

Owing to the recent success of the Transtheoretical Model of behavior change and the possible relationships between health behaviors, this study investigated the stage distribution of 10 healthy behaviors (seatbelt use, avoidance of high fat food, eating a high-fiber diet, attempting to lose weight, exercising regularly, avoiding sun exposure, sunscreen use, attempting to reduce stress, stopping smoking, and conducting cancer self-exams) and their interrelationships in a representative sample of health maintenance organization (HMO) members. The majority of older adults were found to be in either precontemplation or maintenance, illustrating the need to target interventions to precontemplation. Most older individuals were in precontemplation for losing weight and/or sunscreen use and exercise, making these behaviors a priority for intervention research. Possible gateway behaviors to general health could be identified; however, these results are preliminary and require longitudinal follow-up.

Key Words: Staging, Older adults, Health behaviors, Transtheoretical model, HMO

Stages of Change Across Ten Health Risk Behaviors for Older Adults

Claudio R. Nigg,¹ Patricia M. Burbank,² Cindy Padula,² Robert Dufresne,³ Joseph S. Rossi,¹ Wayne F. Velicer,¹ Robert G. Laforge,¹ and James O. Prochaska¹

Empirical data to date support efforts to promote lifestyle change among older adults (Rakowski, 1992). Lifestyle factors, including exercise, dietary behavior, and stress management, have been established as major contributors to healthy aging (Perry, 1995). The need to develop interventions to promote functioning and improve health status and to tailor interventions considering stages of behavioral change have been identified by Ory, DeFries, and Duncker (1998).

Recent research has revealed that smokers are more likely to eat high-fat diets and be inactive than non-smokers (Emmons, Marcus, Linnan, Rossi, & Abrams, 1994). Investigations have also looked at physical activity and nutrition (Simons-Morton, Parcel, Baranowski, Forthofer, & O'Hara, 1991), and smoking and weight control (Hall, Tunstall, Vila, & Duffy, 1992). No studies have been identified, however, that examined multiple health-risk behaviors in older adults. Further, much of the intervention research has focused on specific health problems. Fewer studies have examined interventions to promote health and overall functioning; a major limitation of these has been the lack of an organizing framework (Rakowski, 1998).

The Transtheoretical Model (TTM) of behavior change has been presented as an integrative and comprehensive model of behavior change (Prochaska &

DiClemente, 1983, 1985). The TTM has been successfully applied to numerous health risk behaviors. Original work started with the TTM and smoking cessation (Prochaska & DiClemente, 1983, 1985). More recently, studies have been conducted in various other health behaviors, including addiction and cessation behaviors. The TTM has been used successfully to understand diet (e.g., Bowen, Meischke, & Tomoyasu, 1994), sun exposure (e.g., Rossi, Blais, Redding, & Weinstock, 1995), weight loss (e.g., O'Connell & Velicer, 1988; Rossi, Rossi, Velicer, & Prochaska, 1995), alcohol abuse (e.g., Snow, Prochaska, & Rossi, 1994), screening mammography (e.g., Rakowski et al., 1992) and exercise (e.g., Marcus et al., 1992; Nigg & Courneya, 1998) among other behaviors.

The Transtheoretical Model

The Transtheoretical Model (TTM) was developed as a general explanatory model of intentional behavior change (Prochaska & DiClemente, 1983, 1985; Prochaska & Velicer, 1997). The model is based on the premise that people move through a series of stages in their attempt to change a behavior. Stages can be both dynamic and stable. In other words, stages can last for a considerable period of time, but they are open to change. The stages of the TTM are precontemplation, contemplation, preparation, action and maintenance. They are defined as follows:

Precontemplation is the stage where the individual is not doing the target behavior and is not intending to make changes toward this new behavior. Individuals in this stage are uninformed about the long-term effects of their present behavior and/or are demoralized about their ability to change. They also do not

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¹Cancer Prevention Research Center, University of Rhode Island. Address correspondence to Claudio R. Nigg, Cancer Prevention Research Center, University of Rhode Island, 2 Chafee Road, Kingston, RI, 02881. E-mail: cnigg@etal.uri.edu.

²Department of Nursing, University of Rhode Island.

³Department of Pharmacy, University of Rhode Island.

want to think about change and may be defensive, due in part to social pressures to change. Precontemplators may wish to change, but this seems quite different from a serious consideration of change (Prochaska & DiClemente, 1983, 1985; Prochaska & Velicer, 1997).

Contemplation is the stage where the individual is considering change. Individuals may stay in this stage for more than two years, despite the intention to change. When an individual substitutes thinking for acting, he/she is labeled as a chronic contemplator. Contemplators are ambivalent about changing because they see the pros and cons of sustaining the risk behavior as approximately equal. The central element of this stage is serious consideration of problem resolution (Prochaska & DiClemente, 1983, 1985; Prochaska & Velicer, 1997).

