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# Development of a Stages of Change Model for Sun Exposure

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# DEVELOPMENT OF A STAGES OF CHANGE MODEL
# FOR SUN EXPOSURE

BY

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Abstract

A model of readiness to reduce sun exposure was developed and tested using factor analytic, structural modeling, and cluster analytic techniques, and employing double cross-validation procedures. This model is based on the stages of change model developed by Prochaska & DiClemente (1983) which posits that people pass through a series of stages in their attempts to change behavior: Precontemplation (not intending to change); Contemplation (seriously considering change); Action (actively engaged in change); and Maintenance (successfully sustained change). A 35-item questionnaire measuring the four stages of change was administered to 595 participants in a worksite health promotion program. Six competing measurement models were compared and a four factor correlated model corresponding to the four stages of change was found to provide the best fit to the data. These analyses also resulted in a short and reliable 16 item measure of sun exposure behavior and intentions. Item factor loadings were high (median = .82). Internal consistency (alpha) coefficients for the four stages of change scales were also very good (.80 to .89). Cluster analyses of the four scales resulted in eight distinct profiles similar to those obtained in previous analyses of the stages of change in other problem areas. These developmental findings suggest that the stages of change model, productive in other areas of health behavior, can be adapted to problems of sun exposure and skin cancer prevention.

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The human skin is the body's protective barrier against the hazardous substances of the external world and its health reflects the safety of the environmental conditions in which we live. Consequently, changes in sun exposure behavior have resulted in an epidemic of skin cancers over the last 20 years, with worldwide incidence rates soaring dramatically (Davis, Hoel, Fox, & Lopez, 1990; Fears & Scotto, 1982; Glass & Hoover, 1989; Kopf, Rigel, & Friedman, 1982, Weinstock, 1989). Skin cancer from sun exposure is now the single most common form of cancer, with more than 600,000 new cases each year (American Cancer Society, 1990). The average person in the United States has a 1 in 7 chance of developing some form of skin cancer in his or her lifetime, and it is estimated that 8,800 Americans died last year of skin cancer (American Cancer Society, 1990).

The three major types of skin cancer - melanoma, basal cell carcinoma and squamous cell carcinoma - account for 5%, 75% and 20% of all skin cancers, respectively. Mortality rates from malignant melanoma, the most fatal form of skin cancer, have increased faster than any other type of cancer except for lung cancer among women (Fears & Scotto, 1986), and is now the most common malignancy among white males and females 25 to 29 years of age as well as a leading cause of death in early adulthood (Weinstock, Clark, & Calabresi, 1991). Squamous cell carcinoma, while comparatively less malignant than melanoma, remains a significant cause of death; basal cell carcinoma is rarely fatal but is of particular concern because of the associated morbidity and disfigurement.

While different etiologies have been suggested for the development of melanoma and nonmelanoma skin cancers, all implicate exposure to sunlight as the primary culprit. Melanoma skin cancers have been attributed to intensive but intermittent sun exposure while non-melanoma cancers have been attributed to cumulative lifetime exposure (Armstrong & Holman, 1987; Osterlind, Tucker, Stone, & Jensen, 1988). The historical changes in social norms wherein a tanned body and leisure time in the sun became synonymous with a healthy lifestyle are consistent with the twenty year rise in incidence rates (Keesling & Friedman, 1987). The relationship between geographical latitude and skin cancer incidence is also generally supportive of sun exposure as a primary carcinogenic determinant (Armstrong & Holman, 1987; Lee, 1982). The evidence from human epidemiological and experimental animal studies on the oncogenic effect of excessive sun exposure is similarly well established (Urbach, 1984), with increased risk of skin cancer associated with both constitutional and environmental factors (Elwood, Gallagher, Davison, & Hill, 1985; Hunter, Colditz, Stampfer, Rosner, Willett, & Speizer, 1990). Thus, while a pale inherited skin type renders some people more susceptible to skin cancer, the development of skin cancer is largely behaviorally determined (Stern, Weinstein, & Baker, 1986) with intentional exposure to ultraviolet radiation the main environmental risk (Goldsmith, 1987).

The increased morbidity due to skin cancer from sun exposure together with the aging of the population has been evidenced in the high personal and economic costs of disfigurement, health care delivery and financing (Keesling & Friedman, 1987). The American Academy of Dermatology (1987) links chronic unprotected sun exposure in childhood to the subsequent change in skin texture that promotes wrinkling, skin thickening, and a weakening of the skin's elasticity leading to sagging cheeks, deep facial wrinkles, and skin discoloration later in life. A 12 billion dollar per year cosmetic industry has developed in the United States to mask the signs of aging, an estimated 90% of which is caused by photoaging due to sun exposure (Roger & Gilchrest, 1990). Office visits for non-melanoma skin cancers have increased more than 50% since 1975 contributing more than $125 million to the cost of health care per year (Kraemer, 1989). Further, the prospect of continued depletion of the ozone layer portends 200,000 additional skin cancer deaths over the next five years in the United States (Kerr, 1991), and consequently the exacerbation of the current epidemic. As environmental issues are currently at the forefront of the sociopolitical agenda, cancer-producing behavior associated with sun exposure promises to become increasingly relevant.

With the escalating psychosocial and physical consequences due to unprotected sun exposure practices, the impetus for psychologists to begin to investigate behavior change in this area would seem evident. Yet, the behavioral sciences have been slow to recognize the existence and the extent of the problem (Keesling & Friedman, 1987; Rossi, 1989a, 1989b). Of the few studies available, the primary emphasis has been on assessment of skin cancer knowledge, psychosocial correlates of sun exposure and sunscreen use, and general behavioral intent. Little emphasis has been directed at assessing readiness to change sun exposure behavior and consequently, less emphasis has been dedicated to the development and testing of measures to assess such intentions. Prevention and intervention programs designed to impact on sun exposure practices have also been rare and have been guided by limited theoretical underpinnings. Of the interventions attempted, application of health education approaches have been favored, but have met with minimal success in influencing desired behavior change (Cody & Lee, 1990; Friedman & Keesling, 1989; Johnson & Lookingbill, 1984).

The relative ineffectiveness of information dissemination related to precautionary sun exposure has been evident in several investigations assessing skin cancer and sun exposure knowledge. Hill, Rassaby and Gardner (1984) reported that for men, intention to use sunscreens was correlated with the belief that sunscreens aid in getting a tan. Johnson and Lookingbill (1984) found that while 41% of their sample used sunscreens, 36% of those who did so believed that sunscreens promote tanning. Of those who did use suntan lotion, 30% intended it to prevent sun burning. More than half of the sample did not know the definition of SPF (sun protection factor) nor that higher SPF ratings provide greater protection.

Cockburn, Hennrikus, Scott and Sanson-Fisher (1989) found that knowledge about skin cancer was not associated with sun protection use and that attitudes and beliefs about the benefits and barriers to sun exposure protection predicted failure to use sun precautions. Of their sample of adolescent school children, 70% did not use any form of sun protection. The preferred method of sun protection (if they had to use one) was sunscreen. Johnson and Lookingbill (1984) distributed an informational pamphlet and a free sunscreen sample and found that 89% of their subjects reported reading the pamphlet and skin cancer knowledge was increased at follow-up. Yet, only 41% of the subjects used the free sunscreen sample -- no more than used at pretest -- and only 10% subsequently bought their own sunscreen. Among the sun-exposed subjects who did not previously use sunscreens, these figures were even lower (35% and 5%, respectively). While the lack of a control group makes it difficult to conclude conclusively that the pamphlet was effective in increasing skin cancer knowledge, the use of sunscreens was clearly not affected.

Conversely, Keesling and Friedman (1987) found that knowledge about skin cancer was related to both sunbathing and the use of sunscreens in their adult beach population. Sunbathing was also found to be related to positive attitudes toward risk taking behaviors, to maintaining a positive physical appearance, and to having friends who sunbathe. As such, Friedman and Keesling (1989) suggested that knowledge-based interventions might provide effective strategies for reducing risk from sun exposure. They assigned subjects at random to high and low information conditions and to cancer fear/no fear conditions (using pictures). Skin cancer knowledge was increased in the high information condition, but attitudes towards sunscreens and intentions to use sunscreens were not affected. The fear induction condition was also not effective.

In Australia, Cody and Lee (1990) measured skin cancer prevention behaviors for 312 psychology undergraduates on the four variables derived from the Health Belief Model (HBM) (Janis & Becker, 1984) - percepts of severity, susceptibility, barriers to protective behavior, and benefits of protective behavior. While perceived severity and the perceived benefits of protection were strongly endorsed, barriers to precautionary sun exposure behavior were rated high and perceived susceptibility was deemed low. Thus, despite considerable knowledge regarding skin cancer and protective behavior and despite a high level of exposure of the students to actual skin cancer cases, 78% did not think that skin cancer was a real concern for them. Such an "optimistic bias" has been noted as a serious deterrent for precaution adoption of a diversity of health behaviors (Weinstein, 1988), and for sun exposure protection in particular (Miller, Ashton, McHoskey, & Gimbel, 1990).

Miller, Ashton, McHoskey, and Gimbel (1990) played a videotape to adolescents documenting the risks associated with sun exposure either before or after responding to a questionnaire dealing with attitudes and beliefs about suntanning. While the tape influenced students in the direction of perceiving a tan as less attractive and enhanced their concern about the dangers of tanning, all students manifested the "optimistic bias" effect with regard to their estimated likelihood of developing skin cancer. Cody and Lee (1989) also investigated the effectiveness of videotapes upon the health beliefs of their college student population but used both emotional and informational skin cancer prevention tapes. They found that perceived susceptibility as well as perceived barriers remained unaffected by the video interventions. However, knowledge scores were significantly greater for the informational video when compared to a control video. Skin protection intentions were also increased for both informational and emotional video conditions, although remaining high for only the emotional video at a 10 week follow-up. Unfortunately, neither videotape intervention impacted on actual skin examination behavior.

More ambitious large scale programs using multimedia campaigns have been designed to target community awareness and to modify behavior concerning sun exposure practices. Again, the primary approach has been to adapt a health education model. One such public education approach involved the distribution of skin cancer comic books to 35,000 Hawaii residents as well as the airing of television and radio announcements (Putnam & Yangisako, 1982). Evaluation of the program consisted of surveying a subset of the total target caucasian group. While the comic book was interpreted as successful in motivating desired behavior change among the number of households who remembered receiving it (44%) and then chose to read it (90%), pre-existing differences existed in the subgroup's knowledge and motivation relative to the entire intervened community, the effect of the television and radio ads were not controlled in the study design, and the campaign lacked a control population from which behavior change rates could be compared.

Two multimedia programs in Australia, the Slip! Slop! Slap! and the "SunSmart" campaigns have also reported an increase in sun protective behavior. The "Slip" (on a shirt)

"Slop" (on some sunscreen), and "Slap" (on a hat) campaign (Rassaby, LaCombe, Hill & Wakes, 1983) evidenced an increase in sunscreen use over a one year period of mass media advertising and community activities. The "SunSmart" campaign (Borland, Hill, & Noy, 1990) followed with broader objectives aimed at reducing barriers to sun protection. They found that after one year, 48% of the people surveyed reported having made extra sun protective efforts during the preceding summer, with approximately 24% attributing their actions to the campaign. Further, 66% of the subjects indicated that they had encouraged others to increase their level of sun protection. Use of sunscreens (29%, 49%), hats (22%, 32%), and shirts (13%, 22%) were the most frequently cited changes for subjects and the most frequently recommended behaviors to others, respectively. As no experimental community control groups were employed in the Slip! Slop! Slap! or "SunSmart" campaigns, ascertaining whether informational and behavioral changes are directly attributable to either campaign, to the combined effect of both the Slip! Slop! Slap! and "SunSmart" campaigns, or simply due to changing social norms independent of either mass media intervention is, at best, speculative.

Indeed, assessment of existing sun exposure behavior in non-intervened Rhode Island samples revealed results consistent with the SunSmart campaign post-intervention behavior change results - 50% to 60% of adults had already changed their sun exposure behavior for greater than one year and 25% were maintainers of sunscreen use for greater than one year (Blais & Rossi, 1990; Rossi & Blais, 1991). Further, in a national telephone survey of 1,013 adults and 126 teenagers conducted by the American Academy of Dermatology (in Gilmore, 1989), 67% of teen-agers and 77% of the adults reported taking precautions when in the sun and 96% of respondents could name at least one negative impact from the sun. Yet, 66% of the teen-age females, 34% of teen-age males, 31% of adult females and 28% of adult males still reported intentionally working on a tan. Blais and Rossi (1990) also noted that while 50% of their sample responded as "early adopters" of healthy sun habits, the frequency at which they actually applied these cancer-reducing behaviors was still too low to afford adequate skin protection. Thus, the question of what intervention modalities work best when and for whom has yet to be investigated.

A clear need for the field is the adoption of effective models to guide data collection, analysis, and interpretation to aid in the development of prevention and intervention programs (Rossi, 1989a, 1989b). To date, behavioral studies of sun exposure have relied mainly on the Health Belief model (Janz & Becker, 1984), but this model may be more properly viewed as heuristic (Hill et al., 1984), and thus may not be specific enough to help develop concrete interventions. Since no models exist which have been designed specifically for sun exposure, it is likely that models from other health behavior areas will have to be adopted, or that combinations of models will have to be employed (Cummings, Becker, & Maille, 1980; Hill et al., 1984, Keesling & Friedman, 1987; Rossi, 1989a, 1989b). A model which has been particularly effective in a variety of health-related areas is the Transtheoretical Model of behavior change (Prochaska & DiClemente, 1983, 1985, 1986).

Originally developed to synthesize and systematize the field of psychotherapy (McConnaughy, Prochaska, & Velicer, 1983; McConnaughy, DiClemente, Prochaska, & Velicer, 1989; Prochaska, 1979; Prochaska & DiClemente, 1982), the stages of change model has been applied successfully across a diversity of problem behaviors including but not restricted to, smoking cessation (DiClemente, Prochaska, Fairhurst, Velicer, Valesquez, & Rossi, 1991; Prochaska & DiClemente, 1983; Velicer, DiClemente, Rossi, & Prochaska, 1990), adolescent cigarette smoking acquisition (Stern, Prochaska, Velicer, & Elder, 1987), cocaine abuse (Rosenbloom, 1991), alcohol abuse (Snow, Prochaska, & Rossi, 1991), outpatient alcohol treatment (DiClemente & Hughes, 1990), dietary fat reduction (Rossi, Rossi, & Prochaska, 1990), mammography screening (Rakowski, 1990), HIV risk reduction (Prochaska, Redding, Harlow, Rossi, & Velicer, 1991), and adolescent delinquent behavior (Fiore, 1991). The central construct of the model is the stages of change. Research on how people change behavior over time in the natural environment as well as in intervention programs indicates that people pass through a series of stages:

precontemplation (not intending to change, or denying the need to change), contemplation (seriously considering change), action (actively engaging in changing behavior), and maintenance (sustaining successful change efforts to prevent relapse). However, progression through the stages is not linear, since the majority of people relapse and recycle back to the contemplation stage, usually several times before successfully changing their behavior.

