that could be similarly evaluated in more than one sample. Understanding of cluster subtypes within the Preparation stage is of special interest because individuals in this stage intend to take action in the next month, and it is stage where serious decision making processes take place. This stage is typically related to a higher frequency of attempts to acquire healthier habits in comparison to the Precontemplation and Contemplation stages.

Description of the clusters. The initial solution reached from the random subsamples was applied to the general sample, and four clusters were labeled corresponding to different patterns (shape, level, and scatter) based on the scores from the Pros, Cons, and Self-efficacy measures.

The profiles of the clusters suggest heterogeneity within the Preparation stage. The Early Preparation cluster (30.47% of participants) was characterized by a shallow inverted V shape, and by above average scores on all the measures. This pattern indicates that even when participants consider acquire sun protection habits in the near future, there is a battle between the benefits and the inconvenience of doing so. Efforts should focus on the reduction of the Cons, or perceived negative aspects of the acquisition of healthy habits. The scores from the Self-efficacy measure are higher than what would be expected from individuals not intending to practice sun protective behaviors. This was the second largest group overall, and was stable across samples. When the Processes of Change were analyzed, results indicated that this group used these processes in the medium range. Participants in the Early Preparation cluster are using 6 of 8 processes more than members of the Disengaged cluster. Fewer differences were reported in

comparison to the Level Preparation subtype. Scores in the Sun Protection Behavior Scale (SPBS) were similar to the Level Preparation and Disengaged clusters. A small group of participants categorized in this cluster never use sunscreen, while a larger group (but less than half) reported using sunscreen with a SPF 15-29.

The Progressing cluster (15.23% of all participants) showed a profile that resembles the one for people in the Action stage of change. This cluster was stable across samples. The pattern followed by this group, with above average scores on the Pros of sun protection and the Self-efficacy measure, but below average score on the Cons, describes a group of individuals that are ready to move to the next stage (it was characterized by a V shape). This profile may represent subjects that are cautious about declaring themselves members of the next stage. They may not be sure they are taking, or might consider taking, all the precautions necessary to protect themselves from sun exposure. When the Processes of Change were analyzed, results indicated that members of this subtype reported using 7 of 8 processes more than participants in the Level Preparation and Disengaged clusters. Also, they reported using 2 of the 8 processes more than members of the Early Preparation cluster. In relation to the SPBS, the Progressing cluster reported the highest score on this scale, showing that this group is the most effective for the implementation of specific strategies that reduce unprotected sun exposure. More than half of the members of this cluster are using sunscreen with a SPF 15-29, and more than one fourth of this group is using sunscreen with a SPF 30 or more. Also, one fourth of this group is married, which is a higher proportion in comparison to the other clusters.

The largest subtype was the Disengaged cluster (44.92% of all participants), which was characterized by similar and around average scores on all the measures. Low level and low scatter characterized this profile. Compared to the previous subtypes, this cluster was less stable across subsamples. Individuals in this group may be minimizing the positive aspects of acquiring strategies to reduce unprotected sun exposure. When the Processes of Change were analyzed, results indicated that this group used these processes in the medium range. Scores in the Sun Protection Behavior Scale (SPBS) were similar to the Early Preparation and Disengaged clusters. Most of the participants categorized in this group reported using sunscreen with SPF 15-29. In comparison to the Early Preparation and Progressing subtypes, a higher proportion of participants never use sunscreen. Also, in comparison to all the clusters, a higher proportion of participants categorized in this group are married.

The smallest subtype was the Disengaged cluster (9.38% of all participants). The pattern followed by this group was the least stable across samples. All the three scores from the scales were below average. This may represent that neither the benefits nor the disadvantages of acquiring healthy habits, or feeling convinced that sun protection would be used in challenging situations, are perceived as important measures. A need to address the significance of these concepts for the prevention of skin cancer should be emphasized. Regarding the Processes of Change, participants in the Disengaged group used the processes the least. Scores in the Sun Protection Behavior Scale (SPBS) were similar to the Early Preparation and Level Preparation clusters. When additional behavioral variables were analyzed, it was found that a higher proportion of members of this cluster reported never using sunscreen, in comparison to the other clusters. The

smallest proportion of members of this cluster use sunscreen of SPF 15-29. None of the participants in the Disengaged subtype reported being married, which is a smaller proportion in comparison to the other clusters.