Preparation is defined by making small changes. Typically, preparers have a plan of action or have made some behavior changes; however, preparers have not yet reached a preset behavior criterion to reach the action stage. Immediate intention to engage in the behavior is also thought to be important in the definition of the preparation stage. The preparation stage is not very stable and contains people who are more likely than precontemplators or contemplators to progress. Preparation combines the criteria of intention and behavior (Prochaska & DiClemente, 1983, 1985; Prochaska & Velicer, 1997).

The *action* stage is where the individual actively engages in the new behavior. Overt behavioral changes have occurred within the last 6 months at this stage. Individuals in the action stage change their behavior, experiences, or environment in order to overcome their problems. Modifications tend to be highly visible and receive the greatest recognition from others. This, the least stable stage, corresponds with the highest risk for relapse. For this stage, the usual time criteria given is zero to 6 months. The hallmarks of the action stage are changing the target behavior to a preset criterion and making significant efforts to change (Prochaska & DiClemente, 1983, 1985; Prochaska & Velicer, 1997).

Maintenance is the stage where the individual is sustaining the change over time. This is a period of continued change where the individual is working to prevent relapse and to consolidate the gains attained during the action stage (Prochaska & DiClemente, 1983, 1985; Prochaska & Velicer, 1997). The last stage identified for cessation behaviors (*termination*) may not be applicable to adoption behaviors (Prochaska & Marcus, 1994). The definition of *termination* is an absolute absence of temptation to engage in an old behavior and 100% self-efficacy in engaging in the new healthy behavior (Prochaska & Velicer, 1997). However, in the area of exercise adoption, for example, formerly sedentary individuals would seem to be always at a risk for relapse and must continue to work to stay in the maintenance stage.

Although not explicitly reported in this research project because of feasibility and cost, it is important to note that movement through these stages may not occur in a linear fashion; often individuals move through the stages repeatedly, in a cyclical manner, before main-

tenance is reached. As people progress through stages of change they participate in overt and covert activities to alter their experiences and environments in order to change their behavior; these activities are called processes of change (Prochaska & DiClemente, 1983; 1985; Prochaska & Velicer, 1997).

The TTM also incorporates the constructs of decisional balance and self-efficacy. Decisional balance focuses on the benefits (pros) and costs (cons) of a behavior (Janis & Mann, 1977), and is thought to be important in decision making and, hence, in behavior change (Velicer, DiClemente, Prochaska, & Brandenburg, 1985). Self-efficacy involves judgment of one's abilities to perform a behavior required to achieve a certain outcome and is believed to be critical in behavior change (Bandura, 1982, 1986). Prochaska and Velicer (1997) recently described the entire TTM in detail.

Application of the Stages of Change to Older Adults

The TTM has been successfully applied to older adults. Rimer and colleagues (1994) demonstrated that older smokers in stage-tailored interventions combined with telephone counseling had significantly higher quit rates at 3 months; the tailored guide was rated more highly, and participants were more likely to have quit at 12 months in the targeted group. Clark, Kviz, Prochaska, Crittenden, and Warnecke (1995) examined stages of readiness to quit smoking in a sample of older adults. This work validated that older adults are concerned about health and able and willing to change their health behavior. Different factors were found to be important at the different stages of the smoking cessation process.

The stages of change have been successfully applied to exercise in older adults. Barké and Nicholas (1990) demonstrated that the stages of change are applicable to an older adult population and effectively differentiated between active and inactive older adults. Marcus and associates (1992), in a study that included young and older adults, found that a 6-week intervention program using written materials based on the TTM and tailored to the stages of change increased the stage of exercise adoption for most participants. Numerous studies have provided evidence that supported the application of the stages of behavior change across age groups and cultures in the exercise domain (Courneya, Nigg, & Estabrooks, 1998; Gorely & Gordon, 1995; Lee, 1993).

Although the pattern of stage distribution has important implications for the design of interventions, few studies have looked at stage distributions in large representative samples. Velicer and colleagues (1995) reported stage distributions for smoking in three samples (random sample from Rhode Island, California, and 114 worksites from four geographic areas) and found that 40% of smokers were in precontemplation, 40% in contemplation, and 20% in preparation. This distribution was stable across age groups except for the 65 and older group who identified themselves more in the precontemplation stage. Representative data also

exist for University of Geneva members (students, faculty, and staff) and residents of Geneva, Switzerland (Etter, Perneger, & Ronchi, 1997) for smokers where the distribution was 70% precontemplators, 20% contemplators, and 10% preparers for both groups. No association was found between age and stage of change; however, the age ranged only up to 70 years, not allowing a proper representation of older individuals.

Distributions among stages of change for multiple health behaviors and representative samples of older people have not yet been presented. This line of research could illuminate which behaviors public health efforts need to emphasize for older individuals. Further, the relationships between multiple health behaviors for older adults also have not been investigated to date. This type of investigation has the potential to identify a gateway behavior to health. It is thought that when a gateway behavior is intervened upon, other behaviors follow suit—thus potentially increasing the impact of an intervention. When considering the preliminary success of the TTM in understanding health behavior change in older adults, it is important to describe health behavior staging distributions and their relationships specifically for older adults. Therefore, the purpose of this investigation was to identify older adults' stage distribution for 10 selected health behaviors and to investigate relationships among these health behaviors.