Interventions designed to change lifestyle risk factors have frequently not been as successful as hoped, mainly because most programs are implicitly designed for individuals who are ready to take action. Interventions which are tailored to participants' stage of change have been more successful in modifying problem behavior, with the amount of progress made a function of the stage of change a person is in at the start of treatment. For example, an intensive action-maintenance oriented treatment program for cardiac patients was highly successful for smokers who were ready for action (94% abstinent), but failed for smokers who were precontemplators (0% abstinent) and contemplators (35% abstinent) (Ockene, Ockene, & Kristeller, 1988). The importance of matching treatment to stage was further underscored in a prospective study of smoking cessation in which it was found that helping people progress just one stage can double the chances that the participants will take action on their own in the near future (DiClemente, Prochaska, Fairhurst, Velicer, Velasquez, & Rossi, 1991).

It is likely that the discouraging results of sun exposure prevention programs to date are due to the application of action-oriented strategies to participant groups not yet ready for action (Rossi, 1989a, 1989b), or to the application of health education campaigns that move people to contemplate change but demand action-oriented outcomes as the indicants of intervention success. Using data reported by Johnson and Lookingbill (1984), Rossi (1989a, 1989b) estimated that the majority of that subject sample were in the precontemplation and contemplation stages, with only a few individuals in the action stage. He noted that the imposition of an action criteria of success -- using and buying sunscreens -- virtually guaranteed discouraging results. Ironically, the Johnson and Lookingbill study might very well have been successful in reaching precontemplators and contemplators, but no outcome criteria appropriate for these groups were assessed.

In addition to the stages of change, the Transtheoretical Model contains several other dimensions. The processes of change are strategies and techniques people use as they progress through the different stages of change. The transition to each stage from the previous stage is characterized by the use of a particular set of change processes (Prochaska, DiClemente, Velicer, Ginpil, & Norcross, 1985; Prochaska, Velicer, Guadagnoli, Rossi, & DiClemente, 1991). For example, the processes people use to move from precontemplation to contemplation are different from the processes used by people moving from contemplation to action. Decisional balance represents the relative weighting of the pros and cons of changing behavior so as to reduce risk. This dimension of the model is successful in predicting the decision to move to the action stage (Velicer, DiClemente, Prochaska & Brandenburg, 1985) as well as the decision to move from precontemplation to the contemplation stage of change. Self-efficacy represents the degree of confidence and temptation experienced across a wide range of challenging situations. This dimension of the Transtheoretical model is successful at predicting maintenance and relapse (Prochaska, et al., 1985; Velicer, DiClemente, Rossi, & Prochaska, 1990). Keesling and Friedman (1987) suggest that self-efficacy may be a particularly important variable for understanding sun exposure habits.

The Transtheoretical Model is unique in that it integrates alternative models into an eclectic whole, indicating when, how, and where the different theories are most applicable to the change process. For example, some aspects of the Health Belief Model and similar health-education approaches would fit into the "consciousness raising" process of change and be apt to move precontemplators into contemplation. Social learning and behavioral modification approaches are most applicable to individuals in the action or maintenance stages of change. Azjen and Fishbein's (1980) Theory of Reasoned Action could be seen as bridging the transition from contemplation and action, emphasizing behavioral intention and social and behavioral norms. The pros and cons of behavior change are based, in part, on the decision-making model of Janis and Mann (1977), and are important for understanding the decision to move from precontemplation to contemplation. The self-efficacy aspect of the Transtheoretical Model is based on the model of self-efficacy proposed by Bandura (1977, 1982), and is a critical variable related to successful maintenance and to relapse. The situational self-efficacy component also relates to the coping models of relapse and maintenance pioneered by Shiffman (Shiffman, 1982, 1986; Velicer, DiClemente, Rossi, & Prochaska, 1990). Thus, the Transtheoretical Model subsumes and surpasses the most effective prevention models currently available. Such an approach to model building, integrating the best aspects of competing models, is inherently strong, and has been advocated for the health behavior field in general (Cummings et al., 1980), and for the sun exposure area in particular (Hill et al., 1984; Keesling & Friedman, 1987; Rossi, 1989a).

Applying to sun exposure a model successful in other health areas may make initial technology transfer between these problem areas easier than might have been expected. Indeed, Keesling and Freidman (1987) noted that sun exposure might be considered in the context of addictive behaviors in future research. While such a statement is speculative, there are important similarities between sun exposure and behaviors such as smoking, alcohol use, and over-eating. All may be considered approach behaviors in the sense that all have immediate pleasurable aspects followed by long term increased risks for illness. For all these behaviors, short term gains can outweigh long term risks. Of course, problems unique to the area of sun exposure will remain (e.g., its seasonal nature, the fact that it is a "new" problem, etc.). However, both Rogers (1983) and Weinstein (1988) have proposed that stage-based models are most applicable for the diffusion of health promotion innovations and for individual "precaution adoption" of new health behaviors. As such, there should be advantages in adapting to sun exposure a stage-based model which has proven success in changing problem behaviors in other health-related areas.

To date, instrument development and preliminary analyses of a staging algorithm and several decisional balance measures have indicated that adaptation of the stages of change model to sun exposure is relatively straightforward, produces measures with stable psychometric properties, and contributes uniquely to that which is known about sun exposure behavior. The algorithm is a brief measure of the stages of change and assesses intentions to change sun exposure behavior to reduce the risk of skin cancer in a discrete yes/no classification format. This instrument has been administered to two different populations and has revealed similar results for both samples: 30% of respondents were in the precontemplation stage, 5% in the contemplation and action stages, and 60% in the maintenance stage (Rossi, 1990a, 1990b). However, when long-term maintainers are removed from the analysis so that only subjects actively engaged in change are included, 80% of subjects are in the precontemplation stage of change. These results suggest that individuals resistant to change or not considering change are the likely focus of skin cancer interventions. As such, greater investigation into the behavioral profiles of such persons would seem prerequisite to developing and administering prevention programs.

Measurement research and cluster sample profiles for the stages of change have been undertaken successfully in the health areas of psychotherapy (McConnaughy, DiClemente, Prochaska, & Velicer, 1989; McConnaughy, Prochaska, & Velicer, 1983), outpatient alcoholism treatment (DiClemente & Hughes, 1990), and adolescent cigarette smoking acquisition (Stern, Prochaska, Velicer, & Elder, 1987). Adaptations of the stages of change instruments have been uniformly developed and tested through the use of a) principal components analyses for assessment of factor structure and for data reduction, b)coefficient alpha for a measure of internal consistency, and c) cluster analyses for the validation of the stages via subgroup classification profiles. Both DiClemente and Hughes

(1990) and Stern et al. (1987) further attempted external validation of the cluster profiles, although only Stern et al. (1987) externally validated the principal component factor structure. Further, McConnaughy et al. (1989) successfully cross-validated their stages of change scales through replication of the original study with a new clinical sample. Thus, a fairly standard methodology for assessing the internal consistency, internal and external validity of the stages of change construct has been established.

This study was designed to develop and test a model of readiness to reduce sun exposure with subjects participating in a worksite health promotion research program in Rhode Island. The model is based on the stages of change model developed by Prochaska and DiClemente (1983). It is hypothesized that responses to the Sun Exposure Stages of Change Questionnaire will generate a reliable and stable factor structure consistent with the factor structures of the stages of change instruments applied to other health-related problem behaviors. The structure of the Sun Exposure Stages of Change Questionnaire will be assessed through the use of factor analytic, structural modeling, and cluster analytic techniques, and through item and scale statistics.

Principal components analyses and factor analyses using structural equation modeling will be used in this study to reduce the item set of the SEQ and to assess and confirm the structure of the SEQ. Cluster analyses will be conducted to determine whether the profiles observed support the stages of change model for sun exposure and/or indicate additional profile subtypes to be explored in subsequent analyses. The cluster analytic results will also be assessed for correspondence with previous profile subtypes derived from cluster analyses in other health-related areas which employed a stages of change model (DiClemente & Hughes, 1990; McConnaughy, DiClemente, Prochaska & Velicer, 1989; McConnaughy, Prochaska, & Velicer, 1983). The result of these exploratory and confirmatory analyses will be the development of a short, reliable and valid measure of sun exposure behavior and intentions.

By developing a theory-guided stage-based model for sun exposure, knowledge about who are responding to what types of intervention and when could then begin to be investigated. By developing an instrument which assesses readiness to change, program success need no longer be determined solely by an action-oriented criterion (ie.; % of persons using sunscreen). Rather, interventions could be evaluated with respect to their degree of facilitation in progressing individuals through one stage of change to another toward the eventual goal of adopting and maintaining safer sun exposure behavior.

## Methods

Subjects

Subjects are 595 participants in a worksite health promotion program in Rhode Island. The population is approximately two-thirds female with a mean age of 37.2 years (SD = 14.2). The average years of education is 12.3 (SD = 1.9) with a median annual income of $30,000. Most participants are from blue collar occupations (approximately 85%). The responses of complete responders comprise the data within this study.

Measures

Sun Exposure Questionnaire. The Sun Exposure Questionnaire (SEQ) is a 35-item instrument devised to measure the four stages of change - precontemplation, contemplation, action and maintenance (Appendix A). The precontemplation scale consists of 8 items, while the contemplation, action and maintenance scales consist of 9 items each. Items are theoretically based on the stages of change model and adapted from the general stages of change questionnaire (McConnaughy, et al., 1983) to the problem of sun exposure, specifically. A Likert-type, five-point response format was used (1 = Strongly Disagree to 5 = Strongly Agree).

Stages of Change Algorithm. The stages of change algorithm classifies people into categorical stages of change representing precontemplation, contemplation, action and maintenance. It consists of a short series of 5 questions answered in a yes/no format assessing behavioral intention and actions to change sun exposure habits to reduce the risk of skin cancer (Appendix A).

<u>Procedure</u>

After volunteering for the study, informed consent was obtained from all the participants. Subjects were mailed the sun exposure survey along with a battery of health questionnaires during one of several regularly scheduled assessment periods. Subjects were entered into a $100 lottery for completing the health survey but no additional incentive was offered for completing the sun exposure survey.

<u>Analyses</u>

Analysis of a stages of change model for sun exposure was conducted using a split-half procedure in which the sample was randomly divided, with the first half of the sample used for exploratory analyses and the second half used for cross-validation confirmatory analyses. Such exploration through confirmation has been recommended for exploratory factor analyses in general (Kroonenberg & Lewis, 1982), and for covariance structures specifically (Cudeck & Browne, 1983). Next, a "double cross-validation" was performed by repeating the split-half process (Cudeck & Browne, 1983; Kroonenberg & Lewis, 1982). Thus, the former principal components analysis sample becomes the validation sample and the structural equation sample becomes the calibration sample. This double cross-validation procedure using structural equation modeling has not previously been conducted in the measurement development and assessment of the stages of change. It was conducted in this proposed study as further evidence of the internal validity and robustness of the SEQ factor structure. Lastly, cluster analysis was performed on the total sample with split-half validation employed to assess whether the two subsamples replicated the clusters identified from the total sample.

## Results

### Cross-Validation #1

Exploratory Analyses. Exploratory principal components analyses were conducted on the 35 X 35 interitem correlations using the half sample A (N=273) to derive the factor structure of the SEQ and to determine the number of components to retain. The number of components to extract was based on statistical grounds using Velicer's (1976) MAP (minimum average partial) procedure and Horn's (1965) parallel analysis, as well as guided by theoretical and design considerations as to the number of components expected from the SEQ. Both the MAP and parallel analysis procedures have proven success at accurately determining the number of components to retain across a wide range of simulated conditions (Zwick & Velicer, 1986). The MAP procedure and Horn's parallel analysis differed in their extraction solution for sample A. MAP posited a 5 factor solution and parallel analysis posited a 3 factor solution to the data. Consequently, varimax and oblique rotations were conducted for the range of component structures with 3, 4, and 5 factor solutions tested.

As the two rotational patterns were in agreement, varimax results were interpreted as is consistent with previous analyses of stages of change instruments for other health behavior. A three component solution corresponding to the 3 stages of change - precontemplation, action, and maintenance - was most clearly identified. A fourth component with 3 contemplation item loadings emerged but only weakly while a 5th component was not meaningful.

Principal components analysis in conjunction with coefficient alpha (Cronbach, 1951) and item-total correlations were used as a data reduction technique. An item was retained on a factor if the item loaded .50 or greater on the target component, did not load higher than .40 on any other component, and was reflective of the breadth of the construct. Items that did not load on any component, were complex (loaded .40 or greater on 2 or more components), or did not fit theoretically, were deleted.

Coefficient alpha was used to determine the degree of internal consistency (scale homogeneity) for each of the retained components. The alphas for the precontemplation, action and maintenance scales were .88, .89, and .87. Item-total correlations were computed and items which had low and/or negative item-total correlations or which substantially reduced a scale's internal consistency were deleted. These component selection criteria and deletion procedures resulted in a short factor structure of 4 items for each of the 3 components accounting for 74% of the variance. Table 1 presents the varimax rotated component pattern for the 12 X 12 interitem correlation matrix for sample A.

Coefficient alpha and item-total correlations were also used to select four coherent and internally consistent items for a plausible fourth component representing the contemplation scale. The SEQ was designed theoretically to assess four stages of change and, while the principal components analyses suggest but do not clearly isolate a fourth component, the potential for such a factor to emerge with the more powerful technique of structural equation modeling exists and needs to be tested with the calibration sample B. The 16 items selected for the SEQ are presented in Appendix B. Reduction of the 35 items to 4 items per component did not substantially reduce the internal consistency of the scales, actually increasing coefficient alpha slightly for the action scale. The coefficient alphas for 4 item precontemplation, contemplation, action and maintenance scales were .88, .79, .90, .84, respectively.

Confirmatory Analyses. Confirmatory factor analyses using structural equation modeling (Bentler, 1989; Joreskog & Sorbom, 1989) was conducted on the hold-out, calibration sample B ($N$ = 260). Five competing measurement models were compared with maximum likelihood and elliptical factor analyses using the EQS computer program (Bentler, 1989). The five models were: 1) General (1 factor) model; 2) 2 factor model; 3) 3 factor model; 4) 4 factor uncorrelated model; and 5) 4 factor correlated model.

The one factor model is the simplest plausible model, positing the existence of a single general stage of change for sun exposure. Support for this model would suggest that subjects do not differentiate among stages of readiness in their attempts to change sun exposure behavior.

The two factor model proposes the existence of 2 stages that people pass through in their change attempts. Support for this model would suggest that subjects differentiate only between non-adoption (Precontemplation + Contemplation) and adoption (Action + Maintenance) of sun exposure behavior aimed at reducing risk of skin cancer.

The three factor model proposes that people recognize 3 stages of change corresponding to a Precontemplation stage, a Contemplation plus Action stage (Decision Making), and a Maintenance stage. This model would suggest that people either 1) have no intention of changing; 2) are in the process of thinking about changing sun exposure behavior and may have begun initiating such changes; or 3) have already changed sun exposure habits for some time. Support for a 3 factor model has been found by Stern et al. (1987) for adolescent smoking acquisition.

The <u>four factor uncorrelated model</u> posits that people distinguish four stages in the process of behavior change: Precontemplation (not intending to change); Contemplation (seriously considering change); Action (actively engaged in change); and Maintenance (succesfully sustained changed). Further, these four factors are considered to be independent, unrelated components of behavior change.

The <u>four factor correlated model</u> is similar to the previous model except that the scales are allowed to correlate. Support for this model would be consistent with results found for most other health behaviors (DiClemente & Hughes, 1990; McConnaughy, DiClemente, Prochaska & Velicer, 1989; McConnaughy, Prochaska, & Velicer, 1983). Such a correlated model would further suggest the existence of a hierarchical (second order) factor. If the correlated model is supported, an hierarchical model will also be tested.