Conclusion

This study supports the presence of important differences within the Preparation stage of change across different behaviors. The Early Preparation group was more similar to the previous stage. The Progressing cluster resembled a profile characteristic of more advanced stages, since the Cons are below average, while scores from the Pros and Self-efficacy measures are well above average. The Disengaged cluster was the one that reported more risk behaviors across most of the variables included in the analysis. Different from other studies, there was no cluster that most clearly exemplified the Preparation stage. Also, the Level Preparation cluster suggests that once people get closer to advanced stages (Action and Maintenance), the balance between the Pros and Cons may be less comprehensible. The results of this study add to our understanding of adults that are considering changing their sun protection behavior in the near future.

Summary

Previous studies among smokers have found distinctive subtypes within stages based on scores from the Pros, Cons, and Temptation scales for smoking cessation and acquisition. Meaningful clusters were identified based on constructs of the Transtheoretical Model for behavior change, and these clusters differentiated on other smoking-related variables external to the initial analysis (Anatchkova et al., 2005, 2006a, 2006b; Norman et al., 2000; Velicer et al., 1995; Velicer et al., 2007). The pattern of results for the external validation analyses provided strong support for the model. Differences between clusters in variables such as cigarettes per day and minutes until first cigarette were consistent with the existing theory. Results in these studies were typically in the direction predicted by profile interpretation: clusters with profiles that resembled earlier stages, or that were interpreted as being less engaged with the targeted behavior, reported less healthy habits on most of the following analyses. The present study is an exploration of the application of a similar approach applied to a different behavior, the acquisition of sun protection habits. As in smoking acquisition and cessation, distinctive profiles were found. Differences between subtypes on other sun-related variables were in the direction predicted by profile interpretation. Groups with profiles that resembled earlier stages for the acquisition of sun protection habits also reported a higher level of high risk behaviors. These findings provide a strong support for the Transtheoretical Model and its application among different behaviors.

Clusters within stages for smoking have been demonstrated to be able to predict future behavior, which is very important for the development of interventions that apply the Transtheoretical Model for the promotion of sun protection habits. It was found for

smoking cessation that the profiles within stages were described by patterns of stability (individuals remained in the same stage of change over the 2-year period), regression (backward movement of at least one stage), progression (forward movement of at least one stage), or vacillation of change (forward or backward stage movement but no net change by the end of the 2-year period) across stages. Profile differences were validated by differences on variables external to the constructs of the Transtheoretical Model (Norman et al., 2008). In another study, a longitudinal validation of clusters followed the initial identification of subtypes for smoking acquisition within the Precontemplation stage. Each subject was classified as still in the acquisition Precontemplation stage, having advanced to one of the other acquisition stages, or having started smoking at three follow-up assessments (12-month post baseline, 24 months, and 36 months). A low proportion of participants identified as members of High Risk cluster remained in the Precontemplation stage for smoking acquisition (nonsmokers) and a higher proportion of participants in the Protected cluster reported the same behavior. These findings support the applicability of subtypes identification for the promotion of healthier lifestyles.

The present study illustrated that clear and valid patterns exist within the Precontemplation, Contemplation, and Preparation stages of change for UV protection, and demonstrated that the profiles are to be interpretable within the context of the stage in which the participants was initially classified. The patterns reported by the differences in the pattern of the Pros, the Cons, confidence levels and behaviors reflected variability within stage. But at the same time, the differences were in the same direction as expected based on the intentions of the people to acquire sun protection habits. This indicates how

the Transtheoretical Model is a multivariate approach that incorporates pertinent factors, and shouldn't be identified as just the stages-of-change model.

Limitations. Cluster analysis is an exploratory method, and the final solution depends to some extent on the interpretation of the researcher. Independent replications of the findings should follow this study, as a way to increase the generalizability of the results.

One limitation of this study is the use of a primary care patient population. Most subjects were female, White, reported a good health status, and married. Most of the participants were between the ages of 34-64, so younger and older participants were not included in the study.

It also should be noted that, even with the combined sample, the size of some subgroups remained very small, and thus these analyses may have limited statistical power.

The results of this study may not hold for other aspects of sun exposure, such as perceived susceptibility for skin cancer, attitudes toward tanning, knowledge of the risk of exposure to artificial ultraviolet light, and concern for appearance.