Method

Participants

Screening for smoking behavior was attempted with a total population of 24,178 adults in three offices of a managed care system via mail and telephone surveys. The screening was completed on 19,266 participants, who served as the sample for the present study (participation rate = 79.7%). The mail version of the screener was completed by 9,541 individuals, and 9,725 completed the telephone screener. The reasons for people not completing the screener ($n = 4,912$) were: (a) unable to contact after 15 attempts ($n = 2,303$), (b) refused ($n = 1,350$), (c) unable to complete the screener due to cognitive or language difficulties ($n = 710$), (d) moved ($n = 419$), or (e) deceased ($n = 130$).

Of those reporting age, 14,972 participants were younger than 55 (54.7% female, mean years of education [MYE] = 13.74, $SD = 2.88$); 1,924 were aged 55 to 64 (53.1% female, MYE = 12.37, $SD = 3.06$); 1,194 were aged 65 to 74 (53.0% female, MYE = 11.51, $SD = 2.94$); and 421 were aged 75 and older (58.9% female, MYE = 10.78, $SD = 3.45$).

Procedure

The entire adult population serving different geographic regions (Rhode Island and southeastern Massachusetts) of a managed care system was screened for smoking via mail and telephone questionnaires as part of a large randomized clinical trial of smoking cessation (Velicer, Prochaska, Fava, Laforge, & Rossi, 1999). All listed members were first sent an introduc-

tory letter, which identified the study as sponsored by both the managed care organization and the research center. A week later the screening interview was mailed. Subscribers who did not respond by mail were surveyed by telephone. Although only identified smokers were invited to participate in the smoking cessation study (Velicer et al., 1999), all screened individuals are included in the analyses presented here.

Instruments

Rossi (1992) developed the instrument as a general survey of health behaviors and as a screening device designed to detect smokers for the smoking cessation study (Velicer et al., 1999). Stages of change were assessed for seatbelt use, avoidance of high-fat food, eating a high-fiber diet, attempting to lose weight, exercising regularly, avoiding sun exposure, using sunscreen, attempting to reduce stress, stopping smoking, and conducting cancer self-exams. The operationalization of the behaviors is presented in Table 1. Single-item algorithms were used for each behavior, which consisted of the question of interest and five statements representing each stage. Participants were asked to mark the one statement that applied to their current behavior status.

Maintenance individuals reported doing the health behavior for 6 months or longer. People in the action stage were doing the health behavior but for less than 6 months. Not doing the health behavior but intending to within the next 30 days defined the preparation stage. Not doing the health behavior but intending to within the next 6 months represented the contemplation stage. The precontemplation stage was operationalized as not doing and not intending to do the health behavior in the next 6 months. The measure can be found on our website (<http://www.uri.edu/research/cprc/Measures/GHS1991.htm>).

Table 1. Item Stems Used for the 10 Health Behaviors

| Behavior | Stem |
|-----------------|---|
| Using seatbelts | Do you consistently use seatbelts as a driver or passenger in a car? |
| Avoiding fat | Do you consistently avoid eating high-fat foods? |
| Eating fiber | Have you been eating a diet high in fiber? |
| Losing weight | Have you been trying to lose weight? |
| Exercising | Do you exercise three times a week for at least 20 minutes each time? |
| Avoiding sun | Do you take precautions against exposure to the sun? |
| Using sunscreen | Do you consistently use sunscreens when in the sun more than 15 minutes? |
| Reducing stress | Have you attempted to reduce the amount of stress in your daily life? |
| Smoking | Have you quit smoking cigarettes? |
| Self-exam | Do you examine yourself for warning signs of cancer (for example, breast, testicles, skin)? |

Results

Individuals who never smoked were not included in the smoking distribution. Although weight loss is clearly a health-promoting behavior in the obese, it is also recommended for many people who do not classify as clinically obese. Consequently, the entire sample is included for the stage distribution for weight loss, as for all other behaviors. Because of the random pattern of missing data, analyses were conducted with the available data. Frequency distributions of each age category across the stages for the 10 health behaviors are presented in Table 2. Age was divided into the following categories: 18–54; 55–64; 65–74; and 75+. The selection of the groups 55–64, 65–74, and 75+ is based on National Center for Health Care Statistics published data on mortality, morbidity, and functional

status (Katz, Greer, Beck, Branch, & Spector, 1985; Rabin & Stockton, 1987). The category of 85 years and older is also identified in these references. However, the sample size of the 85+ age category was not sufficient in terms of power for meaningful analysis. Therefore, the age categories of 75–84 and 85+ were combined. Although this research focuses on older adults, the 18–54 age category is included for comparison purposes and age trend identifications.

