

Current Research

Differences in Psychosocial Variables by Stage of Change for Fruits and Vegetables in Older Adults

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ABSTRACT

Objective To describe differences in demographic and psychological variables by stage of change for five servings of fruits and vegetables per day in older adults.

Design Cross-sectional survey with data collected in the participant's home or the project office by interviewers.

Subjects 1,253 community-residing individuals 60 years or older (mean age=75 years) living in East Providence, RI.

Measures Stage of change; decisional balance; processes of change; self-efficacy; dietary intake measured by the National Institutes of Health (NIH) Fruit and Vegetable Screener, the 5 A Day Screener, and the NIH Fat Scan; demographics; and anthropometrics.

Statistical Analyses Variables were compared by stage of change using analysis of variance for continuous variables and χ^2 analysis for categorical variables. Servings of fruits and vegetables were transformed (square root) prior to analyses.

Results There was a strong effect of stage of change on intake measured by the Fruit and Vegetable Screener [$F_{(2, 1203)}=109, P<.001, \eta^2=.154$] and the 5 A Day Screener [$F_{(2, 1203)}=128, P<.001, \eta^2=.175$] with a linear increase from precontemplation to action/maintenance. There was an overall stage effect on decisional balance, processes of change, and self-efficacy [Wilks's $\lambda=.703, F_{(30, 2132)}=13.72, P<.001, \text{multivariate } \eta^2=.162$], and significant univariate effects for all variables.

Conclusions Self-assessed servings ("How many servings do you usually eat?") can be used for stage classification for older adults. Interventions for older adults in early stages should focus on increasing perceived benefits of healthful eating and cognitive process use. Self-efficacy

as well as behavioral processes seem to be important in attaining maintenance.

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One of the most important ways to decrease the risk of chronic disease is to consume five to nine servings per day of a variety of fruits and vegetables (1-4). A comprehensive review concluded that 78% of cancers have shown a significant decrease in risk with higher intakes of fruits and vegetables (5). Other reviews and studies found a reduction in risk for cardiovascular disease and stroke with a greater consumption of these foods (6-8). Components in fruits and vegetables may be particularly beneficial to the elderly because they reduce the progression of age-related macular degeneration and bone loss (9-12). Both the 2000 edition of the *Dietary Guidelines for Americans* (13) and *Healthy People 2010* (14) place great importance on increasing the consumption of fruits and vegetables, and campaigns such as the 5 A Day for Better Health Program have focused extensive efforts on encouraging more consumption of these foods (15). Since the program's inception there has been an increase of 3.7% in the proportion of adults meeting the criterion of five servings per day (16).

Research suggests that older people are consuming more fruits and vegetables than their younger counterparts, but the majority consume less than five servings per day. Baseline data for the 5 A Day for Better Health program indicated that people older than age 50 reported a higher number of servings than adults less than 50 years of age (3.6-4.1 vs 3.0-3.4) (17) and more recent data found that 36.8% of women 65 years of age or older met the criterion of five servings per day (18).

One of the most promising models of behavior change is the Transtheoretical (Stages of Change) Model (19,20). Research based on the model has established the following five stages of readiness to change problem behaviors: precontemplation (no intention to change behavior in the next 6 months), contemplation (intention to change within the next 6 months), preparation (serious intention to change within the next 30 days), action (engaged in behavior change at the targeted level but for less than 6 months), and maintenance (sustained behavior change at the required level for 6 months or more). Individuals often move through the stages repeatedly in a cyclical fashion before reaching maintenance (21,22). Interventions tailored by stage of change have been effective in changing fruit and vegetable consumption across a variety of study populations, but none have directly targeted older adults (23-25). Stages of change have been used to