Future research. The sample used in the present study is a portion of a sample collected from a larger, multiple behavior intervention study to guide a population of primary care patients to quit smoking, eat healthier, prevent skin cancer, and receive regular mammograms. Only information from the sun protection segment of the intervention was included in the analysis, which was conducted on only the treatment group (the control group wasn't included in the study since they were not assessed on all the relevant variables). As part of this intervention, participants were assessed at 6, 12,

and 24 months after the initial assessment. Additional studies could investigate how the identification of subtypes within stages can be applied for the prediction of future behavior for sun protection habits. Follow-up evaluations could be conducted to determine the proportion of participants that remains in the same cluster as in baseline is clustered in a subtype with a different profile. The measurement of over time progress and improvement in the target behavior can be measured by criteria as the percentage of participants that change to, clusters with profiles characteristic of more advanced stages.

Table 1. Study 1:

Means, Standard Deviations and Subtypes Comparisons for Sun Protection Processes of Change.

Processes	M	SD	
			F = 11.56**; $\eta^2 = .409$
<i>Consciousness Raising</i>			F = 43.09**; $\eta^2 = .186$
Early Progressing	4.65	1.46	
Progressing	5.93	1.77	P > all
Immotive	4.59	1.57	I, E > D
Disengaged	3.51	1.65	
<i>Dramatic Relief</i>			F = 50.80**; $\eta^2 = .213$
	5.35	1.99	
Early Progressing			
Progressing	7.31	2.04	P > all
Immotive	5.63	1.82	I, E > D
Disengaged	4.28	1.80	
<i>Environmental Reevaluation</i>			F = 40.50**; $\eta^2 = .176$
Early Progressing	5.23	1.69	
Progressing	6.62	1.95	P > all
Immotive	5.10	1.76	I, E > D
Disengaged	4.04	1.85	
<i>Self Re-evaluation</i>			F = 71.62**; $\eta^2 = .277$
Early Progressing	4.52	1.90	
Progressing	6.53	2.10	P > all
Immotive	4.51	1.89	I, E > D
Disengaged	2.82	1.36	
<i>Social Liberation</i>			F = 8.84**; $\eta^2 = .041$
Early Progress	7.10	1.58	
Progressing	7.82	1.64	P > E, D
Immotive	7.43	1.65	I > D
Disengaged	6.75	1.93	

*Counter Conditioning*F = 9.48**, $\eta^2 = .044$

Early Progressing	7.16	2.23	
Progressing	7.05	2.00	P, E > I
Immotive	5.98	2.32	E > D
Disengaged	6.19	2.87	

*Helping Relationship*F = 13.67**, $\eta^2 = .064$

Early Progressing	5.23	2.34	
Progressing	6.13	2.40	P > E, D
Immotive	5.91	2.36	E, I > D
Disengaged	4.04	2.38	

*Reinforcement Management*F = 11.74**, $\eta^2 = .055$

Early Progressing	2.65	0.99	P > all
Progressing	3.04	1.29	I, E > D
Immotive	2.64	0.99	
Disengaged	2.16	0.45	

*Self-Liberation*F = 54.45**, $\eta^2 = .217$

Early Progressing	4.00	1.63	P > all
Progressing	5.28	1.92	I, E > D
Immotive	3.54	1.50	
Disengaged	2.63	1.13	

E= Early Progressing, P= Progressing, I= Immotive, D= Disengaged

** $p < .01$

Table 2. Study 1:

Means, Standard Deviations, and Subtype Comparisons for the Sun Protection Behavior Scale.

Sun Protection Behavior Scale	M	SD	
Early Progressing	17.57	4.39	F = 64.63**; $\eta^2 = .260$
Progressing	20.54	1.77	P > all
Immotive	14.44	4.48	E > I, D
Disengaged	13.44	3.69	

E= Early Progress, P= Progressing, I= Immotive, D= Disengaged

** $p < .01$

Table 3. Study 1:

Results for Chi-square Analyses for Four Clusters at Precontemplation Stage on Three Behavioral Variables.