Within-Behavior Results

Data for the various health behaviors were compared over the differing age categories using chi-square (χ^2) analysis for goodness of fit with Bonferroni corrected alpha ($p < .005$). The data then were examined

Table 2. Stages of Change Distributions Across Age Categories for 10 Health Behaviors

| Behavior | Age | PC | C | P | A | M |
|--|-------|-----------------|----------------|----------------|-----------------|-----------------|
| Using seatbelts ($\chi^2_{(12)} = 133.1^*$) | <55 | 3958 (26.0%) | 692 (4.5%) | 1136 (7.5%) | 770 (5.1%) | 8678 (57.0%) |
| | 55–64 | 478 (24.2%) | 99 (5.0%) | 220 (11.2%) | 132 (6.7%) | 1043 (52.9%) |
| | 65–74 | 242 (19.5%) | 71 (5.7%) | 155 (12.5%) | 93 (7.5%) | 680 (54.8%) |
| | 75+ | 68 (15.8%) | 31 (7.2%) | 50 (11.6%) | 31 (7.2%) | 251 (58.2%) |
| Avoiding fat ($\chi^2_{(12)} = 612.4^*$) | <55 | 3975 (26.1%) | 1228 (8.1%) | 1508 (9.9%) | 1485 (9.8%) | 7009 (46.1%) |
| | 55–64 | 268 (13.5%) | 93 (4.7%) | 161 (8.1%) | 183 (9.2%) | 1274 (64.4%) |
| | 65–74 | 150 (12.0%) | 46 (3.7%) | 70 (5.6%) | 95 (7.6%) | 885 (71.0%) |
| | 75+ | 59 (13.4%) | 11 (2.5%) | 30 (6.8%) | 20 (4.5%) | 320 (72.7%) |
| Eating fiber ($\chi^2_{(12)} = 512.73^*$) | <55 | 4430 (29.3%) | 1111 (7.4%) | 1079 (7.1%) | 1344 (8.9%) | 713 (47.3%) |
| | 55–64 | 298 (15.2%) | 120 (6.1%) | 140 (7.2%) | 155 (7.9%) | 1243 (63.5%) |
| | 65–74 | 163 (13.3%) | 40 (3.3%) | 75 (6.1%) | 88 (7.2%) | 863 (70.2%) |
| | 75+ | 69 (16.1%) | 13 (3.0%) | 26 (6.1%) | 21 (4.9%) | 299 (69.9%) |
| Losing weight ($\chi^2_{(12)} = 337.46^*$) | <55 | 5940 (39.0%) | 1035 (6.8%) | 1036 (6.8%) | 2778 (18.2%) | 4454 (29.2%) |
| | 55–64 | 619 (31.2%) | 126 (6.4%) | 138 (7.0%) | 255 (12.9%) | 846 (42.6%) |
| | 65–74 | 490 (39.3%) | 51 (4.1%) | 76 (6.1%) | 132 (10.6%) | 499 (40.0%) |
| | 75+ | 264 (60.7%) | 27 (6.2%) | 22 (5.1%) | 30 (6.9%) | 92 (21.1%) |

(Table continues on next page)

Table 2. Stages of Change Distributions Across Age Categories for 10 Health Behaviors (Continued)