Evaluation of alternative models requires an assessment of the model's overall fit to the data and a consideration for parsimony (McDonald & Marsh, 1990). Because no overall fit index has been agreed upon as the preferred measure, Marsh, Balla and McDonald (1988) recommend that several different indices of fit be computed and compared to determine goodness-of-fit.

Five different indices of fit were used to assess the 5 measurement models. The maximum likelihood (ML) $\chi^2$ statistic and the Elliptical (ERLS) $\chi^2$ statistic are absolute measures of fit (without reference to the null model). As the $\chi^2$ statistics are highly dependent on sample size, they will not be used as a sole source of model evaluation but as a basis for comparison with other fit indices. The Root Mean Square Residual (RMR) is another absolute index and is a measure of non-fit of a model (Jöreskog & Sörborm, 1989). The Bentler-Bonnet fit index (BBI; Bentler & Bonnet, 1980), the Tucker and Lewis fit index (TLI; Tucker & Lewis, 1973), and the comparative fit index (CFI; Bentler, 1990) are all indices of relative fit as compared to the null model.

Higher values indicate better fit for the BBI, TLI, and CFI with '1.0' being a perfect fit and '0' indicating a lack of fit. Values of .90 are generally considered an excellent model fit while values less than .80 are considered indicative of the need for further improvement. For the $\chi^2$ and RMR indices, lower values indicate better fit. For RMR, values of .06 or less are considered an acceptable measure of non-fit.

The competing models are evaluated and compared in Table 2 for sample B. Across all the models, the 4 factor correlated model provides the best fit to the data. Based on this model, the elliptical estimates were obtained for the factor loadings of the 16 stages of change items (Table 3 - sample B). The Pearson correlation coefficients among the 4 stages of change scales are shown in (Table 4 - sample B). While both ML and ERLS estimates were determined, the elliptical solution is provided here and is recommended for both normal and non-normal data by Sharma, Durvasula, and Dillon (1989). The factor loadings were very good (mean = .74), with a range of .59 to .89. All factor loadings were statistically significant ($p < .001$). The absolute value of the factor correlations ranged from .039 to .833. These factor correlations implied the existence of a hierarchical factor.

A model with a single hierarchical factor proved a very good fit to the data, $\chi^2$ (100) = 206.516 ($p < .001$), BBI = .942, TFI = .963, CFI = .969, RMR = .048. The higher order factor accounted for a large percent of the variance in three of the four factors (precontemplation, contemplation, and action), $R^2$ = .72, .81, .86, respectively. For the maintenance factor only .03 percent of the variance was accounted for by the higher order factor.

Scale statistics, including means and standard deviations, were computed for the four factors (Table 4 - sample B). No significant problems with skewness (range = -1.19 to 1.26) or kurtosis (range = -1.11 to 1.46) were indicated.

Cross-Validation #2

Exploratory Analyses. As there is no a priori reason that one subset of the data should have been chosen as the exploratory half and another chosen as the confirmatory half, a double cross-validation was performed to assess whether the findings from the first cross-validation study were an artifact of the particular validation and calibration samples chosen. Exploratory principal component analyses were conducted on the 35 X 35 interitem correlations using the sample B ($N$ = 260) rather than sample A ($N$ = 273), to derive the factor structure of the SEQ and to determine the number of components to retain. The MAP procedure and Horn's parallel analysis again differed in their extraction solutions with MAP positing a 4 factor solution and parallel analysis positing a 2 factor solution to the data. Varimax and oblique rotations were conducted for 2, 3, and 4 factor solutions with consistent results found for both rotational techniques. Varimax factor loadings were again chosen for interpretation. A three component solution best described the data corresponding to the precontemplation, action, and maintenance stages of change. The coefficient alphas for the three scales were .85, .87, and .84, respectively.

Data reduction employing principal component analysis, coefficient alpha, and item-total correlations resulted in a revised 4 items per scale version. Table 1 shows the varimax rotated component pattern for the 12 X 12 interitem correlation matrix for sample B. The three components accounted for 69% of the variance. A fourth scale was found to be internally consistent using coefficient alpha and, combined with theoretical intent, a set of 4 items for this plausible scale was created. Revision of the scales to 4 items did not substantially reduce the scales' internal consistency, actually increasing slightly for the action scale. The alphas for the precontemplation, contemplation, action and maintenance scales were .83, .81, .88, and .79, respectively.

Confirmatory Analyses. Confirmatory factor analyses using structural equation modeling were conducted on the hold-out, calibration sample A ($N$ = 273). Five measurement models (1 factor, 2 factor, 3 factor, 4 factor uncorrelated, 4 factor correlated) were again compared with maximum likelihood and elliptical factor analyses. The competing models for sample A are evaluated and compared in Table 5.

Assessment of the model fit indices indicates the 4 factor correlated model provides the best fit to the data. Based on this model, the elliptical estimates were obtained for the 16 factor loadings corresponding to the stages of change items (Table 3 - sample A). The Pearson correlation coefficients among the 4 stages of change scales for sample A are shown in Table 4. The factor loadings were very good (mean = .72), with a range of .57 to .89. All factor loadings were statistically significant ($p$ < .001). The absolute value of the factor correlations ranged from .095 to .875. These factor correlations implied the potential existence of a hierarchical factor.

A model with a single hierarchical factor was attempted but would not converge. Such a result suggests a possible

Heywood case (Rindskopf, 1984) and denotes an unworkable model for the data. When the 3 factor model and the 4 factor correlated model were corrected for overparametization of the models using the Parsimonious Ratio Index (Mulaik, et. al, 1989), the model fits were virtually identical for the two models (BBI = .783, .782; TLI = .797, .799; CFI = .804, .802; for the 3 factor and 4 factor models, respectively).

Scale statistics, means, and standard deviations were computed for the four factors (Table 4). No significant problems with skewness (range = -1.15 to 1.10) or kurtosis (range = -1.15 to 1.20) were indicated.

Follow-up Analyses

A comparison of the PCA results derived from each sample half, A and B, indicates that factor loadings were comparably high in each sample (Table 3). The coefficient alphas for the scales were generally lower in sample B than in sample A except for the higher alpha for the contemplation scale in sample B (Table 4). In both samples, a 3 factor solution was posited by the principal components analysis with a fourth component suggested but not clearly interpretable.

The results of the structural equation modeling suggested that in both halves, a 4 factor model was the most viable model in which to understand the data. When sample A was used as the calibration sample, a 3 factor model was found to be as reasonable as a 4 factor model. When sample B was used as the calibration sample, a 4 factor model and a hierarchical 4 factor model presented the most reasonable model fits. However, the 4 factor hierarchical model failed to replicate with sample A.

In an effort to clarify discrepant results between the two data halves, structural equation modeling was conducted for a 4 factor correlated model on the total sample ($N$ = 595) for the entire 35 items. Structural equation modeling has been suggested as an alternative to principal components analysis for exploring the factor structure of the data, for item reduction, and measurement development (Bollen, 1989). The results of this analysis clearly identified high factor loadings for all 4 proposed factors - Precontemplation, Contemplation, Action and Maintenance. Additionally, the validity of the 16 items selected from the 35 item pool during the double cross-validation process was confirmed by the high factor loadings of these items on their respective factors in this total sample (Table 3). Further, the model fit indices for the 4 factor correlation model on the 16 X 16 interitem correlation matrix (Table 6) were greater than the 3 factor model although both models were comparable after correction for overparametization using the Parsimonious Ratio Index (BBI = .800, .797; TLI = .802, .803; CFI = .808, .806; for the 3 factor and 4 factor models, respectively). Again, a 4 factor hierarchical model did not converge and is considered an unacceptable model for explaining the data.

External Validity of the SEQ

External validity of the SEQ factors was obtained by comparison with an alternative method of assigning subjects to stages - the stages of change algorithm (Appendix A). By classifying subjects categorically with the stages of change algorithm, the majority of subjects were found to be in either the precontemplation (N = 200, 33.6%) or maintenance (N = 358, 60.2%) stages of change. The contemplation (N = 25) and action (N = 3) stages comprised 4.2% and 0.5% of the sample, respectively. Nine respondents (1.5%) did not provide sufficient information to be placed in any of the algorithm stage categories. Similar stage distributions have been found across other samples using the stage algorithm with approximately 30% of subjects in the precontemplation stage, 5% in both contemplation and action, and 60% in maintenance (Rossi, 1990a, 1990b).

Multivariate analysis of variance (MANOVA) was employed to validate the SEQ factors with the staging algorithm. However, having too small a number of people per cell makes MANOVA analysis inappropriate. Therefore, due to the bipolar staging outcome of the population, the 4 stages were divided into 2 categories - "non-adopters" (N = 233, 39.2%) and "adopters" (N = 362, 60.8%) - with precontemplators and contemplators collapsed into the former grouping and action and maintenance collapsed to create the latter grouping. Given the relatively recent introduction of sun exposure as a serious health problem, such a categorization seems reasonable. As Blais and Rossi (1990) argue, categorization of subjects into the two categories of adoption - adopters and non-adopters - is justified within a diffusion framework which suggests that the adoption process of newly diffused innovations initially distributes individuals bimodally at opposite ends of the adoption spectrum.

A one way multivariate analysis of variance (MANOVA) was conducted on the 4 SEQ staging scales using adopter/non-adopter status as the independent variable. Scale scores were created by summing the items defining each scale and scores were transformed to T-scores with a mean of 50 and a standard deviation of 10 to facilitate interpretation. The MANOVA main effect for adopter/non-adopter status was significant and strong, Wilks' $\Lambda$ = .506, $F(4,540) = 131.74$, $p < .001$. multivariate $\eta^2 = .494$.

Follow-up univariate analyses were conducted for each of the 4 scales (Table 7). Non-adopters scored significantly higher on the precontemplation scale, while adopters scored significantly higher on the contemplation, action, and maintenance scales of the SEQ. The action scale accounted for the greatest proportion of variance between the groups ($\eta^2$ = .48) while the maintenance scale accounted for relatively little of the variance ($\eta^2 = .01$). Note that non-adopters are consistently below the mean for the contemplation, action, and maintenance scales while adopters are consistently above the mean for these 3 scales - a reversal of pattern profiles.

A direct discriminant function analysis (Huberty & Morris, 1989) was performed using the 4 scales as the predictor variables of adopter/non-adopter status. One significant discriminant function was obtained, Wilks' $\Lambda$ = .506, $\chi^2(3) = 368.72$, $p < .001$, $R_c^2 = .494$. Classification analysis results showed that 86.2% of the sample was correctly classified with 77.3% correct for the non-adopter group and 91.7% correct for the adopter group.

## Cluster Analyses

Cluster analyses were performed on the total sample ($N$ = 545) to determine whether the initial heterogenous pool of subjects could be classified into a smaller number of cohesive subgroups. Cluster analysis allows group profiles to be plotted in order to assess whether the major profiles retained support the stages of change model for sun exposure as well as correspond to the obtained sample profiles derived from previous cluster analyses in other health-related problem areas (McConnaughy, et al., 1983, 1989; DiClemente & Hughes, 1990; Stern, Prochaska, Velicer, & Elder, 1987). A hierarchical agglomerative procedure (Johnson, 1969) was employed using the 4 SEQ scale scores which are the summed items for each scale converted into standardized T-scores with a mean of 50 and a standard deviation of 10. This procedure calculates the squared Euclidean distance between each cluster and merges clusters that have the smallest distance. Each subject begins as an individual cluster and continues until all subjects "agglommerate" into one large group.

Different rules or "sorting strategies" exist for the formation of clusters under a hierarchical procedure. Wards Method optimizes the minimum variance and considers all possible clustering combinations (Ward, 1963). It has generally performed better than other methods in simulation studies (Cooper, 1987; Milligan, 1980), and is the preferred method in the social sciences (Blashfield, 1980). Similarly, no single method for determining the number of clusters to retain has been established. As such, the degree of interpretability of distinct clusters, visual inspection of the clustering dendogram (Aldenderfer & Blashfield, 1984, 1987), and the cubic clustering criteria (Milligan & Cooper, 1985) were guides in selecting the major profiles.

Interpretation of Profiles. Solutions for 3 to 15 clusters were investigated with the total sample. The 10 cluster solution was most clearly interpretable with 8 major clusters derived from the solution. They were labeled: Immotive, Precontemplation, Ambivalent, Impulsive, Decision Making, Ready for Action, Action, and Maintenance. Both the Precontemplation and Decision-Making profiles were formed by collapsing two similar profiles into the one profile. Clusters ranged form 15 to 149 subjects and accounted for all of the 545 subjects involved in the analysis. Scores above 50 on the profiles are considered endorsement for that scale.

Cluster Profiles.

Immotive Cluster: The 15 subjects in this cluster are characterized by a profile highly above average on the precontemplation scale, and well below average on the contemplation, action, and maintenance scales (Figure 1). These subjects are neither contemplating nor engaging in change. Indeed, they seem to be actively denying the relevance of sun exposure as a problem, and appear resistant or immotive to considerations of altering their sun exposure behavior.

Precontemplation Cluster: The 104 subjects in this cluster group are above average on the precontemplation scale and below average on the contemplation, action, and maintenance scales but not to the same degree as Immotive subjects (Figure 2). These subjects are neither contemplating nor engaging in change but seem to be maintaining the status quo with respect to sun exposure behavior.

Ambivalent Cluster: Fifty-five subjects comprised this cluster. They scored above average on both the precontemplation and maintenance scales but low on contemplation and action (Figure 3). This group is endorsing ambivalent statements. While admittedly concerned about their efficacy to maintain changes without relapse, these subjects are simultaneously trying to ignore the existence of sun exposure as a problem rather than attempting to change.

Impulsive Cluster: Twenty-nine subjects appeared in this cluster. They endorsed scores slightly above average on the precontemplation and action scales and endorsed scores below average on the contemplation and maintenance scales (Figure 4). These subjects seemed to be acting impulsively, neither maintaining nor intentionally thinking about changing their sun exposure behavior but sporadically taking precautionary action when in the sun.

Decision Making: The 149 subjects in this cluster are below average on both the precontemplation and maintenance scales, and above average on the contemplation and action scales (Figure 5). These subjects have made a serious decision to change their sun exposure behavior and have begun to take some action. They appear not to have changed their behavior long enough to endorse the maintenance scale, as yet unaware of their risk to relapse and the difficulties to be encountered when attempting to maintain behavior changes. This cluster profile can be thought of as a reversal of the ambivalence profile.

Ready-For-Action: Ninety-eight subjects define this cluster. They are below average on precontemplation and slightly above average on the contemplation, action, and maintenance scales (Figure 6). They are slightly concerned about maintenance and relapse issues, have acknowledged the problem of sun exposure behavior, and are preparing to address it. This group is involved in both thinking about their sun exposure behavior and tentatively acting on these ideations.

Action Cluster: Forty-four subjects were included in this cluster type. These subjects are characterized by a profile of below average endorsement on the precontemplation scale and above average endorsement on the contemplation, action, and maintenance scales (Figure 7). Rather than denying sun exposure as a problem behavior, they are thinking about sun exposure issues, are in the midst of actively changing their sun exposure behavior, and are working on maintaining such changes.

Maintenance Cluster: A total of 51 subjects comprised this cluster group. Subjects scored about average on the precontemplation scale, slightly above average on the contemplation and action scales, and above average on the maintenance scale (Figure 8). Subjects in this profile are no longer engaged in new precautionary action while in the sun. Rather, they are involved in maintaining previous sun exposure behavior changes and are concerned with the threat of relapse.