Variables	n	Early Progressing (%)	Progressing (%)	Immotive (%)	Disengaged (%)	χ^2
<hr/>						
<i>SPF of sunscreen</i>						107.6**
Never						
Uses	170	30.3	11.6	42.9	75.0	
1-4	68	8.4	12.6	17.1	7.7	
5-9	97	18.1	18.9	16.4	3.8	
10-14	15	3.2	4.2	0.7	1.9	
15-29	169	34.8	43.2	20.0	7.7	
30+	33	5.2	9.5	2.9	3.8	
Total	552					
<i>(Ever) Used a tanning booth/sun lamp</i>						37.42**
No	330	67.9	48.2	51.4	87.7	
Yes	238	32.1	51.8	48.6	12.3	
Total	568					
<i>If yes, past year used a tanning booth/sun lamp</i>						
No	151	74.5	65.7	49.3	71.4	8.99*
Yes	87	25.5	34.3	50.7	28.6	
Total	238					

** $p < .01$, * $p < .05$

Table 4. Study 1:

Demographic Variables and Results for Chi-square Analyses for Four Clusters at
Precontemplation Stage.

Variables	n	Early Progressing (%)	Progressing (%)	Immotive (%)	Disengaged (%)	χ^2
<i>Age</i>						
						22.38*
< 34	93	13.4	23.9	25.4	12.2	
34-49	175	36.2	31.9	38.6	57.1	
50-64	141	32.3	34.4	27.2	20.4	
65+	55	18.1	9.8	8.8	10.2	
Total	464					
<i>Gender</i>						
						0.728
Male	153	30.4	32.9	31.4	26.9	
Female	340	69.6	67.1	68.6	73.1	
Total	493					
<i>Marital Status</i>						
Married	313	62.7	61.3	74.3	64.7	13.22
Living with Partner	15	2.2	4.8	2.7	2.0	
Not Married	59	13.4	13.1	8.0	15.7	
Separated	8	3.0	2.4	0.0	0.0	
Divorced	59	14.2	12.5	11.5	9.8	
Widowed	24	4.5	6.0	3.5	7.8	
Total	478					
<i>Race</i>						
						15.49
White	463	96.3	98.8	97.4	88.2	
Black	7	1.5	0.6	1.8	3.9	
Asian or Other Pacific Islander	2	0.7	0.0	0.0	2.0	
Other	7	1.5	0.6	0.9	5.9	
Total	479					

<i>Ethnicity</i>						2.59
Non-						
Hispanic	476	98.5	99.4	100.0	100.0	
Hispanic	3	1.5	0.6	0.0	0.0	
Total	479					
<i>Health Status</i>						17.53
Poor	7	2.2	1.8	0.9	0.0	
Fair	56	7.5	10.8	11.3	25.5	
Good	187	37.3	43.1	36.5	37.3	
Very Good	172					
		38.1	35.3	38.3	25.5	
Excellent	57	14.9	9.0	13.0	11.8	
Total	479					

* $p < .05$

Table 5. Study 2:

Means, Standard Deviations and Subtypes Comparisons for Sun Protection Processes of Change.

Processes	M	SD	
			$F = 3.37^{**}; \eta^2 = .354$
<i>Consciousness Raising</i>			
			$F = 8.14^{**}; \eta^2 = .095$
Early Contemplators	5.47	1.46	P, C > E, D
Classic Contemplators	6.53	1.50	
Progressing	6.49	1.91	
Disengaged	5.05	1.99	
<i>Dramatic Relief</i>			
			$F = 6.57^{**}; \eta^2 = .076$
Early Contemplators	6.76	1.86	All > D
Classic Contemplators	7.57	1.63	
Progressing	7.36	2.26	
Disengaged	5.48	2.16	
<i>Environmental Reevaluation</i>			
			$F = 9.39^{**}; \eta^2 = .110$
Early Contemplators	6.37	1.64	P, C > E, D
Classic Contemplators	7.36	1.65	
Progressing	7.46	1.76	
Disengaged	5.52	2.46	
<i>Self Re-evaluation</i>			
			$F = 10.67^{**}; \eta^2 = .124$
Early Contemplators	5.92	1.98	P, C > E, D
Classic Contemplators	7.28	1.70	
Progressing	7.12	2.20	
Disengaged	4.81	2.68	
<i>Social Liberation</i>			
			$F = 2.65; \eta^2 = .024$
Early Contemplators	7.78	1.66	
Classic Contemplators	8.36	1.42	
Progressing	7.52	1.59	
Disengaged	7.52	1.97	