| Behavior | Age | PC | C | P | A | M |
|---|-------|-----------------|-----------------|-----------------|-----------------|------------------|
| Exercising ($\chi^2_{(12)} = 275.49^*$) | <55 | 2580 (16.9%) | 2172 (14.3%) | 2825 (18.5%) | 1728 (11.3%) | 5934 (38.9%) |
| | 55-64 | 437 (22.1%) | 241 (12.1%) | 344 (17.4%) | 175 (8.9%) | 778 (39.4%) |
| | 65-74 | 287 (22.9%) | 118 (9.4%) | 183 (14.6%) | 88 (7.0%) | 576 (46.0%) |
| | 75+ | 169 (38.7%) | 23 (5.3%) | 45 (10.3%) | 19 (4.3%) | 181 (41.4%) |
| Avoiding sun ($\chi^2_{(12)} = 134.61^*$) | <55 | 3131 (20.6%) | 692 (4.5%) | 439 (2.9%) | 752 (4.9%) | 10220 (67.1%) |
| | 55-64 | 292 (14.8%) | 65 (3.3%) | 56 (2.8%) | 69 (3.5%) | 1497 (75.6%) |
| | 65-74 | 181 (14.3%) | 36 (2.9%) | 19 (1.5%) | 41 (3.2%) | 986 (78.1%) |
| | 75+ | 67 (15.5%) | 7 (1.6%) | 11 (2.5%) | 17 (3.9%) | 331 (76.4%) |
| Using sunscreen ($\chi^2_{(12)} = 215.77^*$) | <55 | 5170 (34.0%) | 1255 (8.3%) | 825 (5.4%) | 605 (4.0%) | 7332 (48.3%) |
| | 55-64 | 788 (40.4%) | 130 (6.7%) | 117 (6.0%) | 60 (3.1%) | 857 (43.9%) |
| | 65-74 | 521 (43.2%) | 80 (6.6%) | 84 (7.0%) | 35 (2.9%) | 486 (40.3%) |
| | 75+ | 202 (49.3%) | 18 (4.4%) | 31 (7.6%) | 14 (3.4%) | 145 (35.4%) |
| Reducing stress ($\chi^2_{(12)} = 237.52^*$) | <55 | 3654 (24.2%) | 927 (6.1%) | 761 (5.0%) | 2009 (13.3%) | 7778 (51.4%) |
| | 55-64 | 399 (20.5%) | 74 (3.8%) | 74 (3.8%) | 182 (9.3%) | 1218 (62.6%) |
| | 65-74 | 292 (24.4%) | 42 (3.5%) | 42 (3.5%) | 71 (5.9%) | 752 (62.7%) |
| | 75+ | 128 (30.3%) | 14 (3.3%) | 16 (3.8%) | 15 (3.5%) | 250 (59.1%) |
| Smoking ($\chi^2_{(12)} = 193.78^*$) | <55 | 1734 (21.3%) | 1571 (19.3%) | 757 (9.3%) | 422 (5.2%) | 3671 (45.0%) |
| | 55-64 | 160 (12.6%) | 151 (11.9%) | 99 (7.8%) | 50 (3.9%) | 808 (63.7%) |
| | 65-74 | 79 (10.6%) | 54 (7.3%) | 55 (7.4%) | 25 (3.5%) | 529 (71.3%) |
| | 75+ | 22 (10.1%) | 8 (3.7%) | 8 (3.7%) | 12 (5.5%) | 167 (77.0%) |
| Self-exam ($\chi^2_{(12)} = 168.50^*$) | <55 | 4007 (26.4%) | 1151 (7.6%) | 890 (5.9%) | 661 (4.3%) | 8487 (55.9%) |
| | 55-64 | 376 (19.0%) | 97 (4.9%) | 134 (6.8%) | 81 (4.1%) | 1289 (65.2%) |
| | 65-74 | 230 (18.4%) | 63 (5.0%) | 67 (5.4%) | 38 (3.0%) | 852 (68.2%) |
| | 75+ | 99 (23.0%) | 13 (3.0%) | 23 (5.3%) | 9 (2.1%) | 286 (66.5%) |

Note: PC = precontemplation; C = contemplation; P = preparation; A = action; M = maintenance.
* $p < .005$.

for significant overall relationship between advanced stage and age using Kruskal & Wallis gamma.

The chi square for the stages of seatbelt use between the age groups was significant ($\chi^2_{(12)} = 133.1$; $p < .005$). However, there was no significant association between seatbelt use and increasing age (gamma = .00, $Z = 0.213$, NS).

There were significant differences between stages for the different age groups for behavior related to maintaining a low-fat diet ($\chi^2_{(12)} = 612.49$; $p < .005$). For both those older than 75 and those between 65 and 74 years of age, most subjects were in the maintenance stage (71.0 and 72.7%, respectively). There was an association (gamma = .36, $Z = 25.50$, $p < .01$) between increasing age and adherence to a lower fat diet. While only 13.4% of those older than 75 years of age were in precontemplation, the ratio almost doubled (26.2%) for those aged 18 to 54 who had not considered reduction in dietary fat.

There were significant differences between stages for the different age groups for behavior related to maintaining a high-fiber diet ($\chi^2_{(12)} = 512.73$; $p < .005$). There was also an association (gamma = .33, $Z = 23.64$, $p < .01$) between increasing age and adherence to a high-fiber diet. There was a tendency for those older than 65 to be more conscious of eating a high-fiber diet, with the majority (70%) being in maintenance phase, whereas only 47.2% of those under age 55 were in the high-fiber maintenance stage.

There were significant differences between stages for the different age groups for behavior related to losing weight ($\chi^2_{(12)} = 337.46$; $p < .005$). More of those aged 55 to 64 and 65 to 74 were in the maintenance phase of weight loss (42.6% and 40.0%) than those in the 18 to 55 (29.2%) and in the over 75 (21.2%) age group. It is of interest that a disproportionate number (60.7%) of those over 75 were in the precontemplation group. This is in contrast to those aged 65 to 74 years (39.3%), 55 to 64 years old (31.2%), and 18 to 54 years (39.0%). There was no pattern for higher stage of change with increasing age for weight loss (gamma = .07, $Z = 5.21$, NS).

There were significant differences in stages of exercise for the different age groups ($\chi^2_{(12)} = 275.49$; $p < .005$). The majority of the oldest candidates (>75 years old) were in the precontemplation (38.7%) and the maintenance (41.4%) stages for exercise. For those between 65 and 74 years of age, the majority of the subjects were in the maintenance stage (46.0%), followed by the precontemplation stage (22.1%). There was no association with higher stages and age (gamma = .03, $Z = 2.00$, NS).