Internal Validity of Profiles. After identification of the major clusters, the split-sample validation design was employed to assess internal validity. The 595 subjects were randomly assigned into two subsamples with cluster analysis performed on each half. The cluster solutions for each of the subsamples yielded results similar to the total sample cluster analysis (Figures 1-8). The sample half A (N = 273) replicated the following 6 clusters: Immotive, Precontemplation, Ambivalent, Decision Making, Action, and Maintenance. The sample half B (N = 260) replicated the following 7 clusters: Immotive, Precontemplation, Ambivalent, Impulsive, Decision Making, Action, and Maintenance. Sample B also revealed a unique 8th cluster solution labeled "Contemplation" (Figure 9). The 25 subjects in this cluster are characterized by low scores on precontemplation, a higher level of endorsement on contemplation, low scores on action and above average scores on maintenance. While not yet ready for action, these subjects are contemplating changing sun exposure behavior. Note that the ready-for-action cluster found in the total sample was not replicated in either of the two subsample cluster analyses.

Another approach to assessing the internal validity of the profiles is to plot each scale score for the precontemplation, contemplation, action, and maintenance scales cross-sectionally by the cluster subtypes for the total sample (Figures 10-13). The cluster profiles are organized sequentially to represent different points in the change process from the earliest cluster (immotive) to the latest cluster (maintenance). While this organizational criterion for the subtypes is straightforward for the majority of the cluster groups, the proper placement of the ambivalence and impulsive clusters is less obvious. Should the ambivalence and impulsive clusters be considered separate "stages" or subtypes of a contemplation stage or should the clusters be conceived as transitional phases similar to relapse - a form of regression from a later to an earlier pre-action stage? With respect to either interpretation, it was deemed reasonable to position the ambivalence and impulsive clusters at the indecisive, inactive point in the change process, between the precontemplation and decision making clusters. Further, individuals in the impulsive cluster are characterized as engaging in some active trial behavior, while ambivalent individuals are not attempting sun exposure behavior change. It therefore seemed appropriate to situate the impulsive cluster farther along in the developmental sequence than the non-active ambivalence cluster.

As movement from one stage of change to the next, from precontemplation to maintenance, represents progress in the change process, cross-sectional analyses of each scale score across the developmental sequence of cluster subtypes should reveal profile patterns which increase or decrease accordingly. For example, the precontemplation scale scores should peak early in the sequence of cluster subtypes as the Precontemplation stage should correspond to earlier stages in the sequence of clusters.

Indeed, analysis of the four cross-sections revealed profiles in the expected direction. Scores were higher on precontemplation for the immotive, precontemplation, and ambivalent groups; higher on contemplation for the decision making, ready-for-action, action and maintenance groups, higher on action for the decision-making, ready-for-action, action, and maintenance; and higher on maintenance for ambivalence, ready-for-action, action and maintenance (Figures 10-13).

## Discussion

The findings from this Sun Exposure Questionnaire model development and testing demonstrate that the stages of change model, successful in promoting change in a diversity of health-related areas, can be adapted to the problem of sun exposure and skin cancer prevention. The SEQ was found to be a brief, reliable and valid measure of the stages of change for sun exposure, identifying four stages of change - precontemplation, contemplation, action and maintenance. The structure of the SEQ was replicated across two independent samples of participants when the same analytical method (PCA or Structural Equation Modeling) was employed, and partially replicated when compared across the two analytical approaches.

Follow-up analyses using structural equation modeling on the total sample was conducted to help clarify sample half differences. Results confirmed the 4 factor solution with high factor loadings for the 16 items representing the 4 stages of change. Although the 3 and 4 factor models were found to be comparable after correction for overparametization, the 4 factor model was considered the most viable model given its theoretical relevance and the design intent of the measurement instrument. Such comparability of models is not indicative of poor model identification. Indeed, Cliff (1983) cautions that there are an infinite number of models that may fit the data well. However, not all models are equally meaningful or theoretically driven.

The lowering of the fitting functions following the correction for overparametization does suggest that improvement in fit and model specification is possible. Yet, examination of the item loadings indicate but a single low item which loaded on the contemplation scale. The loading for this item was .568 for sample half A and .587 for sample half B. However, this loading jumped to .731 when considered for the total sample. Although this item could be revised, a loading even as low as .568 is not unacceptable given the scale is composed of only four items and has high internal consistency. Rather, assessment of the items suggest not a problem with internal consistency but one of exclusivity wherein contemplation and action items are not exclusive to the stage of change they represent. For example, an individual might very well be compelled to respond positively to both contemplation and action items (ie.; "I've heard of SPF and would like to know more about it.). In fact, all contemplation items were found to load on the action component in the PCA analyses except for item number 33 which loaded on both the precontemplation and action components. Examination of the Pearson correlations also showed contemplation and action scales to be highly correlated in the total sample (.715) and in the sample halves A (.733) and B (.681). While some degree of overlap is anticipated between the stages, too high a correlation may help explain why PCA did not isolate contemplation and action as separate components while factor analysis using structural equation modeling found a 4 factor model to be a good fit to the data. Unlike principal components analysis, factor analysis using structural equation modeling takes into account measurement error in the computation of factors and as such is a more powerful and comprehensive technique. One wonders whether some of the original attempts at model development and testing of the stages of change would have revealed additional stages if subjected to this more sophisticated methodology.

Previous analyses of the stages of change model for psychotherapy (McConnaughy, et al., 1983, 1989) have demonstrated a simplex pattern between the stages in which adjacent stages are most highly correlated with each other than non-adjacent stages. In such a scenario, precontemplation is more highly correlated with contemplation, contemplation with action, and action with maintenance. Such a simplex pattern was not indicated for the stages of change for sun exposure. The precontemplation and contemplation scales were most highly correlated with action, action most highly correlated with contemplation, and maintenance most highly correlated with contemplation. It is difficult to discern whether revision of the contemplation and action scales would transform the relationship between the scales into a simplex pattern. It may be that a non-simplex pattern is characteristic of "acquisition" type behaviors such as sun exposure, diet, exercise, and adolescent cigarette smoking, in which the behavior in question must be vigilantly maintained rather than having an eventual termination point. Indeed, the correlations between the stages of change for adolescent smoking acquisition do not form a simplex pattern (Stern, et al., 1987).

It is because people may respond both high or low on more than one stage that subjection of the stages of change instruments to cluster analysis is critical. Cluster analyses of the total sample of participants yielded 8 stage of change profile patterns reflective of the differential involvement of individuals across the stages. The eight clusters were labeled Immotive, Precontemplation, Ambivalent, Impulsive, Decision Making, Ready for Action, Action, and Maintenance. The subgroups derived were similar to those obtained in previous analyses of the stages of change in other problem areas such as psychotherapy (McConnaughy, DiClemente, Prochaska, & Velicer, 1989; McConnaughy, Prochaska, & Velicer, 1983), alcohol use (DiClemente & Hughes, 1990), and adolescent cigarette smoking (Stern, Prochaska, Velicer, & Elder, 1987), although the specific labeling of the clusters varied by study.

Replication of the profiles was successful for all but the Impulsive and ready-for-action profiles in sample half A, and all but the ready-for-action profile in sample half B. The non-replication of these profiles does not suggest that they are invalid but rather that the clusters may not be as distinct and readily emergent from neighboring clusters when analyzed in the smaller split-half samples. Both the impulsive cluster and the ready-for-action clusters are fairly well represented with 29 and 98 subjects in each group, respectively, in the total sample.

Note that while no distinct contemplation cluster emerged in the total sample cluster analysis, it did reveal itself in the half sample B. Perhaps contemplation is too transient a process be captured, occurring as it does between the haphazard, non-contemplative Impulsive subjects and the resolute and committed mind-set of the Decision Making subjects. It is also possible that few contemplators can be categorized as neither ambivalent nor impulsive in their sun exposure behavior. Again, revision of the contemplation scale may help this profile emerge more distinctly if indeed it exists separate from the decision making cluster. Certainly, further replication of the profiles is necessary to determine the validity of each cluster and to assess whether such profiles warrant consideration as additional stages of change. Additional investigation will also help to clarify cluster interpretations and the appropriateness of their identifying labels.

Of the eight emerging clusters, the largest number of subjects were found in the decision-making profile (N = 149) and the precontemplation profile (N = 104). The decision making profile is consistent with the pattern of mean level responding across the 4 scales. The mean contemplation and action scale scores were higher (3.46 and 3.30, respectively for the total sample) than the mean level endorsements of the precontemplation (2.11) and maintenance (2.50) items. While it seems that subjects are reluctant to endorse the precontemplation items, assessment in terms of T-score units revealed a large proportion of subjects denying the need to change relative to other subjects.

Initially, the large number of subjects in the decision making subgroup appears contradictory to the stage distribution of subjects on the stage algorithm. Recall that 33.6% of the subjects were classified by this method into precontemplation and 60.2% into maintenance. However, Blais and Rossi (1990) found that subjects self-classified as adopters of healthy sun habits by the stage algorithm were actually applying protective behaviors at too low a level to afford adequate skin protection, underscoring the need for a clearer understanding of what constitutes sufficient and appropriate precautionary sun exposure behavior. So, while such subjects may have changed their sun exposure habits to reduce their risks of skin cancer for greater than 6 months and are thus algorithmically staged as maintainers, their behavioral pattern profile places them within the decision-making, ready for action, or action labeled subgroups as defined by the cluster analysis.

External validity of the SEQ by the stage algorithm was demonstrated with non-adopters scoring higher on the precontemplation scale and adopters scoring higher on the contemplation, action, and maintenance scales. However, the very little of the variance in the maintenance scale was explained by the adoption categories ($\eta^2 = .01$) suggesting that while relapse concerns are significantly different between the groups, degree of precautionary activity is the more crucial discriminator. The scales correctly classified subjects into adoption status 86% of the time. Scale prediction was more accurate for adopters (92%) than non-adopters (77%). Given that non-adopters are the individuals most targeted for intervention, discovery and inclusion of additional variables predictive of non-change into the item content of the scale to increase scale prediction is recommended. Certainly use of the SEQ in combination with other measurement instruments is suggested as no one instrument can be expected to account for all the variability within a study group.

External validation of cluster profiles requires demonstration of significant differences among clusters on a set of variables not used to generate the cluster solution (Aldenderfer & Blashfield, 1984). Unfortunately, no appropriate set of variables was available in this sample. Assessment of the external validity of the cluster profiles is therefore necessary in future investigations. Alternative Transtheoretical Model constructs such as the Decisional Balance scale and the Temptation scale, or some other sun exposure behavioral outcomes would aptly serve as external variables being characteristically distinct from the cluster variables and readily interpretable given theoretical expectations as to appropriate outcomes.

Other limitations of the study should be noted. First, the sample selected for this model testing is a developmental one based on cross-sectional self-reports from volunteers at a work-site setting. As such, population norms are still required before the SEQ instrument is administered generally. Further, replication across a diversity of populations is necessary before generalizing the model parameters beyond the work-site sample. However, similar percentages of adoption across the stages of change using the algorithm method across several different populations suggests that even if the work-site population is not a representative one, the self-reports are at least consistent.

Second, the self-report mode of data collection needs to be considered in future research to determine whether the stage scales and cluster profiles revealed are simply a function of the self-report technique. If such a bias exists and responses have been influenced by social desirability, the bias would be in the direction of under-reporting the number of individuals not engaged in changing sun exposure behavior. Given that the number of subjects self-classified in non-adoptive clusters is already quite large in this sample, correction of such a bias would shift the distribution of subjects to "earlier" stages of change, with greater endorsement of the precontemplation and contemplation scales and greater subject representation of non-maintenance cluster subgroups.

Lastly, as more knowledge is accumulated and more information is diffused into the media and health literature, the profiles of the sun exposure habits of individuals will probably become more equally distributed into the distinct stages of change - precontemplation, contemplation, action and maintenance - as suggested by the Transtheoretical Model of behavior change (Prochaska & DiClemente, 1986). Longitudinal investigations of the SEQ as a function of the diffusion process would be of particular interest for model development and testing as well as for prevention and intervention objectives.

This study contributes important information to that which is known about sun exposure behavior and intentions, as well as extending the Transtheoretical Model to the newly emergent and understudied cancer risk factor of unprotected sun exposure. This investigation also provides an opportunity to empirically examine the robustness of the stages of change model using a double cross-validation procedure and structural equation modeling techniques, analytical tools that have not yet been applied in previous measurement studies of the staging construct.

By developing a theory-guided stage-based model for sun exposure, a conceptual framework within which to design, analyze, and interpret prevention programs is established. Indeed, the disappointing results of previous sun exposure interventions may reflect the lack of a proper model within which to investigate program success. Adoption of a stages of change model for sun exposure allows assessment of success based on a subject's degree of movement from one stage of change to another rather than on an action-oriented criterion. Action-oriented outcomes are appropriate for only a subset of the population at risk for skin cancer from sun exposure who have not changed their behavior but are ready for action. Our staging algorithm indicates that only 0.5% of the sample were even contemplating changing their sun exposure behavior. Further, the stages of change model allows one to determine which individuals are responding to what interventions and when in the change process - critical variables for program planning, design and implementation. Once a population-normed Sun Exposure Questionnaire becomes available, skin cancer prevention programs can be targeted at individuals in all stages of change with intervention modalities matched to maximize desired behavior change. The exploration of subtypes through cluster analysis allows such interventions to be fine-tuned to specific stage profiles. Identification and assessment of the processes of change employed, the relative weighting of the pros and cons, and the level of self-efficacy across a variety of situations can all be explored as a function of a person's stage of change. Such a future endeavor would yield an even more systematic approach to creating intervention modalities for the prevention of skin cancer.

# Sun Exposure Questionnaire

**Skin cancer from sun exposure affects over one million people every year. Many people get more sun exposure than they realize from simple outdoor activities all year long, such as gardening, sports, hiking, skiing, swimming, and from working outdoors (for example, police officers, construction workers, letter carriers). This is a survey of your sun exposure behaviors and intentions. In answering these questions, it may be helpful to think about how you felt this past summer.**

1. Have you changed your sun exposure habits to reduce the risk of skin cancer? _____ Yes _____ No

2. If you have changed your sun exposure habits to reduce the risk of skin cancer, when did you do so?
   _____ more than 12 months ago
   _____ more than 6 months ago
   _____ more than 3 months ago
   _____ less than 3 months ago

3. If you have not changed your sun exposure habits to reduce the risk of skin cancer, do you intend to do so:
   within the next 12 months? _____ Yes _____ No
   within the next 6 months? _____ Yes _____ No
   within the next 30 days? _____ Yes _____ No

4. Compared to last year, have you reduced the amount of sun exposure you received this year? _____ Yes _____ No

5. Do you use sunscreens regularly, that is, whenever you know you will be out in the sun for more than about 15 minutes? _____ Yes _____ No

6. Do you intend to use sunscreens regularly:
   in the next 12 months? _____ Yes _____ No
   in the next 6 months? _____ Yes _____ No

7. Have you used sunscreens regularly:
   in the past 12 months? _____ Yes _____ No
   in the past 6 months? _____ Yes _____ No

**Indicate how much you agree or disagree with the following statements. Please use the following five-point scale:**

1 = Strongly Disagree
2 = Disagree
3 = Undecided
4 = Agree
5 = Strongly Agree

1. _____ I wish I had more ideas on how to reduce the risks of sun exposure.

2. _____ After all the changes I've made, every once in a while I still find myself in the sun without proper protection.

3. _____ I'd like to know more about skin cancer and sun exposure.

4. _____ I've heard about skin cancer and sun exposure, but why waste time worrying about it?