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	Process of change	Description	Example of using each process of change
Experiential strategies	Consciousness raising	A cognitive process of change that involves raising awareness about the problem of eating enough vegetables and fruits.	Reading more about eating more vegetables and fruits.
	Dramatic relief	An affective process that involves creating a motivating emotional experience that encourages the individual to eat enough fruits and vegetables.	Feeling worried about getting sick if you don't eat enough fruits and vegetables.
	Self reevaluation	An evaluative process that involves reappraising what is thought and felt about eating fruits and vegetables.	Feeling good about yourself if you eat fruits and vegetables.
	Self liberation	An existential process that involves invoking will power, making a commitment, and recognizing choices with regard to eating vegetables and fruits.	Talking yourself into eating more fruits and vegetables.
	Environmental reevaluation	An evaluative process that involves considering the impact of one's dietary behavior on others.	Considering the idea that, in general, seniors would benefit from eating more fruits and vegetables.
	Social liberation	An evaluative process that involves considering the impact of the environment or others on one's ability to eat vegetables and fruits.	Noticing that more and more seniors are eating vegetables and fruits these days.
Behavioral strategies	Helping relationships	A humanistic process of change that involves accepting or seeking help from others.	Accepting help from others in preparing fruits and vegetables.
	Reinforcement management	A behavioral process that involves providing rewards for eating vegetables and fruits.	Making use of the approval of other people as a reward to motivate one to eat more vegetables and fruits.
	Interpersonal systems control	A behavioral process that involves seeking out people who promote eating vegetables and fruits or avoiding people who discourage that behavior.	Spending time with other people who encourage one to eat more vegetables and fruits.
	Counter conditioning	A behavioral process that involves substituting vegetables and fruits for other foods.	Snacking on vegetables and fruits instead of high-fat foods.
	Stimulus control	A behavioral process that involves using cues to take control and promote eating vegetables and fruits.	Keeping fruits in a bowl on the counter.
	Planning ahead	A behavioral process that involves being proactive about situations to promote eating enough vegetables and fruits.	Cutting up vegetables ahead of time to add to meals during the week.

Figure 1. Processes of change for increasing fruit and vegetable intake in older adults.

integrate core constructs from leading theories of behavior change, including decisional balance, processes of change, and self-efficacy (21,26). One of the key features of the stage model is that processes of change (see Figure 1), such as learning about health benefits of fruits and vegetables (consciousness raising) or substituting fruits and vegetables for other foods (counterconditioning), are considered to mediate stage progression (20). However, no studies have described processes for fruits and vegetables.

To develop effective interventions for older adults, it is necessary to understand the relationship between stage and other key Transtheoretical Model variables in this population. The purpose of this study was to describe differences by stage in demographic and psychological variables that could be used to tailor interventions for older adults.

METHODS

This is a descriptive study of the baseline participants enrolled in the SENIOR project (Study of Exercise and

Nutrition in Older Rhode Islanders). SENIOR is an intervention for community-dwelling older adults focusing on increasing fruit and vegetable consumption and exercise (27). The sample population includes 1,277 men and women, age 60 years and older, living in the city of East Providence, RI. However, only 1,254 subjects providing stage of change data and dietary or Transtheoretical Model data are included in this study. To participate, participants had to meet the age requirement, provide informed consent, and be able to answer questions in English or Portuguese. The study was approved by the University of Rhode Island's Institutional Review Board.

Subjects were recruited into the SENIOR project during a 12-month period through a variety of reactive recruitment methods, including newspaper and television advertisements, display tables set up at local supermarkets and pharmacies, as well as flyers and posters. In addition, community groups and organizations (such as the local senior center) assisted with recruitment. Proactive recruitment efforts (letters followed by phone calls) recruited approximately 11% of the subjects (28).

Trained interviewers, older adults from a variety of racial and ethnic backgrounds who resided in East Providence, collected all baseline data in the participant's home or in the SENIOR project office. After completion of training, the interviewers administered a comprehensive questionnaire that included demographics and assessments of physical activity as the instruments described in the following section.

Instruments

Dietary Assessment. Two brief food–frequency-type instruments assessed the number of servings of fruits and vegetables consumed per day. The first instrument, the National Institutes of Health (NIH) All-Day Fruit and Vegetable Screener (29), is a nine-item instrument that includes assessment of portion size as well as consumption of mixed vegetable dishes. The second, used in 5 A Day studies, is a seven-item instrument measuring frequency of intake (including fried potatoes) and consumption of fruits and vegetables, but does not assess portion size or mixed dishes (30). Dietary fat intake (% energy from fat) was estimated from the NIH Fat Scan (31); this 17-item instrument assesses frequency of consumption of 15 foods as well as use of fat-reduced margarine.