There were significant differences between stages for the different age groups for behavior related to safe sun behavior ($\chi^2_{(12)} = 134.61$; $p < .005$). There was a very modest (gamma = .20, $Z = 11.11$, $p < .01$) association between higher stages of safe sun behavior and increasing age. Whereas 14.3 to 15.5% of those aged 55 and above were in precontemplation, 20.6% of those aged 18 to 54 were in precontemplation. Whereas 76.4 to 78.7% of those in the over 55-year-old categories were in maintenance, only 67.1% of those aged 18 to 54 were in maintenance. Differ-

ences between those in the stages of contemplation, preparation, and action were nonsignificant.

There were significant differences between stages for the different age groups for behavior related to the use of sunscreen ($\chi^2_{(12)} = 215.77$; $p < .005$). There was a small (gamma = -.13, $Z = 9.21$, $p < .01$) tendency for those who were older not to use sunscreen. While among those 54 and younger 48.3% were in the maintenance stage and 34.0% in the precontemplation stage, among those 75 years or older 35.4% were in maintenance and 49.3% in precontemplation.

There were significant differences between stages for the different age groups for behavior related to decreasing stress ($\chi^2_{(12)} = 237.52$; $p < .005$). There was a slight but significant association between more advanced stages of stress reduction and increasing age (gamma = .13, $Z = 8.18$, $p < .01$). There was a greater tendency for those older than 55 to be in the maintenance stage (59.1 to 62.6%) than those aged 18 to 54 (51.4%).

There were significant differences between stages for the different age groups for behavior related to smoking cessation ($\chi^2_{(12)} = 193.78$; $p < .005$). There was a tendency (gamma = 0.24, $Z = 12.70$, $p < .01$) for older patients to be in higher stages of smoking abstinence. Those older than 75 had 88.5% in maintenance and 5.1% in precontemplation, whereas only 70.6% of those 18 to 54 were in maintenance and 11% of them were in precontemplation.

There were significant differences between stages for the different age groups for behavior related to cancer self-exam ($\chi^2_{(12)} = 168.50$; $p < .005$). There was a slight association (gamma = 0.18, $Z = 11.50$, $p < .01$) between being in the maintenance phase of this behavior and advancing age. From 65.2% to 68.5% of those in the age categories of 55 and older were in maintenance, whereas from 18.4% to 23.0% of the older subjects were in precontemplation and 26.4% of those younger than 54 were in precontemplation. Differences between other stages for the various age groups were nonsignificant.

Between-Behavior Results

To analyze the relationships between the stage distributions of the various behaviors the measure of association gamma was used, as the data are ordinal-categorical. The associations across the four age categories are displayed in Table 3. Considering the sample size, significance interpretations are relatively meaningless. Therefore, the following guidelines for interpreting relationships among variables are used (taken from interpreting correlations): small relationship = 0.2; moderate relationship = 0.5; and large relationship = 0.8.

For the younger group (<55) there is one moderate relationship between avoiding sun and using sunscreen (gamma = .70). Twenty-two small relationships are noted, with avoidance of fat being related to most (seven) other behaviors. In the 55- to 64-year-old group, there are two moderate-sized gammas, between avoiding fat and eating fiber and between avoiding sun and sunscreen use (gamma = 0.52 and 0.64, respectively).

Table 3. Relationship (Gamma) Between 10 Health Behaviors for Four Age Categories

| Behavior | Age | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---------------------|-------|-----|-----|------|-----|------|-----|-----|------|------|
| Using seatbelts (1) | <55 | .23 | .24 | .04 | .14 | .30 | .23 | .09 | .34 | .23 |
| | 55-64 | .21 | .24 | .09 | .21 | .26 | .25 | .16 | .25 | .21 |
| | 65-74 | .27 | .27 | .04* | .24 | .27 | .21 | .12 | .17 | .20 |
| | >75 | .27 | .17 | .12* | .36 | .30 | .24 | .19 | .18 | .23 |
| Avoiding fat (2) | <55 | | .43 | .19 | .25 | .27 | .22 | .24 | .18 | .24 |
| | 55-64 | | .52 | .19 | .28 | .35 | .28 | .35 | .13 | .23 |
| | 65-74 | | .51 | .14 | .26 | .31 | .21 | .38 | .20 | .29 |
| | >75 | | .51 | .11* | .19 | .36 | .16 | .29 | .27 | .34 |
| Eating fiber (3) | <55 | | | .14 | .25 | .25 | .17 | .24 | .18 | .28 |
| | 55-64 | | | .25 | .28 | .31 | .20 | .30 | .17 | .31 |
| | 65-74 | | | .24 | .35 | .36 | .18 | .43 | .36 | .34 |
| | >75 | | | .16 | .19 | .31 | .25 | .31 | .33 | .29 |
| Losing weight (4) | <55 | | | | .05 | .11 | .09 | .19 | .14 | .19 |
| | 55-64 | | | | .13 | .15 | .17 | .27 | .33 | .17 |
| | 65-74 | | | | .14 | .16 | .12 | .37 | .39 | .19 |
| | >75 | | | | .19 | .26 | .14 | .39 | .31 | .25 |
| Exercising (5) | <55 | | | | | .07 | .08 | .13 | .17 | .07 |
| | 55-64 | | | | | .08 | .16 | .20 | .21 | .19 |
| | 65-74 | | | | | .16 | .13 | .19 | .30 | .16 |
| | >75 | | | | | .07* | .14 | .23 | .28 | .15 |
| Avoiding sun (6) | <55 | | | | | | .70 | .30 | .21 | .34 |
| | 55-64 | | | | | | .64 | .36 | .15 | .35 |
| | 65-74 | | | | | | .60 | .41 | .21 | .41 |
| | >75 | | | | | | .61 | .46 | .33 | .36 |
| Using sunscreen (7) | <55 | | | | | | | .24 | .11 | .31 |
| | 55-64 | | | | | | | .29 | .04* | .34 |
| | 65-74 | | | | | | | .27 | .14 | .33 |
| | >75 | | | | | | | .38 | .27 | .40 |
| Reducing stress (8) | <55 | | | | | | | | .03 | .28 |
| | 55-64 | | | | | | | | .11 | .34 |
| | 65-74 | | | | | | | | .19 | .38 |
| | >75 | | | | | | | | .05* | .45 |
| Smoking (9) | <55 | | | | | | | | | .03 |
| | 55-64 | | | | | | | | | .07* |
| | 65-74 | | | | | | | | | .18 |
| | >75 | | | | | | | | | .29 |
| Self-exam (10) | | | | | | | | | | |