5. _____ I have a problem with going unprotected in the sun that I think I should work on.

6. _____ As far as I'm concerned, I don't have any sun exposure habits that need changing.

7. _____ I may have some unhealthy sun expsoure habits, but none that I really need to change.

8. _____ Even though I'm not always successful, I'm beginning to use sunscreens more regularly.

More ⇨

1 = Strongly Disagree
2 = Disagree
3 = Undecided
4 = Agree
5 = Strongly Agree

9. _____ I've made progress in decreasing my sun expsoure, but it's still a struggle.

10. _____ Using sunscreens is inconvenient. Who really wants to bother?

11. _____ I'm finally decreasing my exposure to sunlight.

12. _____ I'm beginning to believe I can do something to reduce my risks from sun exposure.

13. _____ I think I'm ready to take precautions against sunlight.

14. _____ All this talk about sun exposure and skin cancer is boring. People have better things to worry about.

15. _____ I'm not following through with my changes in sun behavior as well as I had hoped.

16. _____ I may be having a recurrence of the unhealthy sun behaviors that I thought I had successfully changed.

17. _____ I'm ready for some changes in my sun exposure behaviors.

18. _____ Asking questions about getting too much sun is a waste of time because this is not a problem for me.

19. _____ There may be risks to sun exposure, but I'm willing to gamble.

20. _____ I'm worried that I might slip back into my unhealthy sun habits again.

21. _____ I may need a boost to help maintain the changes in sun behavior I've made.

22. _____ I've been successful in reducing my sun exposure, but I'm not sure I can keep up the effort.

23. _____ Using sunscreens can be inconvenient, but I'm trying to use them more often.

24. _____ I'm doing something to prevent my risk of skin cancer from too much sun exposure.

25. _____ I'm really working hard at taking precautions against too much sun.

26. _____ I have started taking precautions against too much sun, but I'm not always successful.

27. _____ It might be worthwhile to reduce my risk of skin cancer from sun exposure.

28. _____ I'm concerned that I might slip and forget to use sunscreens.

29. _____ I'm considering using sunscreens more often.

30. _____ I would rather accept the risks of sun exposure than try to change my behavior.

31. _____ I may need some encouragement to maintain my use of sunscreens.

32. _____ Anyone can talk about sun protection; I'm actually doing something about it.

33. _____ I've heard of SPF (sun protection factor) and would like to know more about it.

34. _____ Long periods of sun exposure are sometimes hard to avoid, but I'm working on it.

35. _____ I may not always take precautions when I'm in the sun, but I don't think I'm at risk for skin cancer.

# Appendix B

## Stages of Change - Sun Exposure

Precontemplation

04. I've heard about skin cancer and sun exposure, but why waste time worrying about it?

14. All this talk about sun exposure and skin cancer is boring. People have better things to worry about.

19. There may be risks to sun exposure, but I'm willing to gamble.

30. I would rather accept the risks of sun exposure than try to change my behavior.

Contemplation

13. I think I'm ready to take precautions against sunlight.

27. It might be worthwhile to reduce my risk of skin cancer from sun exposure.

29. I'm considering using sunscreens more often.

33. I've heard of SPF (sun protection factor) and would like to know more about it.

Action

11. I'm finally decreasing my exposure to sunlight.

24. I'm doing something to prevent my risk of skin cancer from too much sun exposure.

25. I'm really working hard at taking precautions against too much sun.

32. Anyone can talk about sun protection; I'm actually doing something about it.

Maintenance

20. I'm worried that I might slip back into my unhealthy sun habits again.

21. I may need a boost to help maintain the changes in sun behavior I've made.

22. I've been successful in reducing my sun exposure, but I'm not sure I can keep up the effort.

31. I may need some encouragement to maintain my use of sunscreens.

Table 1

Principal Component Analyses for the Stages of Change Scales

| | | Sample Half | | | | | |
|---|---|---|---|---|---|---|---|
| | | PC | | A | | M | |
| Stage | Item No. | A | B | A | B | A | B |
| Precontemplation | | | | | | | |
| | 19 | .851 | .790 | | | | |
| | 30 | .823 | .789 | | | | |
| | 14 | .780 | .774 | | -.406 | | |
| | 04 | .737 | .661 | | | | |
| Action | | | | | | | |
| | 24 | | | .872 | .804 | | |
| | 32 | | | .841 | .802 | | |
| | 25 | | | .824 | .798 | | |
| | 11 | | | .768 | .763 | | |
| Maintenance | | | | | | | |
| | 21 | | | | | .865 | .844 |
| | 20 | | | | | .840 | .793 |
| | 22 | | | | | .803 | .760 |
| | 31 | | | | | .766 | .754 |

Note: Values below .40 are omitted. Sample half A ($N$ = 284). Sample half B ($N$ = 266). Item No. refers to item numbers on the questionnaire. See Appendix B for the actual items.

Table 2

Sample Half B: Comparison of 6 Measurement Models for the Stages of Change for Sun Exposure

| Model | $\chi^2$ | df | RMR | BBI | TLI | CFI |
| --- | --- | --- | --- | --- | --- | --- |
| One Factor | | | | | | |
| ML | 707 | 104 | .076 | .681 | .668 | .713 |
| ERLS | 694 | 104 | .076 | .804 | .801 | .827 |
| Two Factor | | | | | | |
| ML | 655 | 103 | .072 | .705 | .694 | .737 |
| ERLS | 636 | 103 | .072 | .820 | .818 | .844 |
| Three Factor | | | | | | |
| ML | 338 | 101 | .050 | .848 | .866 | .870 |
| ERLS | 294 | 101 | .050 | .917 | .933 | .943 |
| Four Uncorrelated Factor | | | | | | |
| ML | 650 | 104 | .197 | .707 | .700 | .740 |
| ERLS | 429 | 104 | .197 | .878 | .890 | .905 |
| Four Correlated Factor | | | | | | |
| ML | 234 | 98 | .038 | .894 | .920 | .935 |
| ERLS | 174 | 98 | .038 | .951 | .973 | .978 |
| Hierarchical Four Factor | | | | | | |
| ML | 281 | 100 | .048 | .873 | .896 | .914 |
| ERLS | 206 | 100 | .048 | .942 | .963 | .969 |

Note: N = 260. df = degrees of freedom; RMR = root mean square residual (Joreskog & Sorbom, 1986); BBI = Bentler-Bonett fit index (Bentler & Bonett, 1980); TLI = Tucker-Lewis fit index (Tucker & Lewis, 1973); CFI = Comparative fit index (Bentler, 1990).

Table 3

Elliptical Factor Loadings for the Stages of Change Scales

| | 4 Factor Correlated Model | | | | | |
|---|---|---|---|---|---|---|
| | Sample A | | Sample B | | Total | |
| Factor Variable | Factor Loading | Error Variance | Factor Loading | Error Variance | Factor Loading | Error Variance |
| Precontemplation | | | | | | |
| 04 | .783 | .387 | .703 | .506 | .766 | .413 |
| 14 | .726 | .473 | .733 | .462 | .768 | .411 |
| 19 | .843 | .288 | .767 | .412 | .878 | .228 |
| 30 | .847 | .282 | .760 | .423 | .849 | .280 |
| Contemplation | | | | | | |
| 13 | .840 | .294 | .850 | .278 | .896 | .198 |
| 27 | .653 | .574 | .677 | .542 | .815 | .335 |
| 29 | .739 | .454 | .707 | .500 | .822 | .325 |
| 33 | .568 | .677 | .587 | .656 | .731 | .465 |
| Action | | | | | | |
| 11 | .790 | .376 | .688 | .527 | .830 | .310 |
| 24 | .893 | .202 | .887 | .213 | .929 | .137 |
| 25 | .852 | .274 | .843 | .289 | .883 | .219 |
| 32 | .818 | .332 | .816 | .334 | .870 | .242 |
| Maintenance | | | | | | |
| 20 | .738 | .454 | .685 | .530 | .807 | .349 |
| 21 | .866 | .249 | .824 | .321 | .866 | .249 |
| 22 | .698 | .514 | .611 | .627 | .783 | .387 |
| 31 | .701 | .508 | .668 | .554 | .764 | .416 |

*Note*: Item numbers refer to the items on the questionnaire. See Appendix B for the actual items. Sample A ($N$ = 273). Sample B ($N$ = 260). Total sample ($N$ = 595). All factor loadings were statistically significant, $p < .001$.

Table 4

Scale Statistics for the Stages of Change Questionnaire

| | | | | Pearson Correlations Among Stages | | | |
|---|---|---|---|---|---|---|---|
| Scale | M | SD | Alpha | PC | C | A | M |
| **Sample A:** | | | | | | | |
| Precontemplation | 2.14 | .92 | .88 | - | | | |
| Contemplation | 3.46 | .84 | .79 | -.634 | - | | |
| Action | 3.29 | .98 | .90 | -.633 | .733 | - | |
| Maintenance | 2.52 | .81 | .84 | -.117 | .374 | .083 | - |

| Scale | M | SD | Alpha | PC | C | A | M |
|---|---|---|---|---|---|---|---|
| **Sample B:** | | | | | | | |
| Precontemplation | 2.05 | .98 | .83 | - | | | |
| Contemplation | 3.49 | 1.04 | .81 | -.604 | - | | |
| Action | 3.33 | 1.09 | .88 | -.684 | .681 | - | |
| Maintenance | 2.50 | .94 | .79 | -.016 | .320 | .042 | - |

| Scale | M | SD | Alpha | PC | C | A | M |
|---|---|---|---|---|---|---|---|
| **Total Sample:** | | | | | | | |
| Precontemplation | 2.11 | .87 | .86 | - | | | |
| Contemplation | 3.46 | .84 | .80 | -.629 | - | | |
| Action | 3.30 | .97 | .89 | -.662 | .715 | - | |
| Maintenance | 2.50 | .78 | .82 | -.082 | .358 | .076 | - |

Note: Sample A ($N$ = 273). Sample B ($N$ = 260). Total Sample ($N$ = 545). Higher means indicate greater agreement (possible range = 1 to 5). Correlations greater than .15 are significant at $p < .01$. PC = Precontemplation; C = Contemplation; A = Action; M = Maintenance.

Table 5

Sample Half A: Comparison of 6 Measurement Models for the Stages of Change for Sun Exposure

| Model | $\chi^2$ | df | RMR | BBI | TLI | CFI |
|---|---|---|---|---|---|---|
| One Factor | | | | | | |
| ML | 953 | 104 | .082 | .646 | .619 | .670 |
| ERLS | 882 | 104 | .082 | .773 | .761 | .793 |
| Two Factor | | | | | | |
| ML | 861 | 103 | .086 | .680 | .657 | .705 |
| ERLS | 769 | 103 | .086 | .802 | .794 | .823 |
| Three Factor | | | | | | |
| ML | 337 | 101 | .058 | .875 | .891 | .908 |
| ERLS | 269 | 101 | .058 | .931 | .947 | .955 |
| Four Uncorrelated Factor | | | | | | |
| ML | 689 | 104 | .217 | .744 | .737 | .772 |
| ERLS | 425 | 104 | .217 | .891 | .902 | .915 |
| Four Correlated Factor | | | | | | |
| ML | 242 | 98 | .043 | .910 | .932 | .944 |
| ERLS | 166 | 98 | .043 | .957 | .978 | .982 |
| Hierarchical Four Factor | | | | | | |
| ML | condition code | | | | | |
| ERLS | condition code | | | | | |

Note: N = 273. df = degrees of freedom; RMR = root mean square residual (Joreskog & Sorbom, 1986); BBI = Bentler-Bonett fit index (Bentler & Bonett, 1980); TLI = Tucker-Lewis fit index (Tucker & Lewis, 1973); CFI = Comparative fit index (Bentler, 1990).

Table 6

Total Sample: Comparison of 3 Measurement Models for the Stages of Change for Sun Exposure

| Model | $\chi^2$ | df | RMR | BBI | TLI | CFI |
|---|---|---|---|---|---|---|
| Three Factor | | | | | | |
| ML | 557 | 101 | .042 | .921 | .922 | .934 |
| ERLS | 481 | 101 | .042 | .950 | .953 | .960 |
| Four Correlated Factor | | | | | | |
| ML | 340 | 98 | .027 | .954 | .959 | .966 |
| ERLS | 229 | 98 | .027 | .976 | .983 | .986 |
| Hierarchical Four Factor | | | | | | |
| ML | condition code | | | | | |
| ERLS | condition code | | | | | |

Note: N = 595. df = degrees of freedom; RMR = root mean square residual (Joreskog & Sorbom, 1986); BBI = Bentler-Bonett fit index (Bentler & Bonett, 1980); TLI = Tucker-Lewis fit index (Tucker & Lewis, 1973); CFI = Comparative fit index (Bentler, 1990).

Table 7

Means, Standard deviations, T-scores, F and $\eta^2$, for the SEQ Scales

| Scale | Group | M | SD | T-Score | F(1,543) | $\eta^2$ |
|---|---|---|---|---|---|---|
| PC | Non-Adopter | 2.98 | 0.78 | 56.63 | 202.44** | .27 |
| | Adopter | 1.42 | 0.48 | 45.84 | | |
| C | Non-Adopter | 2.34 | 0.72 | 42.85 | 260.51** | .32 |
| | Adopter | 3.16 | 0.47 | 54.53 | | |
| A | Non-Adopter | 1.98 | 0.72 | 41.24 | 504.36** | .48 |
| | Adopter | 3.12 | 0.46 | 55.50 | | |
| M | Non-Adopter | 1.92 | 0.58 | 48.91 | 4.57* | .01 |
| | Adopter | 2.03 | 0.66 | 50.79 | | |

Note: The values represent the mean reported level of agreement on a five point scale where 1 = Strongly Disagree; 2 = Disagree; 3 = Undecided; 4 = Agree; 5 = Strongly Agree. $\eta^2$ is a measure of effect size (proportion of variance accounted for). P = Precontemplation; C = Contemplation; A = Action; M = Maintenance.
Adopter N = 335. Non-Adopter N = 210.
* $p < .05$ ** $p < .001$

Figure 1. The Immotive cluster for the stages of change for sun exposure for sample A ($N$ = 20), sample B ($N$ = 17), and the total ($N$ = 15) sample.