Stages of Change. The stages-of-change instrument measures an individual's motivational readiness to eat five servings of fruits and vegetables per day (32). It is a two-step algorithm consisting of a series of four possible questions that includes a skip pattern. All subjects are asked initially to respond to the question, "How many servings of fruits and vegetables do you usually eat each day? (a serving is ½ cup cooked vegetables, 1 cup of salad, a piece of fruit, ¾ cup of 100% fruit juice)" with responses ranging from zero to six or more. Subjects who respond from zero to four are directed to the question, "Do you intend to start eating five or more servings of fruits and vegetables a day in the next 6 months?" Subjects who respond "No" are classified in precontemplation; those who respond "Yes" are asked, "Do you intend to start eating five or more servings of fruits and vegetables a day in the next 30 days?" Those responding "No" are classified in contemplation; individuals responding "Yes" are classified in preparation.

Subjects who indicated on the initial question that they were eating five to six servings were asked, "Have you been eating five or more fruits and vegetables a day for more than 6 months?" Subjects who responded "No" were classified in action and subjects responding "Yes" to this question were classified in maintenance.

Decisional Balance. The decisional balance instrument measures the importance that older adults assign to the pros and cons of making the decision to eat five servings of fruits and vegetables per day. This eight-item survey consists of two scales of four items each representing the benefits (pros) and barriers (cons) of eating fruits and vegetables daily. Subjects were asked to rate the importance of each statement in making the decision to eat fruits and vegetables using a 5-point Likert scale (1=not at all important, 2=slightly important, 3=moderately important, 4=very important, and 5=extremely important). The pros are facilitators of change (reasons to eat fruits and vegetables). The cons are barriers (costs or difficul-

ties involved with eating fruits and vegetables). Previous psychometric studies with older adults (N=178) demonstrated that the measure is valid, with acceptable internal consistency for both scales ($\alpha=.79$ pros, $.75$ cons) with pros loadings ranging from $.56$ to $.81$ (mean= $.70$) and cons from $.52$ to $.81$ (mean= $.66$) (33).

Processes of Change. The processes-of-change instrument measures overt and covert strategies older adults use to help themselves eat more fruits and vegetables (see Figure 1). They tell us how people change their behavior and may involve the use of activities, thoughts, feelings, or events. Twelve strategies were identified in qualitative studies with older adults (34). Six experiential strategies are cognitive and affective in nature and have to do with thinking and feeling. Six behavioral strategies are performance-oriented and focus on turning thoughts into action and getting support. The 36-item instrument consists of three items per process. Subjects were asked how often they thought, felt, or experienced the strategy described in each of 36 statements during the past month using a 5-point Likert scale (1=never, 2=seldom, 3=occasionally, 4=often, and 5=repeatedly). Previous measurement studies with older adults (N=277) demonstrated that this measure is both valid and reliable with α coefficients ranging from $.72$ to $.84$ and loadings ranging from $.62$ to $.91$, with the exception of the stimulus control subscale ($\alpha=.64$, loadings $.503$ to $.723$).

Situational Self-Efficacy. The situational self-efficacy instrument measures overall confidence that older adults have in their ability to eat fruits and vegetables in challenging situations. This instrument consists of six items and provides a total score measuring global self-efficacy. Subjects were asked to use a 5-point Likert scale (1=not at all confident, 2=not very confident, 3=moderately confident, 4=very confident, and 5=extremely confident) to rate each statement with regard to how confident they would be to eat vegetables and fruits in each of the situations presented. Previous instrument development studies with older adults (N=177) demonstrated that this measure is both valid and reliable with excellent internal consistency ($\alpha=.89$) and loadings ranging from $.59$ to $.87$, (mean= $.75$) (35).

Analyses

Analyses were conducted using the Statistical Package for the Social Sciences (SPSS for Windows, Version 11.5, 2003, SPSS, Inc, Chicago, IL). Due to the small sample in the contemplation stage (N=25) this stage was combined with the preparation stage for analyses, and the action stage (n=14) was combined with the maintenance stage. Servings of fruits and vegetables for both instruments were transformed (square root transformation) prior to analyses (medians and untransformed means \pm standard deviations are reported in tables for ease of interpretation). Stage differences in fruit and vegetable intake as well as differences by age and dietary fat intake were examined using multiple analyses of variance, followed by univariate analyses of variance (adjusted for multiple comparisons), followed (when significant) by post hoc analyses (Tukey). Stage differences by Transtheoretical Model variables were analyzed similarly. Stage differ-