*Nonsignificant at $p > .05$.

Twenty-seven small relationships exist in this age group, with eating high fiber diets being related to most (eight) other behaviors.

Regarding the 65- to 74-year-old group, avoiding fat and eating fiber along with avoiding sun and using sunscreen have a moderate relationship (gamma = 0.51 and 0.60, respectively). The number of small relationships is also 27, where avoiding fat and eating high fiber are associated with most (eight) other behaviors. Moderate relationships in the oldest category (75+) are again between avoiding fat and eating fiber and

between avoiding sun and using sunscreen (gamma = 0.51 and 0.61, respectively). Small associations are noted for 28 behaviors in this age group, with avoiding sun and cancer self-exam being associated with most (eight) other behaviors.

Further, examination of the trends of associations with increasing age reveals that the magnitude of the relationships increases for 21 and decreases for only 5 out of the 45 associations. The remaining 19 associations are either constant with increasing age or unique in their pattern.

Discussion

The results indicate that the stage paradigm is applicable for differentiating older individuals' positions along the health behavior change progression. This is important, as the traditional dichotomous categorization of problem behaviors (e.g., smoker/nonsmoker or active/inactive) may obscure important periods of behavior change attempts. Interventions tailored to someone with no intention to quit an unhealthy behavior or start a healthy behavior are fundamentally different from those targeting individuals who are ready to change (e.g., Prochaska, DiClemente, Velicer, & Rossi, 1993; Marcus et al., 1992). Based on these results, different interventions need to be designed to target each stage for the 10 health behaviors examined.

The first and most crucial stage to be addressed is precontemplation. For all 10 behaviors, precontemplators have either the highest or second highest percentage across the five stages, illustrating that a large part of the older population either is not cognizant of their need to change their unhealthy behaviors or that they are in denial and resistant to change. Further, these older cohorts may not value the individual behaviors or may not be convinced of the connection between the behavior and related health outcomes. Once this is realized and people have received the precontemplation interventions, addressing the subsequent stages becomes more important as the processes change with the progression of stage (Prochaska & DiClemente, 1983, 1985; Prochaska & Velicer, 1997).

The other stage that is well represented in this age group is maintenance. These individuals, who have been engaging in healthy behaviors for a considerable amount of time, represent the healthy portion of the population. The general implications of our findings are that interventions targeting older adults should be tailored to their specific psychological and physiological stage-related needs. More specifically, assessment and intervention development for older adults needs to be conducted in its own right, as these distributions do not resemble distributions from other age groups (Etter et al., 1997; Nigg & Courneya, 1998; O'Connell & Velicer, 1988; Prochaska et al., 1994; Velicer et al., 1995).

As the stage paradigm was found to apply to older adults across numerous health behaviors, it is instructive to briefly address the trends revealed across age groups for these behaviors. The prevalence of maintaining a low-fat and high-fiber diet increased with advancing age. This illustrates that older adults are more concerned with their dietary behavior. When the stages of losing weight are examined, there is a trend of successfully losing weight with increasing age until the last age group (75+). This can be explained through the fact that, in this age group, weight loss is not adaptive anymore but, rather, weight maintenance becomes essential (Fischer & Johnson 1990).

A unique pattern is displayed by the exercise staging across the age groups. The distribution increases toward the extreme stages as age increases, illustrating that older people in this sample have either been exercising for a while or are not even thinking about

starting to exercise. A possible explanation of the precontemplator prevalence is that the incidence of chronic illnesses is higher in older adults and, therefore, they may not consider exercise as an option. Another factor contributing to the exercise distribution may have been that the definition of exercise was nonspecific (3 times per week at 20 minutes or longer) with no examples given or intensity specified, leaving room for liberal interpretations. It has been found that providing a more concrete definition of exercise places the distribution toward the inactive stages (Reed, Velicer, Prochaska, Rossi, & Marcus, 1997).