Counter Conditioning

			F = 7.06**; $\eta^2 = .082$
Early Contemplators	6.63	1.93	P > C = E
Classic Contemplators	7.04	1.78	
Progressing	8.14	1.66	
Disengaged	7.00	2.83	

Helping Relationship

			F = 8.04**; $\eta^2 = .094$
Early Contemplators	6.85	2.05	All > D
Classic Contemplators	7.64	2.23	
Progressing	6.54	2.39	
Disengaged	4.81	2.36	

Reinforcement Management

			F = 2.70*; $\eta^2 = .024$
Early Contemplators	3.05	1.30	C > D
Classic Contemplators	3.38	1.42	
Progressing	3.19	1.54	
Disengaged	2.38	0.97	

Self Liberation

			F = 7.63**; $\eta^2 = .089$
Early Contemplators	5.05	1.73	P, C > E, D
Classic Contemplators	6.00	1.74	
Progressing	6.32	2.21	
Disengaged	4.48	2.46	

E= Early Contemplators, C= Classic Contemplators, P= Progressing, D= Disengaged

** $p < .01$; * $p < .05$

Table 6. Study 2:

Means, Standard Deviations, and Subtype Comparisons for the Sun Protection Behavior Scale.

Sun Protection Clusters	M	SD	
			F= 22.76**; $\eta^2 = .253$
Progressing	24.95	4.83	P, C > E, D
Classic Contemplators	23.09	3.44	
Early Contemplators	19.29	4.75	
Disengaged	18.71	4.23	

E= Early Contemplators, C= Classic Contemplators, P= Progressing, D= Disengaged

** $p < .001$

Table 7. Study 2:

Results for Chi-square Analyses for Four Clusters at Contemplation Stage on Three Behavioral Variables

Variables	n	Progressing (%)	Classic Contemplators (%)	Early Contemplators (%)	Disengaged (%)	χ^2
<hr/>						
<i>SPF of sunscreen</i>						32.34**
Never						
Uses	22	3.5	-	12.8	28.6	
1-4	14	5.1	4.3	7.7	9.5	
5-9	49	15.5	31.9	23.1	28.6	
10-14	7	3.5	8.5	1.3	-	
15-29	90	51.7	40.4	44.9	28.6	
30+	29	20.7	14.9	10.2	4.7	
Total	211					
<hr/>						
<i>(Ever) Used a tanning booth/sun lamp</i>						5.62
No	129	72.9	53.2	55.7	61.9	
Yes	82	27.1	46.8	44.3	38.1	
Total						
<hr/>						
<i>If yes, past year used a tanning booth/sun lamp</i>						9.10*
No	63	100	77.3	62.9	87.5	
Yes	19	-	22.7	37.1	12.5	
Total	82					

** $p < .01$, * $p < .05$

Table 8. Study 2:

Demographic Variables and Results for Chi-square Analyses for Four Clusters at Contemplation Stage

Variables	n	Progressing (%)	Classic Contemplators (%)	Early Contemplators (%)	Disengaged (%)	χ^2
<i>Age</i>						13.13
< 34	33	9.8	30.1	20.0	20.0	
34-49	75	49.0	33.3	41.5	46.7	
50-64	52	35.3	20.5	33.9	20.0	
65+	14	5.9	15.4	4.6	13.3	
<i>Total</i>	174					
<i>Gender</i>						0.22
Male	53	26.9	29.3	30.2	31.3	
Female	129	73.1	70.3	69.8	68.7	
<i>Total</i>	182					
<i>Marital Status</i>						14.68
Married	120	71.4	64.1	68.7	56.2	
Living with Partner	6	-	2.6	3.0	18.7	
Not Married	21	12.3	15.4	11.9	31.3	
Divorced	22	14.3	12.8	11.9	37.5	
Widowed	7	2.1	5.1	4.5	12.5	
<i>Total</i>	176					
<i>Race</i>						4.02
White	175	98.5	100	98	100	
Black	1	1.5	-	-	-	
Other	1	-	-	2	-	
<i>Total</i>	177					
<i>Ethnicity</i>						2.59
Non- Hispanic	176	100	100	98	100.0	
Hispanic	1	-	-	2	-	
<i>Total</i>	177					
<i>Health Status</i>						6.85
Poor	1	-	-	1.5	-	
Fair	21	8.0	15.4	10.4	18.7	
Good	76	46.0	35.9	47.8	31.3	
Very Good	65	36.0	43.6	34.3	37.5	
Excellent	14	10.0	5.1	6.0	12.5	
<i>Total</i>	177					

Table 9. Study 3:

Means, Standard Deviations and Subtypes Comparisons for Sun Protection Processes of Change.