Table 1. Demographic, dietary, and anthropometric characteristics of study participants (N=1,253)

Continuous variables	Mean ± SD ^a	
Age (y)	75.4 ± 8.5	
Fat intake (% kcal fat)	29.85 ± 5.04	
Reported height (cm)	164 ± 9.7	
Reported weight (kg)	73.0 ± 15.3	
BMI ^b	27.2 ± 5.0	
Categorical variables	N	%
Employment		
Working	119	10
Retired	1,068	87
Other	39	3
Current Smoker		
Yes	85	7
No	1,097	93
Ethnicity		
White	965	78
Hispanic/Portuguese	176	14
Black	25	2
Other	74	6
Sex		
Male	378	30
Female	875	70
Education		
<High school graduation	285	22
High school graduate	490	38
Some college	251	20
College graduate	246	19
Perceived Health		
Excellent	172	14
Very good	399	32
Good	489	39
Fair	163	13
Poor	25	2
Annual Income (\$)		
<10,000	167	25
10,000-19,999	223	33
20,000-29,999	129	19
30,000-39,999	81	12
40,000-49,999	29	4
50,000-59,999	27	4
≥60,000	24	3
Marital Status		
Married	599	47
Widowed	467	37
Other	197	16

^aSD=standard deviation.
^bBMI=body mass index; calculated as kg/m².

ences by categorical variables were examined using χ^2 analysis.

RESULTS

Participants in this study (N=1,253) had a mean age of 75 years and were predominantly retired, nonsmoking, white women with at least a high school education who perceived themselves in good health (Table 1). Among

those providing income data (N=680), the majority reported household income less than \$20,000 per year. The majority of participants reported engaging in regular exercise (56%), perceived their diet “was low in fat” (51%), and reported height and weight within the normal to overweight range (75%); few participants (4.7%) perceived that they “had run out of food or felt that they might over the previous 6 months,” and only 1.3% reported being underweight (BMI<18) (data not shown).

Fifteen percent of the participants did not intend to increase fruit and vegetable consumption to five servings per day (precontemplation), 64% perceived that they had been consuming at least five servings for more than 6 months (maintenance), 18% were in the preparation stage, and 2% or less were in the contemplation or action stages. The stage distribution varied by marital status [$\chi^2_{(4)}=11.91, P<.05$] but not by sex, income, perceived health, ethnicity, employment, BMI classification, or education. People who were currently married were most likely to be in action/maintenance. There was an effect of stage on fat intake [$F_{(2, 1104)}=34.98, P<.001, \eta^2=.060$], with a lower intake in action/maintenance than other stages (mean=29.01% kcal) and contemplation/preparation (mean=30.96% kcal) than precontemplation (mean=32.21% kcal). There was no difference in stage by age ($P=.903$).

There was a strong effect of stage on intake measured by the Fruit and Vegetable Screener [$F_{(2, 1104)}=109, P<.001, \eta^2=.153$] and the 5 A Day Screener [$F_{(2, 1104)}=128, P<.001, \eta^2=.174$] with a linear increase from precontemplation to action/maintenance (Table 2). Participants in action/maintenance had higher intakes of fruits, vegetables, and fruits and vegetables combined than those in other stages for both instruments.

There was an overall stage effect on decisional balance, processes of change, and self-efficacy [Wilks’s $\lambda=.703, F_{(30, 2132)}=13.72, P<.001$, multivariate $\eta^2=.162$] and significant univariate effects for all variables (Table 3). For pros, all 12 processes, and self-efficacy, older adults in precontemplation had lower scores than those in contemplation/preparation. Four processes and self-efficacy increased between contemplation/preparation and action/maintenance. The pros and the remainder of the processes leveled off with no change between those stages. There were no differences between stages for cons.