Safe sun behaviors increased with advancing age, whereas the use of sunscreen revealed a slight decrease in the older groups. These trends explain each other. The older groups engage in more sun-protective behaviors such as wearing shirts and hats, or not going outside during the peak sunlight hours, which in turn decreases their need for applying sunscreen.

The older groups are more successful at having reduced their stress compared to their younger counterparts. This finding may be sample-specific, as these subjects likely have higher socioeconomic status, including education, than the general population at this age. This may mean that our sample has access to more resources for dealing with stress producing situations (e.g., financial problems). A more likely explanation is that older adults have had more experience—a longer history—of exposure and response to stress, which may make them better adapters.

The results concerning smoking behavior of our younger age group (<55) resemble other results found in representative U.S. samples for the first three stages (Velicer et al., 1995). Compared to younger individuals within this sample, however, more older participants identified themselves as not smoking for more than 6 months. Similarly, older participants engaged in more cancer self-exams compared to their younger counterparts. This reveals the increasing salience of cancer issues in older adults.

The only behavior where no age differences were identified was for seatbelt use. Considering that the question asked about both driver and passenger seatbelt use, the fact that some older individuals do not drive anymore can be ruled out. Therefore, the use of seatbelts is not different across different age groups, with over half of the total sample using them.

Summarizing the behaviors investigated, health professionals' primary focus should be placed on appropriate weight management and increasing sunscreen use and exercise for older individuals. This conclusion is based on the fact that a relatively large number of older individuals staged themselves in precontemplation and fewer in maintenance for these behaviors in relation to the other seven behaviors investigated. These other behaviors should not be ignored, however, as substantial portions of older individuals also report not intending to adopt these health behaviors.

Having discussed the individual behaviors, we can now ask the question of whether it is possible to identify a gateway behavior. A gateway behavior can be visualized as a behavior, when intervened upon, that has positive effects on other behavior changes. The

preliminary evidence points toward this possibility, as a large number of behaviors are somewhat related within each age group. Longitudinal change analyses are needed to fully address the gateway issue, however. In addition, examining the effect of single behavior change interventions on other health behavior changes is needed to further develop knowledge regarding potential gateway behaviors. If the current results are supported by further research, few behaviors may be related to general health for the various age groups. The potential implication that follows is that health behavior change interventions may only need to concentrate on a few key behaviors (specific for each age group). Based on the trend identified in the current results, interventions may need to focus on fewer behaviors in older populations, as the behaviors are more interrelated and there is an increase in the strength of these relationships (see Table 3). A possible explanation for this phenomenon is that those individuals who survive into older age may be characterized as having a greater number of healthy habits than those who do not. If this is the case, the health habits would become more related due to a survival effect. Another explanation may be that people would be more likely to become health conscious as they age. Some evidence exists for this line of reasoning, as older individuals have been found to practice more health promotion strategies than younger people (Leventhal & Prohaska, 1986) and value health more. A greater use of health services has been found to be associated with a stronger belief in the value of health-maintenance activities (Strain, 1991).

When interpreting these results, some caution is warranted due to the following limitations. First, the sample is cross-sectional, not allowing for causal attributions to be made and revealing age *differences*, not age *changes*. Therefore, there is no control for cohort effects. Relatedly, when addressing behavior change—which, by definition, occurs over time—it is recommended to employ longitudinal research designs. Second, owing to the original purpose of this survey (a health behavior screener to determine at-risk individuals), only the stage of change construct of the TTM was assessed in this study. A more complete understanding of the underlying mechanisms of stage (behavior) change would result from the inclusion of the entire TTM. This limitation is also associated with problems arising from our inability to obtain data on the morbidity/disability status and on other covariates that might mediate the relationships between age and stages of health behavior for the study population. The presence of various chronic conditions and health impairments may well have an impact on a person's motivation to comply with certain health behaviors and/or with the person's actual ability to follow certain prescriptions (e.g., exercise). Therefore, the presented results should be considered as preliminary and should be investigated in more depth. Third, the self-report nature of the investigation does not rule out response biases such as social desirability. Fourth, self-selection may have occurred, with the healthier individuals surviving longer, possibly accounting for some of the age differences noted in the various health behaviors.

Finally, the results should not be generalized outside of managed care populations, as these individuals may be different from the general population (e.g., in terms of income level or health awareness).

However, the present study does allow for some important conclusions to be made. The stage paradigm was found to apply to older adults for numerous health behaviors, which implies that public health interventions should be targeted and tested for all stages, from precontemplation to maintenance. The behaviors for which there are the most individuals in precontemplation and the fewest in maintenance are losing weight, sunscreen use, and exercise—showing the urgent need for the public health field to address and intervene in these areas for older adults. Finally, the possibility of gateway behaviors to health in these age groups has been identified and needs to be reconfirmed with future research in an attempt to identify the most cost-effective and efficacious way to intervene in the older adult population.

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