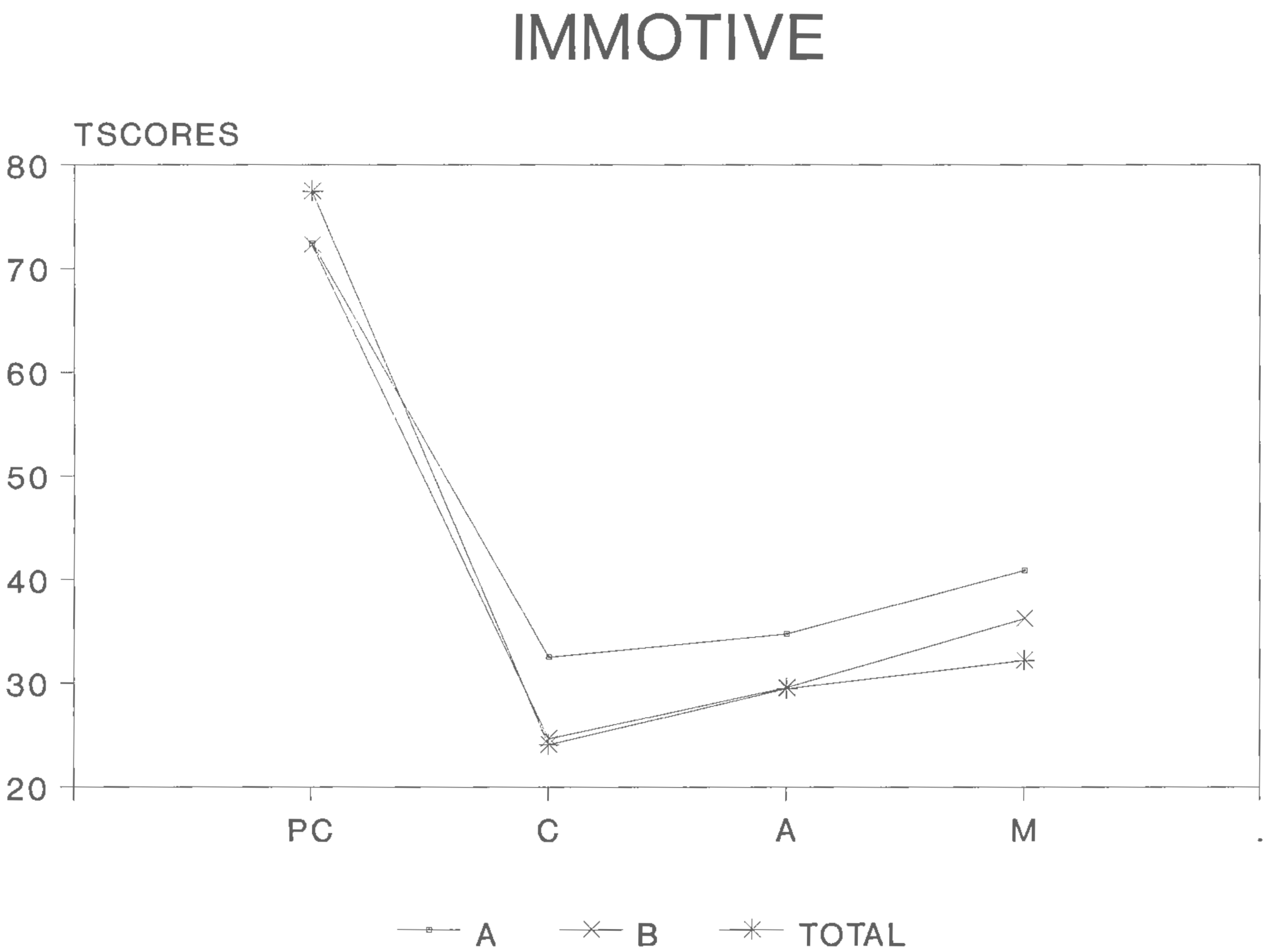

IMMOTIVE
TSCORES
80
70
60
50
40
30
20
PC
C
A
M
A
B
TOTAL

Figure 2. The Precontemplation cluster for the stages of change for sun exposure for sample A ($N$ = 55), sample B ($N$ = 15) and the total ($N$ = 104) sample.

# PRECONTEMPLATION

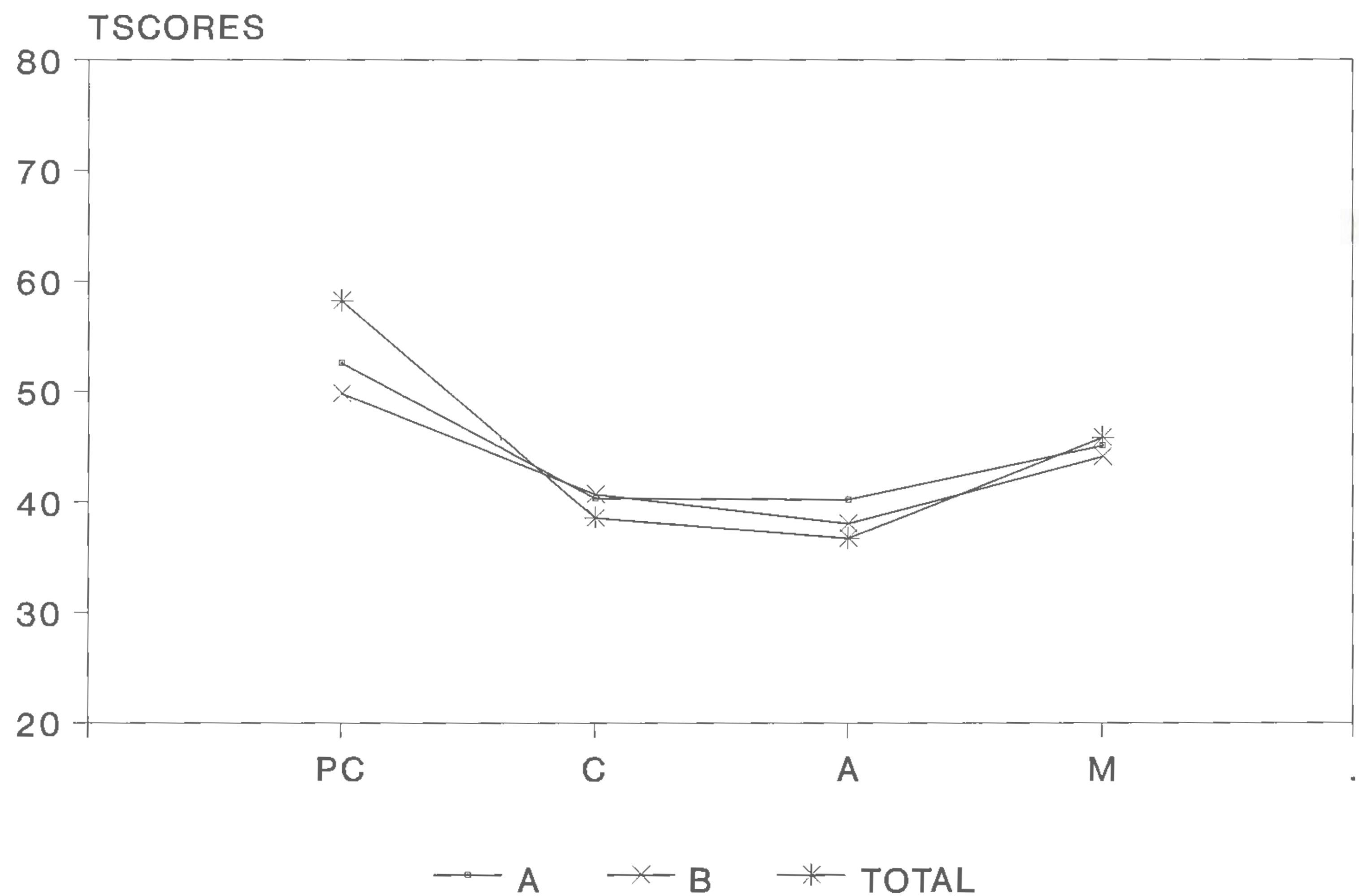


Figure 3. The Ambivalence cluster for the stages of change for sun exposure for sample A (N = 30), sample B (N = 23) and the total (N = 55) sample.

# AMBIVALENCE

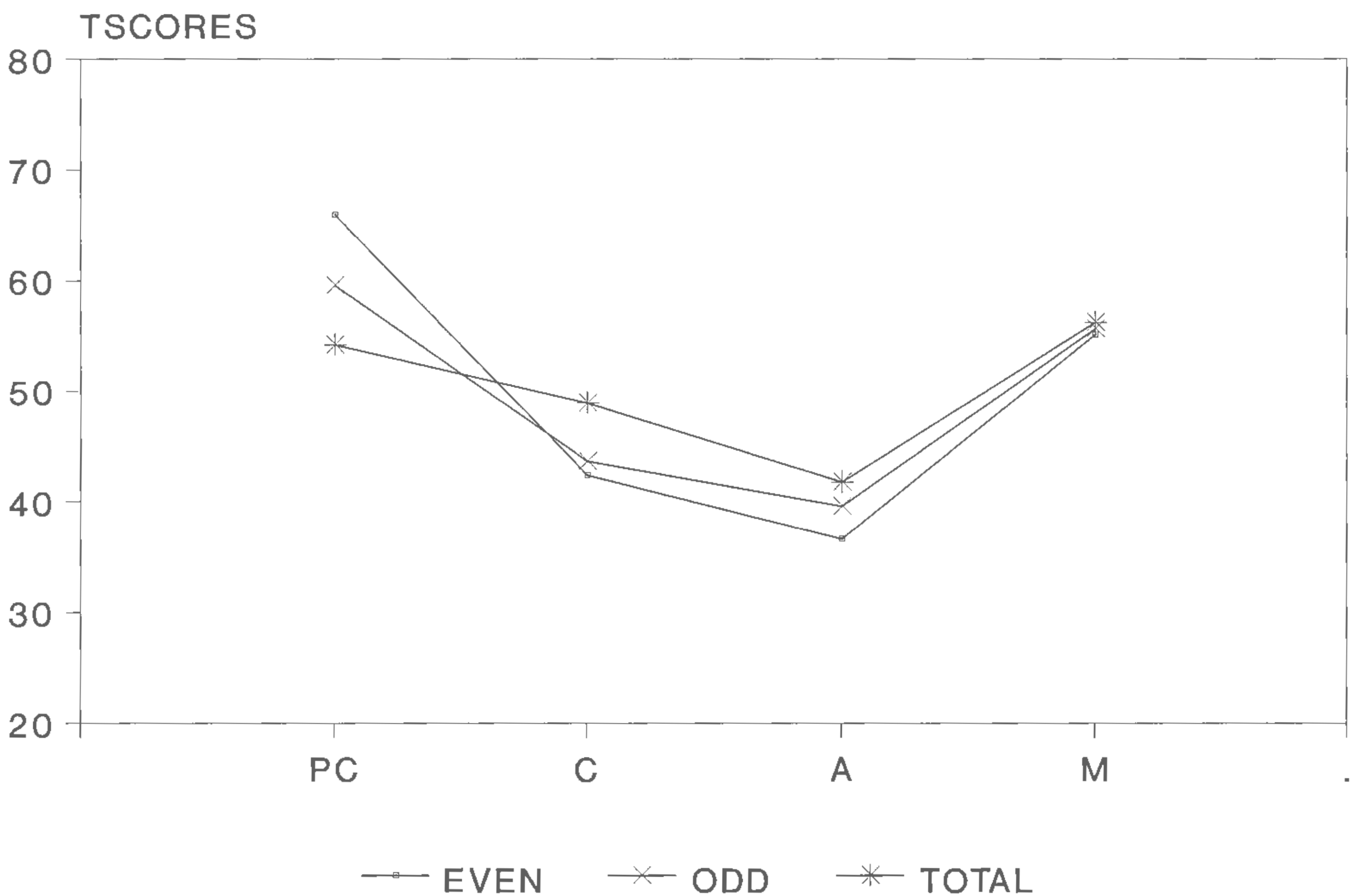


Figure 4. The Impulsive cluster for the stages of change for sun exposure for sample B (N = 25), and the total (N = 29) sample.

# IMPULSIVE

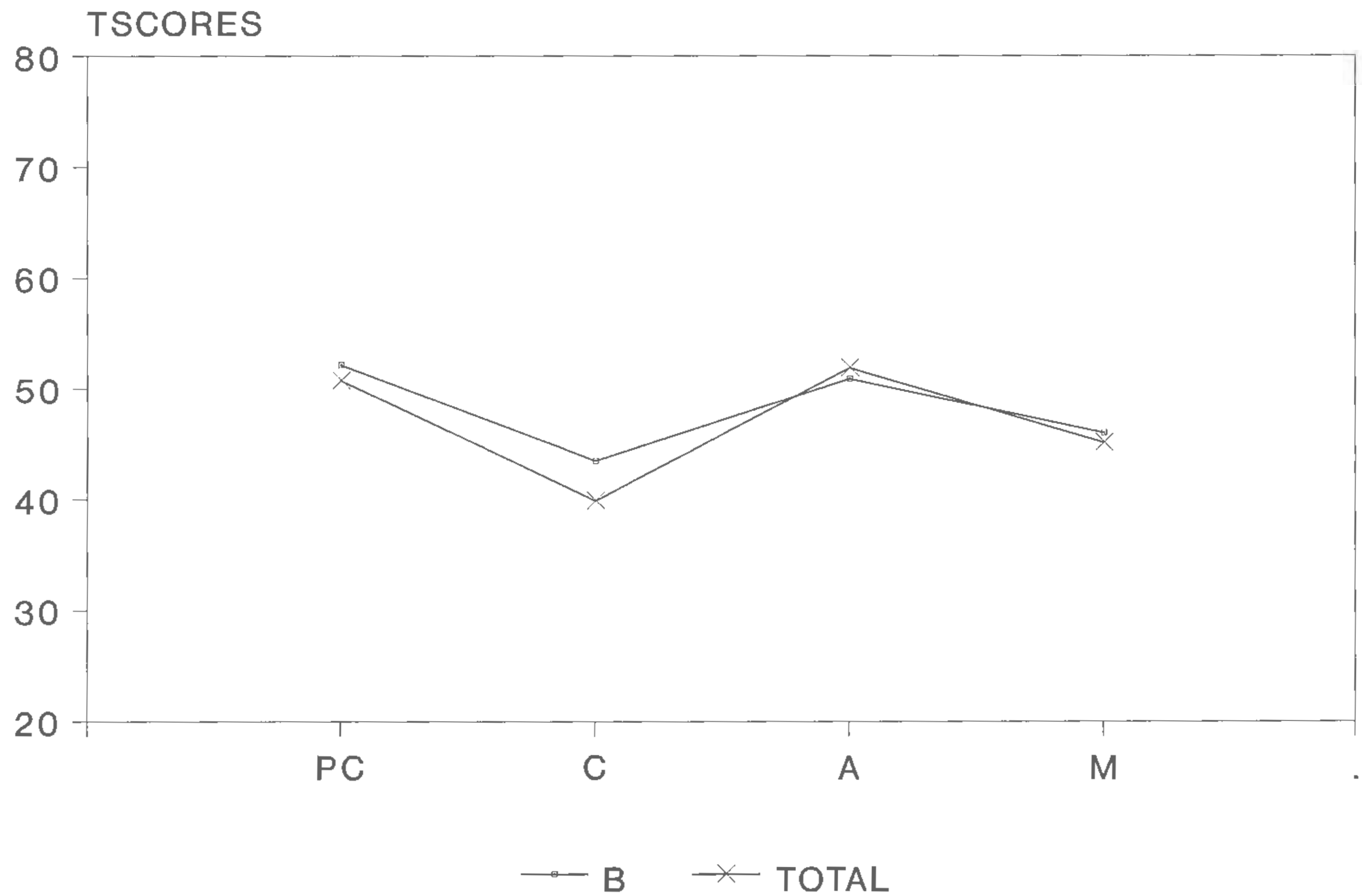


Figure 5. The Decision Making cluster for the stages of change for sun exposure for sample A ($N$ = 105), sample B ($N$ = 89), and the total ($N$ = 149) sample.