DISCUSSION

This study provided strong support for the use of self-assessed number of servings (ie, “How many servings of fruits and vegetables do you usually eat each day?”) for stage of change classification (32) in older adults. There was a linear increase in number of servings of fruits and vegetables from precontemplation to action/maintenance with stage explaining 15% to 17% of the variance in behavior. This is similar to the variance explained by stage in a nationally representative sample (36). Most (37-40), but not all (41) researchers have found that self-assessed intake underestimates fruit and vegetable intake measured by dietary recall or food frequency instruments. This study found that self-assessment underestimated intake compared with the Fruit and Vegetable Screener but there was reasonably close agreement between the 5 A Day Screener instrument and self-assessment. The Fruit and Vegetable Screener produced higher estimates of intake, particularly of vegetables,

Instrument variable	Precontemplation (N=163)	Contemplation/preparation (N=216)	Action/maintenance (N=725)
Screener (median)	4.61	5.86	8.09
Total (mean±SD ^b)	5.21±3.09 ^x	6.48±3.44 ^y	8.92±4.33 ^z
5 A Day (median)	3.75	4.15	5.90
Total (mean±SD)	3.95±2.14 ^x	4.37±2.45 ^y	6.07±2.18 ^z
Screener (median)	1.83	2.59	3.75
Fruits (mean±SD)	2.33±2.10 ^x	3.20±2.67 ^y	4.67±3.19 ^z
5 A Day (median)	1.86	2.07	3.0
Fruits (mean±SD)	1.85±1.35 ^x	2.27±1.49 ^y	3.26±1.51 ^z
Screener (median)	2.56	2.86	3.90
Vegetables (mean±SD)	2.88±1.96 ^x	3.29±1.94 ^y	4.25±2.28 ^z
5 A Day (median)	1.78	1.96	2.71
Vegetables (mean±SD)	2.10±1.22 ^x	2.10±1.26 ^x	2.80±1.21 ^y

^aOnly subjects with complete data for all variables as well as age and dietary fat intake were included in these analyses.
^bSD=standard deviation.
^{x,y,z}Means with the same superscript do not differ (Tukey, $P>.05$).

Variable univariate F η^2 (2 df)	Precontemplation (N=163)	Contemplation/preparation (N=216)	Action/maintenance (N=704)
	← <i>mean±SD^b</i> →		
Pros ^c F=27.86*** $\eta^2=.049$	3.18±0.91 ^x	3.80±0.74 ^y	3.67±0.87 ^y
Cons F=3.70* $\eta^2=.007$	1.82±0.72 ^x	1.79±0.77 ^x	1.67±0.76 ^x
Consciousness Raising ^d F=36.84*** $\eta^2=.064$	2.71±0.99 ^x	3.34±0.87 ^y	3.40±0.93 ^y
Dramatic Relief F=30.20*** $\eta^2=0.53$	2.31±0.91 ^x	3.08±0.94 ^y	2.89±1.02 ^y
Self Re-evaluation F=105.02*** $\eta^2=.163$	2.94±1.04 ^x	3.73±0.81 ^y	4.01±0.82 ^z
Self Liberation F=37.46*** $\eta^2=.065$	2.67±1.05 ^x	3.41±0.92 ^y	3.44±1.07 ^y
Environmental Re-evaluation F=53.43*** $\eta^2=.090$	2.90±0.93 ^x	3.60±0.85 ^y	3.68±0.86 ^y
Social Liberation F=53.44*** $\eta^2=.090$	3.00±0.90 ^x	3.53±0.78 ^y	3.72±0.80 ^z
Helping Relationships F=15.49*** $\eta^2=.028$	2.13±0.98 ^x	2.54±1.08 ^y	2.68±1.17 ^y
Reinforcement Management F=8.81*** $\eta^2=.016$	1.76±0.88 ^x	2.12±0.96 ^y	2.10±0.99 ^y
Counterconditioning F=90.69*** $\eta^2=.144$	2.76±1.01 ^x	3.32±0.84 ^y	3.68±0.77 ^z
Interpersonal Systems Control F=14.29*** $\eta^2=.028$	2.22±1.09 ^x	2.55±1.03 ^y	2.73±1.13 ^y
Stimulus Control F=88.08*** $\eta^2=.140$	2.40±0.83 ^x	2.89±0.77 ^y	3.26±0.76 ^z
Planning Ahead F=34.04*** $\eta^2=.059$	1.86±0.85 ^x	2.40±0.89 ^y	2.54±0.97 ^y
Self-efficacy ^e F=49.58*** $\eta^2=.084$	3.18±0.95 ^x	3.41±0.93 ^y	3.83±0.79 ^z