Processes	M	SD	
<i>Consciousness Raising</i>			
			$F = 3.65^{**}; \eta^2 = .316$
			$F = 10.08^{**}; \eta^2 = .097$
Early Preparation Level	6.36	1.89	$P > \text{All}$ $E, L > D$
Preparation Disengaged	6.30	1.98	
Progressing	4.88	1.87	
	7.58	1.72	
<i>Dramatic Relief</i>			
			$F = 7.02^{**}; \eta^2 = .066$
Early Preparation Level	7.64	1.77	$P, E > L, D$ $L > D$
Preparation Disengaged	7.29	1.93	
Progressing	6.08	2.26	
	8.26	1.78	
<i>Environmental Reevaluation</i>			
			$F = 16.07^{**}; \eta^2 = .151$
Early Preparation Level	7.50	1.68	$\text{All} > D$ $P > L$
Preparation Disengaged	6.89	1.79	
Progressing	4.92	2.30	
	7.87	1.60	
<i>Self Re-evaluation</i>			
			$F = 11.21^{**}; \eta^2 = .108$
Early Preparation Level	7.10	2.00	$\text{All} > D$ $P > L$
Preparation Disengaged	6.60	2.16	
Progressing	5.13	2.11	
	8.11	1.86	

<i>Social Liberation</i>			$F = 4.37^*; \eta^2 = .038$
Early Preparation Level	8.47	1.22	E > D
Preparation Disengaged	7.94	1.56	
Progressing	7.38	1.79	
	7.89	1.25	
<i>Counter Conditioning</i>			$F = 4.45^*; \eta^2 = .039$
Early Preparation Level	7.21	2.00	P > All
Preparation Disengaged	7.27	2.03	
Progressing	6.75	2.36	
	8.39	1.46	
<i>Helping Relationship</i>			$F = 5.15^*; \eta^2 = .047$
Early Preparation Level	7.01	2.17	P > L, D
Preparation Disengaged	6.46	2.43	
Progressing	6.00	3.05	
	7.97	1.84	
<i>Reinforcement Management</i>			$F = 3.38; \eta^2 = .027$ (ns)
Early Preparation Level	3.78	1.83	
Preparation Disengaged	3.30	1.49	
Progressing	3.08	1.38	
	4.08	1.85	
<i>Self-Liberation</i>			$F = 10.05^{**}; \eta^2 = .097$
Early Preparation Level		1.90	All > D
Preparation Disengaged	6.54		
Progressing	6.00	2.00	
			P > L
Early Preparation Level	4.22	2.00	
Progressing	7.03	1.91	

E= Early Progressing, P= Progressing, L= Level Preparation, D = Disengaged

** $p < .001$, * $p < .05$

Table 10. Study 3:

Means, Standard Deviations, and Subtype Comparisons for the Sun Protection Behavior Scale.

Sun Protection Clusters	M	SD	
			$F = 18.71^{**}; \eta^2 = .182$
Early Preparation	22.46	4.79	$P > \text{All}$
Disengaged 1	21.87	4.57	
Disengaged 2	20.33	5.83	
Progressing	27.77	4.48	

E= Early Progressing, P= Progressing, L = Level Preparation, D = Disengaged

 $^{**} p < .001$

Table 11. Study 3:

Results for Chi-square Analyses for Four Clusters at Preparation Stage on Three Behavioral Variables.