# DECISION MAKING

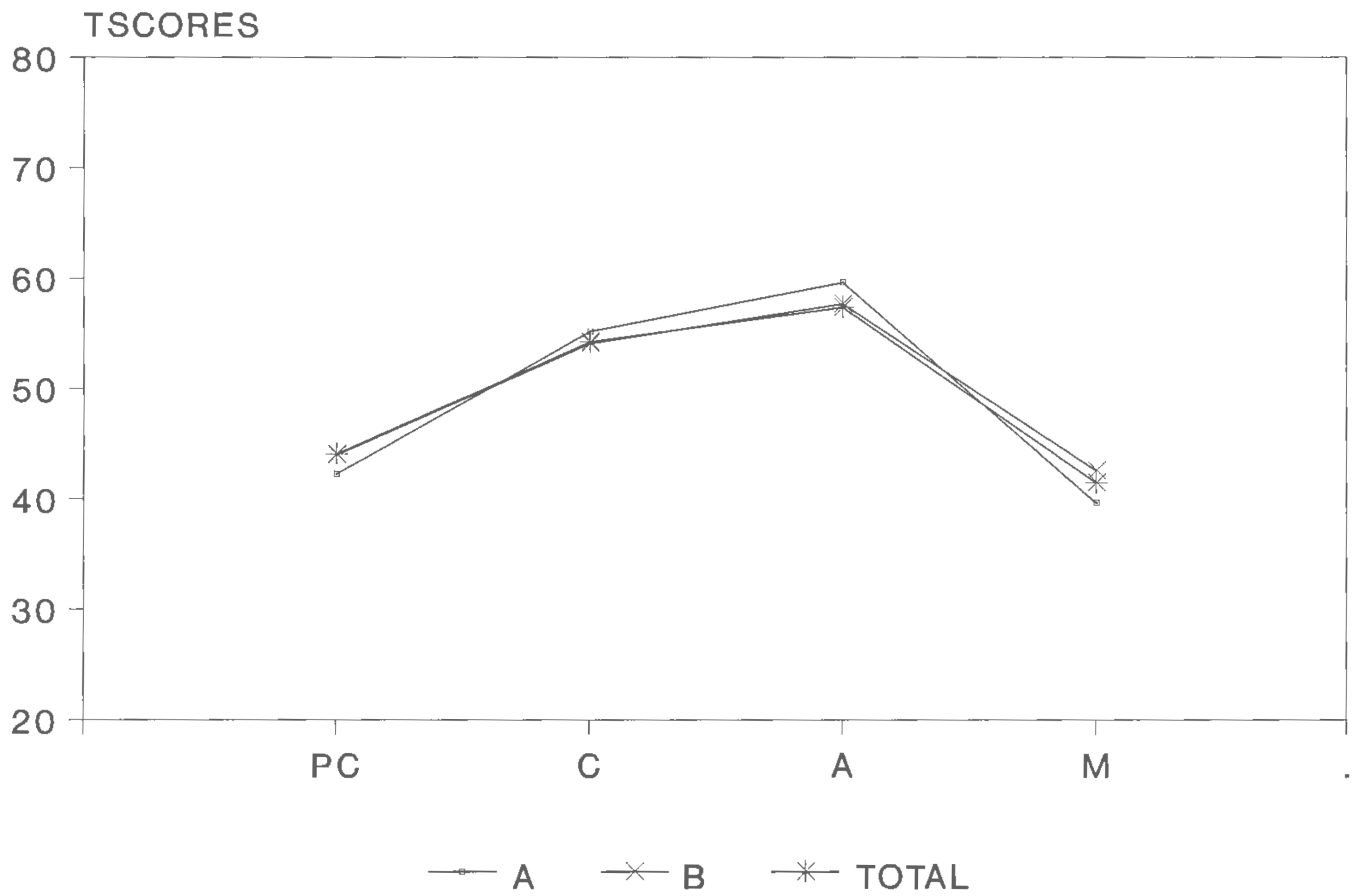


Figure 6. The Ready For Action cluster for the stages of change for sun exposure for the total ($N$ = 98) sample.

# READY FOR ACTION

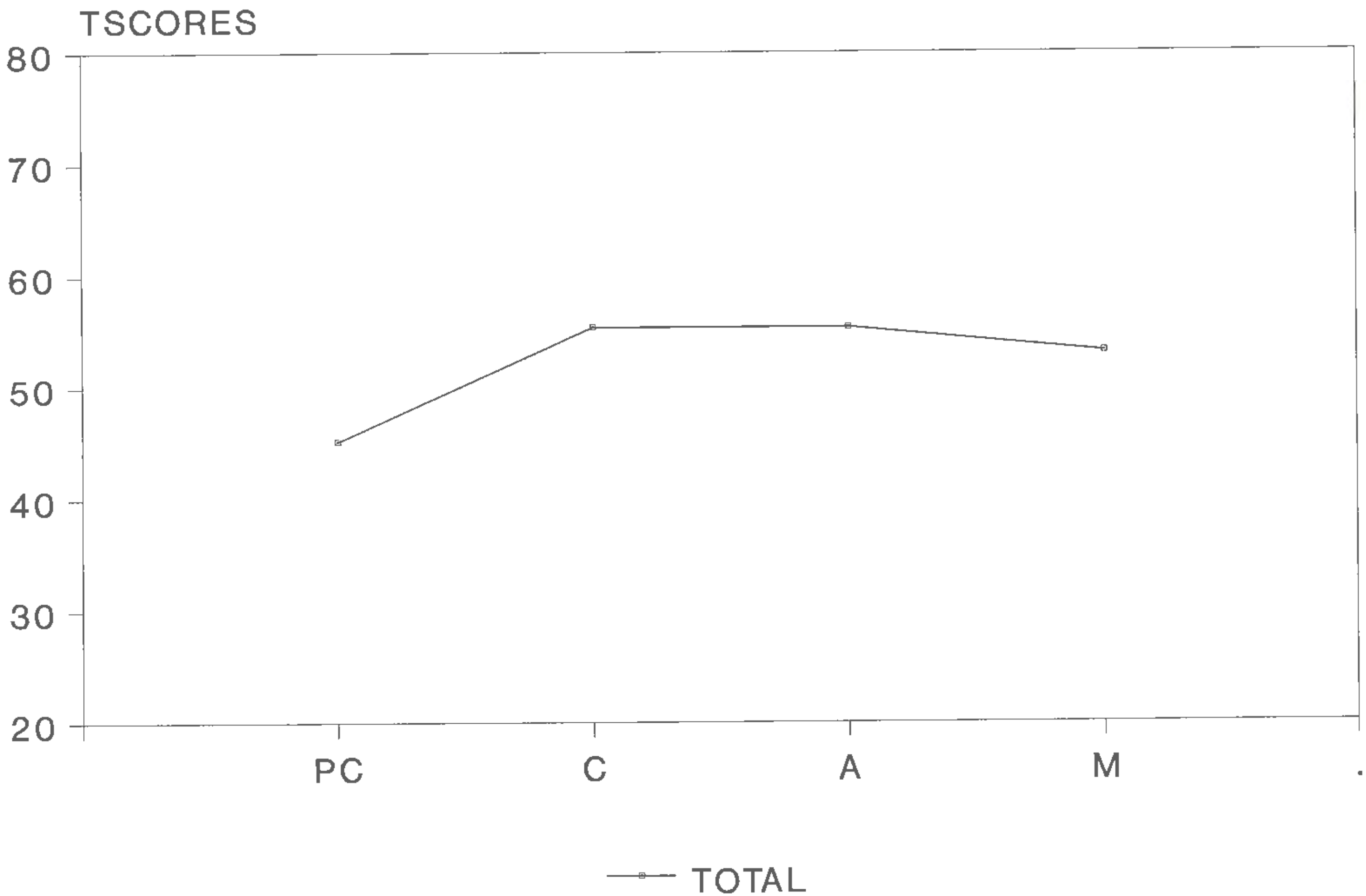


Figure 7. The Action cluster for the stages of change for sun exposure for sample A ($\underline{N}$ = 28), sample B ($\underline{N}$ = 49) and the total ($\underline{N}$ = 44) sample.

# ACTION

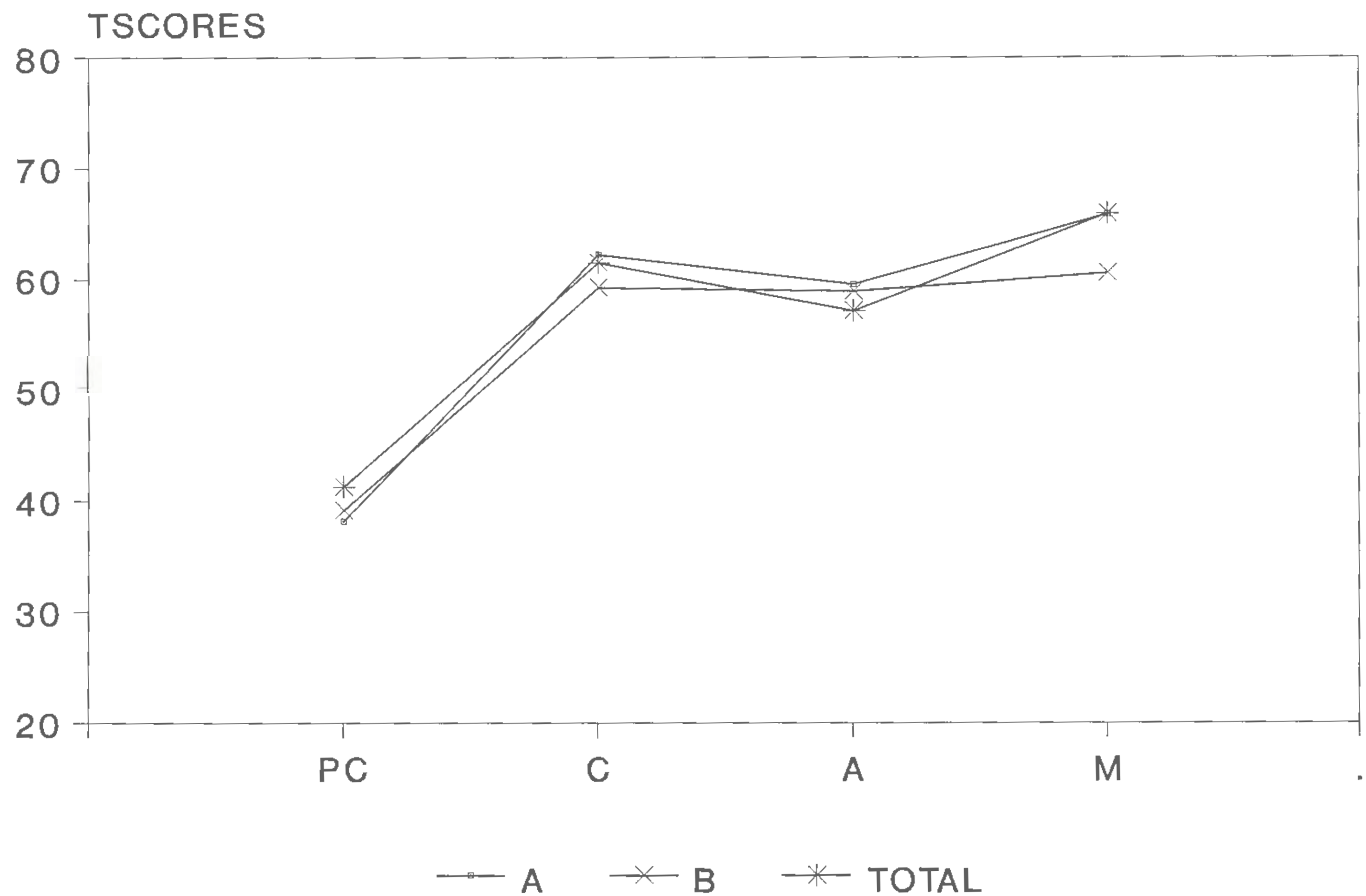


Figure 8. The Maintenance cluster for the stages of change for sun exposure for sample A (N = 38), sample B (N = 38) and the total (N = 51) sample.

Figure 9. The Contemplation cluster for the stages of change for sun exposure for sample B (N = 25).

# CONTEMPLATION

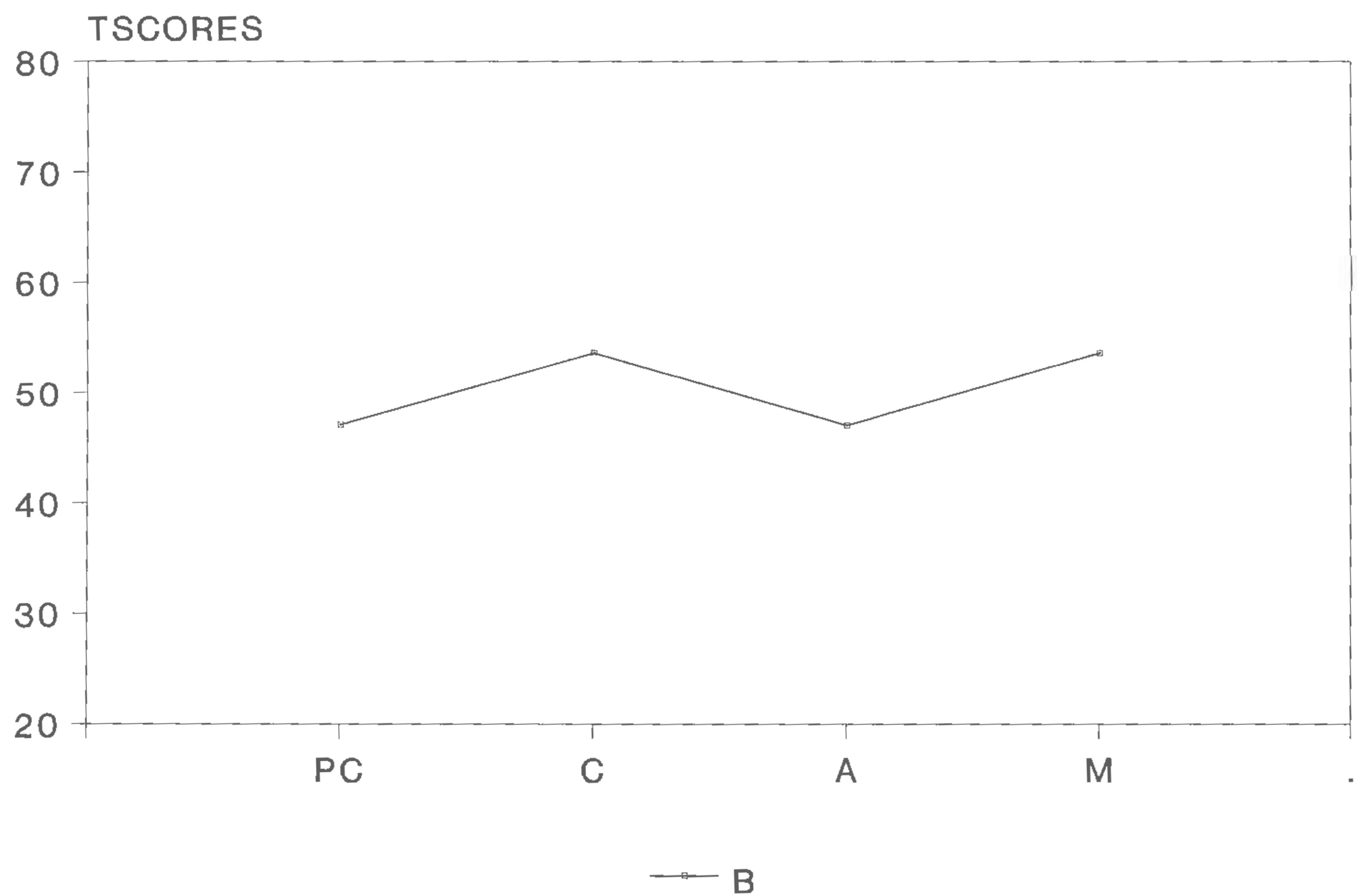


Figure 10. A cross-sectional profile of the Precontemplation stage by cluster subtypes from the total sample ($N$ = 545).