^aOnly subjects with complete data for all variables above were included in these analyses.
^bSD=standard deviation.
^cDecisional Balance (pro and con) scored on a 5-point scale from 1=Not at all important to 5=Extremely important with the raw score divided by number of items (4) in order for scores to directly correspond to the scale above.
^dProcesses of Change scored on a 5-point scale from 1=Never to 5=Repeatedly with the raw score divided by number of items (3) in order for scores to directly correspond to the scale above.
^eSelf-efficacy scored on a 5-point scale from 1=Not at all confident to 5=Extremely confident with the raw score divided by number of items (6) in order for scores to directly correspond to the scale above.
^{x,y,z}Means with the same superscript do not differ (Tukey, $P>.05$).
* $P<.05$.
** $P<.01$.
*** $P<.001$.

than the 5 A Day Screener in this study. Results are similar to those found by Thompson and colleagues (42), but a follow-up study found the Fruit and Vegetable Screener overestimated intake in females (29); 70% of this study's population was female. Regardless of the instrument used, the current study found that older adults in contemplation/preparation consumed more fruits and vegetables than those in precontemplation, and seniors in action/maintenance consumed more than those in other stages, results similar to studies with younger populations (32,36,43). In addition, most older adults perceiving that they met the 5 A Day criterion were accurate in this self-assessment (86.1% Fruit and Vegetable Screener and 81.2% 5 A Day Screener) and consumed a greater median number of servings of fruits and vegetables per day than those perceiving that they failed to meet the criterion Fruit and Vegetable Screener 2.79 servings [$t_{(1262)}=14.03, P<.001$], 5 A Day Screener 1.86 servings [$t_{(738)}=14.13, P<.001$].

This sample was predominantly in the maintenance stage of change, with only 15% in the precontemplation stage. This differs from the stage distribution found in other studies (36,43,44). However, this sample is older (mean age=75 years), and different recruitment procedures and stage of change classification algorithms were used. Intake of fruits and vegetables was higher in this study than others (16-18,36,40). Although older adults tend to consume more fruits and vegetables than younger adults (17,18), the difference is insufficient to explain the high intake found in the current study. It is likely that the reactive recruitment procedures (eg, posters, fliers, promotional events) used to enroll most of the participants in this intervention study generated a sample of older adults who perceived that they were healthy and were actively engaged in the two behaviors (64% maintenance for fruits and vegetables, 56% maintenance for exercise). Although this may limit the generalizability of these findings, previous Transtheoretical Model research on convenience and representative samples found that the relationship between stage of change and psychosocial variables is similar regardless of the sample (45-47).

The algorithm in this study was effective in discriminating between stages for most Transtheoretical Model variables. In general, differences between stages were similar to those found for other health behaviors (21,26,48-50). Pros, process use, and self-efficacy were lowest in precontemplation and increased in contemplation/preparation. Pros and cognitive (experiential) processes, such as feeling good about yourself when you eat enough fruit and vegetables (self-reevaluation), increased more between these stages than behavioral processes and self-efficacy. Progression from contemplation/preparation to action/maintenance was associated with substantial increases in self-efficacy and use of behavioral processes such as substituting fruits and vegetables for less healthful foods (counterconditioning) and using reminders or cues to eat fruits and vegetables (stimulus control). This study found no difference between stages in cons.

These results suggest that, especially in the early stages of change, it may be more effective to incorporate intervention components designed to increase the perceived benefits of eating fruits and vegetables than to focus on decreasing the perceived disadvantages and costs of change. Although findings in this study may serve

as a guide to stage tailoring of interventions for older adults, longitudinal studies are needed to determine which variables are important at each stage transition.

There are limitations of this study. Approximately two thirds of subjects were in action/maintenance. Most subjects perceived their health to be good to excellent, and most had at least a high school education. Minorities, particularly African Americans, were underrepresented; however, demographics were representative of older adults in East Providence (28). Future research is needed to assess whether results are replicated in different populations.

CONCLUSIONS

Results of this study suggest the following:

- Self-assessed servings can be used for stage classification for older adults.
- Interventions for older adults in the precontemplation stage should focus on increasing perceived benefits of eating fruits and vegetables.
- Cognitive processes are important for stage transition toward preparation.
- Behavioral processes and self-efficacy are important in attaining maintenance.

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