Variables	n	Early Preparation (%)	Level Preparation (%)	Disengaged (%)	Progressing (%)	χ^2
<hr/>						
<i>SPF of sunscreen</i>						45.33**
Never		6.7	17.1	45.5	5.1	
Use	36					
1-4	7	6.7	1.8	-	-	
5-9	44	17.6	23.4	4.5	7.7	
10-14	10	1.4	5.4	4.5	5.1	
15-29	111	46.0	43.3	27.3	53.9	
30+	41	21.6	9.0	18.2	28.2	
Total	249					
<i>(Ever) Used a tanning booth/sun lamp</i>						2.34
No	147	53.8	55.7	70.8	59.0	
Yes	112	46.2	44.3	29.2	41.0	
Total	259					
<i>If yes, past year used a tanning booth/sun lamp</i>						
No	91	77.8	80.4	57.1	100.0	6.57
Yes	21	22.2	19.6	42.9	-	
Total	112					

** $p < .001$

Table 12. Study 3:

Demographic Variables and Results for Chi-square Analyses for Four Clusters at

Preparation Stage

Variables	n	Early Preparation (%)	Level Preparation (%)	Disengaged (%)	Progressing (%)	χ^2
<i>Age</i>						8.22
< 34	38	11.0	19.1	15.8	32.3	
34-49	95	46.6	43.8	42.1	41.9	
50-64	57	31.5	27.0	26.3	16.1	
65+	24	11.0	10.1	15.8	9.7	
<i>Total</i>	214					
<i>Gender</i>						1.89
Male	75	27.4	37.1	30.0	34.4	
Female	149	72.6	62.9	70.0	65.6	
<i>Total</i>	224					
<i>Marital Status</i>						25.34*
Married	155	69.4	76.6	68.4	60.0	
Living with Partner	7	1.4	4.3	5.3	3.3	
Not Married	24	9.7	9.6	-	26.7	
Separated	2	-	2.1	-	-	
Divorced	18	13.9	5.3	15.8	-	
Widowed	11	5.6	2.1	10.5	10.0	
<i>Total</i>	217					
<i>Race</i>						13.06
White	213	98.6	98.9	100.0	93.3	
Black	1	-	-	-	3.3	
Asian or Other Pacific Islander	1	-	-	-	3.3	
Other	2	1.4	1.1	-	-	
<i>Total</i>	217					
<i>Ethnicity</i>						0.67
Non- Hispanic	212	97.2	97.9	100.0	96.7	
Hispanic	5	2.8	2.1	0.0	3.3	
<i>Total</i>	217					

<i>Health Status</i>						12.74
Poor	5	2.3	2.8	2.1	5.3	
Fair	23	10.6	11.1	12.8	5.3	
Good	85	39.2	37.5	39.4	36.8	
Very Good	80	36.9	40.3	38.3	26.3	
Excellent	24	11.1	8.3	7.4	26.3	
<i>Total</i>	217					

* $p < .05$

Figure 1. Study 1: Profiles of the four subtypes at the Precontemplation stage from Sample 1.

Figure 2. Study 1: Profiles of the four subtypes at the Precontemplation stage from Sample 2.

Figure 3. Study 1: Profiles of the four subtypes at the Precontemplation stage from Sample 3.

Figure 4. Study 1: Profiles of the four subtypes at the Precontemplation Stage from the General Sample.

Figure 5. Study 2: Profiles of the four subtypes at the Contemplation stage from Sample 1.

Figure 6. Study 2: Profiles of the four subtypes at the Contemplation stage from Sample 2.

Figure 7. Study 2: Profiles of the four subtypes at the Contemplation Stage from the General Sample.

Figure 8. Study 3: Profiles of the four subtypes at the Preparation stage from Sample 1.

Figure 9. Study 3: Profiles of the four subtypes at the Preparation stage from Sample 2.

Figure 10. Study 3: Profiles of the four subtypes at the Preparation Stage from the General Sample.

Appendix A - Survey Measures

Sun Exposure Stages of Change: Sun Protection Items for Staging Algorithm

The following questions are about protecting yourself from too much summer sun exposure. There are several ways to protect yourself from the sun:

- by using sunscreens with a Sun Protection Factor (SPF) of 15 or more
- by wearing protective clothing (for example, a hat with a wide brim, shirts, and long pants)
- by avoiding or limiting exposure to the sun during the mid-day hours

1. Do you protect yourself from exposure to the sun consistently, that is, whenever you know you will be out in the sun for more than about 15 minutes?
2. Have you consistently protected yourself from exposure to the sun for the past 12 months?
3. Do you intend to consistently protect yourself from exposure to the sun in the next 12 months?
4. Do you intend to consistently protect yourself from exposure to the sun in the next 30 days?