# PRECONTEMPLATION

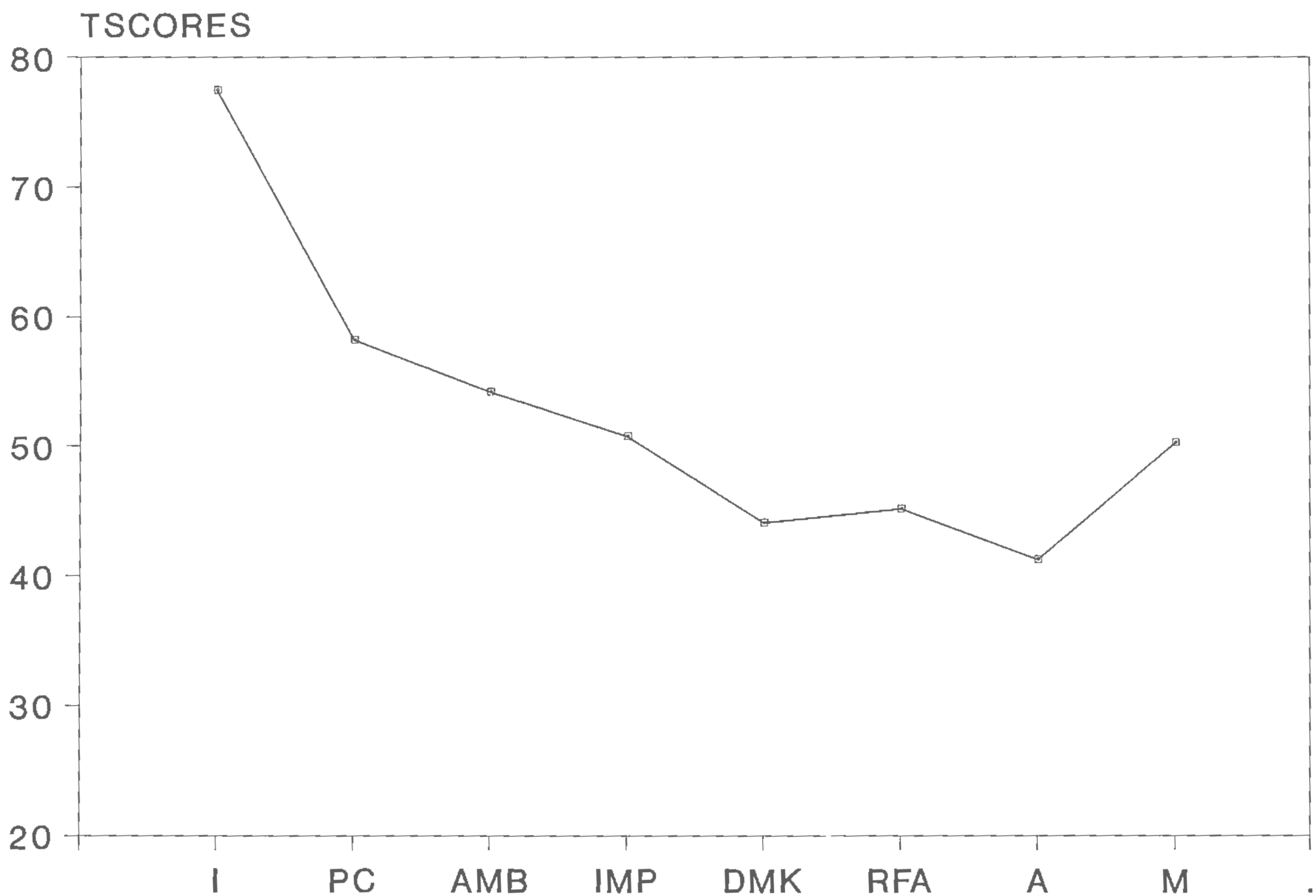


Figure 11. A cross-sectional profile of the Contemplation stage by cluster subtypes from the total sample ($\underline{N}$ = 545).

# CONTEMPLATION

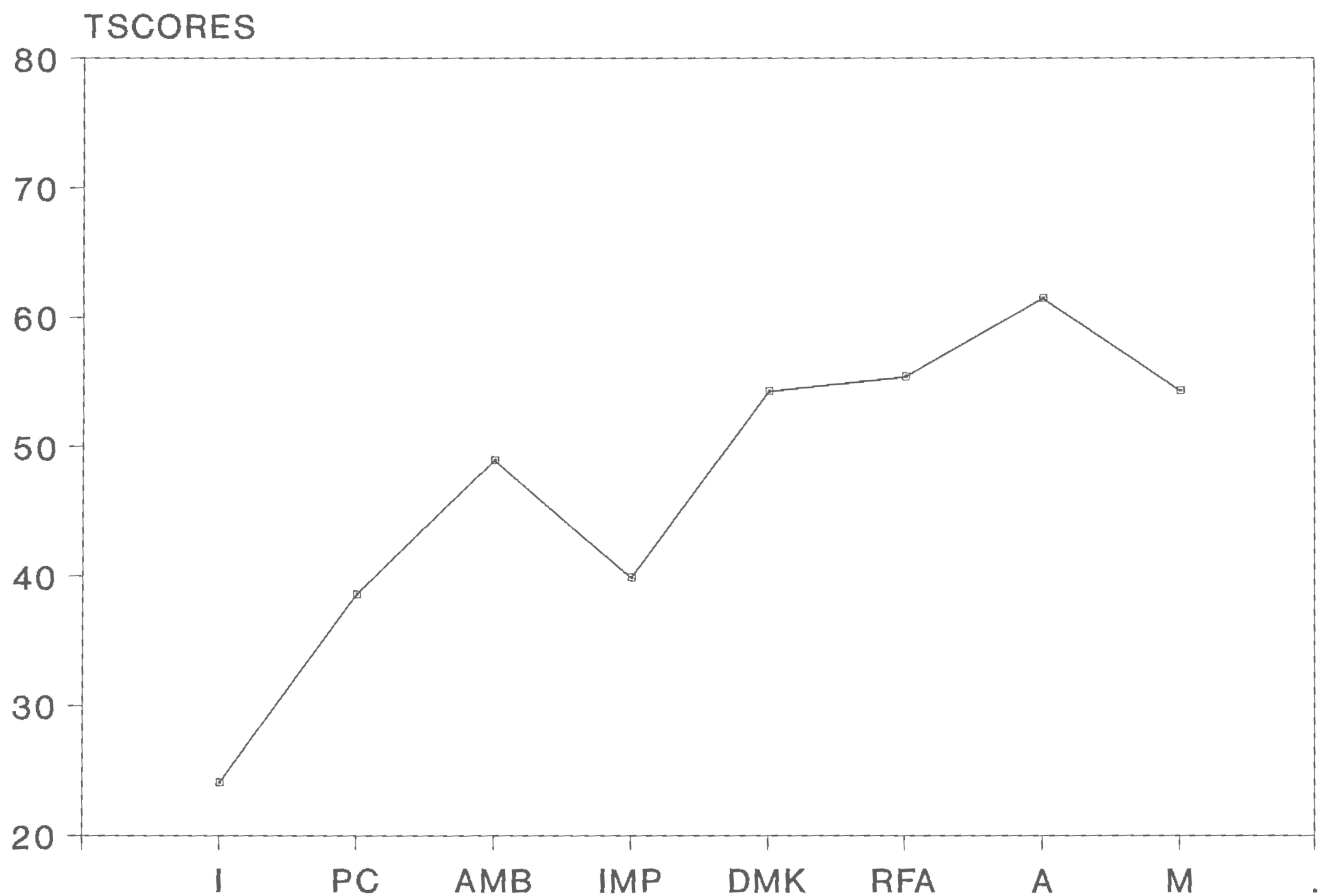


Figure 12. A cross-sectional profile of the Action stage by cluster subtypes from the total sample ($N$ = 545).

# ACTION

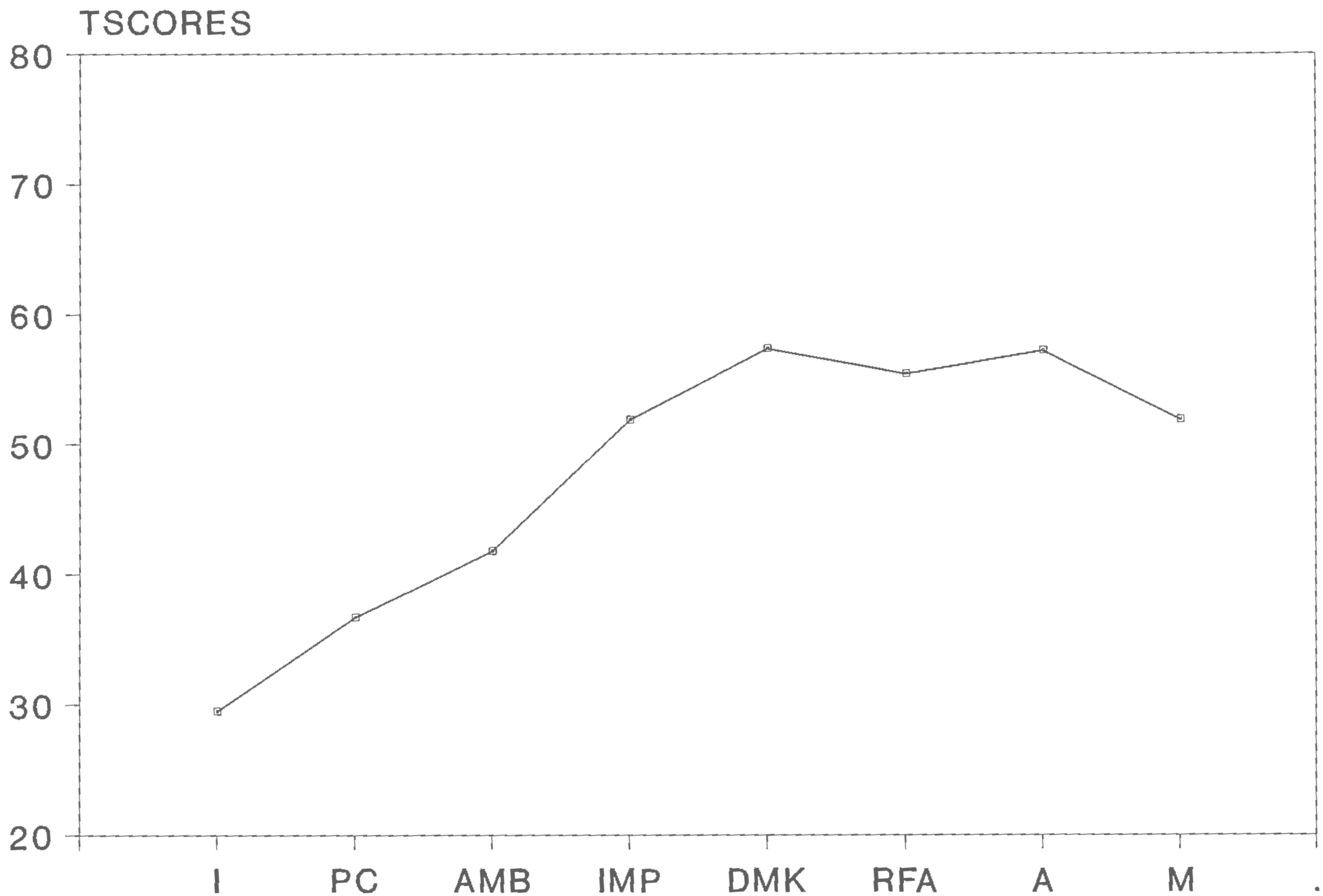
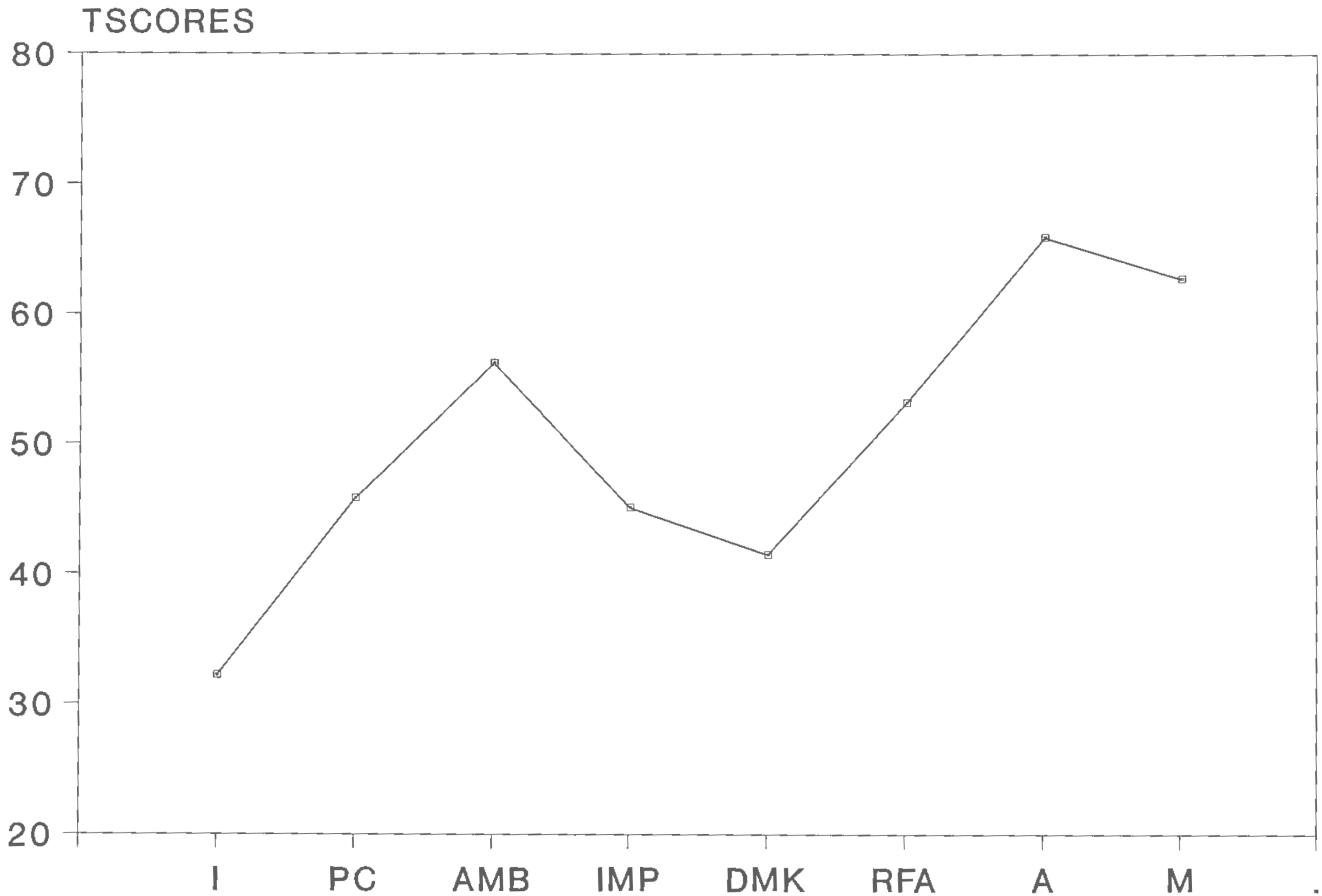


Figure 13. A cross-sectional profile of the Maintenance stage by cluster subtypes from the total sample ($N$ = 545).

# MAINTENANCE



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