Sun Protection Behavior Scale (SPBS)

During the summer, when you are in the sun for more than about 15 minutes, how often do you do each of the following? Please, use the following 5-point scale.

1 = Never 2 = Rarely 3 = Sometimes 4 = Often 5 = Always

Sun Avoidance

1. Wear a shirt
2. Stay in shade
3. Avoid the sun during mid-day hours
4. Limit exposure to the sun during the mid-day hours

Sunscreen Use

1. Use a sunscreen
2. Use a sunscreen with SPF of 15 or more on your face
3. Use a sunscreen with SPF of 15 or more on all sun exposed skin areas.

Decisional Balance

Next are opinions some people may have about protecting themselves from summer sun. Please rate how important each opinion is to you in deciding whether or not to protect yourself from too much sun exposure, using the following scale:

1 = Not Important 2 = Slightly Important 3 = Moderately Important
4 = Very Important 5 = Extremely Important

Cons

1. The sun feels good on my skin
3. I feel healthy when I have a nice tan.
5. Having to avoid the sun takes the fun of being outdoors.
7. I look better when I have a tan.

Pros

2. Reducing sun exposure is an easy way to protect my health.
4. Using sunscreens allows me to enjoy the outdoors with less worry.
6. The health risks from sun exposure are serious
8. My skin won't age so fast if I reduce my sun exposure.

Self-Efficacy

Next are situations in which some people might choose not to protect themselves from too much summer sun. Please rate how confident you are that you would use sun protection in each situation, using the following scale:

1 = Not at all Confident 2 = Not very confident 3 = Moderately Confident
4 = Very Confident 5 = Extremely Confident

How confident are you that you would...

1. Use sunscreen whenever you are out in the summer sun for more than 15 minutes.
2. Use sunscreen when no one else you are with is using sunscreen.
3. Use sunscreen even if you don't like how it feels.
4. Stay in shade when all your friends are enjoying themselves in the sun.
5. Cover up with protective clothing even when it is hot outside.
6. Avoid going outside in the summer during the midday hours.
7. Wear a hat with a wide brim even if you don't like how it looks.

Processes of Change

The following feelings, thoughts, and experiences can affect the summer sun exposure habits of some people. We would like to know how often you may have had similar feelings, thoughts, and experiences during the past summer using the following scale:

1 = Never 2 = Rarely 3 = Sometimes 4 = Often 5 = Always

Counter conditioning

1. I do something else instead of sun bathing when I need to relax.
2. Instead of tanning, I do other things.

Consciousness Raising

1. I look for information about the risks of getting too much sun.
2. I think about what I've seen on TV or in magazines about the health risks of sun exposure.

Dramatic Relief

1. It bothers me when I see someone whose skin has been damaged by the sun.
2. I get upset when I see someone aged by too much tanning.

Environmental Reevaluation

1. Getting too much sun sets an unhealthy example for others.
2. Using sunscreens more often might influence others to do the same.

Helping Relationships

1. People who are important to me encourage me to protect myself from the sun.
2. I have a friend or family member who reminds me to use sunscreen.

Reinforcement Management

1. I reward myself when I avoid the sun.
2. I am rewarded by others for reducing my sun exposure.

Self-Reevaluation

1. I think about the damage to my appearance that will result from too much sun.
2. I worry that too much sun will make my skin look bad.

Social Liberation

1. I notice that many people are protecting themselves from the sun these days.
2. I see more and more people using sunscreens to protect themselves from the sun.

Self Liberation

1. I make commitments to reduce my sun exposure.
2. I tell myself that if I try hard enough I can avoid the risk from sun exposure.

Behavioral Measures

1. SPF of the sunscreen you use most often
1 = Never uses sunscreen 2 = SPF 1-4 3 = SPF 5-9 4 = SPF 10-14
5 = SPF 30 or more
2. Have you ever had a painful sunburn?
1 = Never 2 = Once 3 = Twice 4 = 3-5 times 5 = More than 5 times
3. In the past year, have you had a painful sunburn?
1 = Never 2 = Once 3 = Twice 4 = 3-5 times 5 = More than 5 times
4. Have you ever used a tanning booth or sunlamp?
1 = Yes 2 = No
5. Have you used a tanning booth or sunlamp in the past year?
1 = Yes 2 = No

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