

# Motivation in health behavior: Measurement, antecedents, and correlates

Additional reliability, validity, and information on health behavior correlates for a recently developed measure of intrinsic motivation in health behavior are reported. A randomly selected sample of 379 elders responded to a structured interview containing the Health Self-determinism Index (HSDI) and other relevant variables. The overall reliability of the HSDI was supported with an alpha coefficient of 0.78. The multidimensionality of the instrument was reconfirmed through principal components analysis, and factor invariance across study samples was established. The total HSDI and subscale scores were associated with the practice of selected life-style behaviors. The homogeneity of the sample raises significant considerations relative to contextual item sensitivity and sample-induced response tendencies.

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**T**HE HEALTH Self-determinism Index (HSDI) was recently proposed as a new measure of intrinsic motivation in health behavior.<sup>1</sup> The multidimensional construct consists of four subscales that address the individual's self-determined health judgments, self-determined health behavior, perceived competency in health matters, and internal-external cue responsiveness. The potential use of the instrument in both clinical and research settings has been advocated. The HSDI may be helpful in pointing to nursing interventions that can be specifically matched to a client's motivational orientation. Furthermore, its use in clinical nursing investigations will begin to define more precisely the antecedents and correlates of motivation in health behavior.

This study reports further reliability and validity information on the HSDI, exam-

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ines the demographic and health-related predictors of intrinsic motivation and its components, and demonstrates the correlation between motivation and selected health behaviors. Specifically, the investigators sought to examine how the HSDI might perform when limited to a more homogeneous population (the elderly):

- To what degree does the dimensional structure of health self-determinism in older adults correspond to the previously established dimensionality in the general adult population?
- To what extent do selected sociodemographic variables and health status measures specific to the elderly predict the elders' subscale scores on the HSDI?
- Will the HSDI and its subscales be associated with smoking or the use of alcohol or tranquilizers in the elderly?

## LITERATURE REVIEW

A model of client health behavior developed by the senior author purports that intrinsic motivation should be a primary construct used to explain health behavior, as well as a target for intervention development.<sup>2,3</sup> A complete review of the construct is beyond the scope of this article but can be found elsewhere.<sup>4,5</sup> Briefly, however, intrinsic motivation is the human need to be competent and self-determining with respect to the environment. It is this need that "energizes people's will . . . to oppose or supplement the force of drives, to resolve conflicts among needs, and to hold needs in abeyance."<sup>5(p27)</sup>

The majority of health promotion and health maintenance behaviors require invoking the will and are thereby a func-

tion of individual choice based on personally desired goals (positive or negative). For this reason, intrinsic motivation seems to be particularly relevant as a motivational construct in research on health promotion behavior. Health beliefs, locus of control, and behavioral attribution as motivational constructs have ignored the element of choice and self-determinism. Additionally, they have not been able to differentiate consistently between persons who practice health promotion or health maintenance behaviors and those who do not.<sup>6-9</sup>

The HSDI is a paper-and-pencil measure, the responses to which reflect the extent of agreement or disagreement on a five-point ordinal scale. The items are divided equally between those reflecting an intrinsic motivational orientation and those reflecting an extrinsic motivational orientation. Extrinsically worded items are then reverse-scored so that higher total scores and subscale scores correspond to an intrinsically motivated person, while lower scores correspond to an extrinsically motivated person.<sup>1</sup>

Twenty items originally comprised the instrument. In five different psychometric evaluations of the measure, three items were consistently poor performers as evidenced by very low standard deviations, low item-to-total correlations, and decreased alpha coefficients within subscales. These items have been subsequently dropped from the HSDI so that it now contains 17 items.

Reliability estimates of the total scale across five studies have resulted in highly acceptable alpha coefficients for the newly developed instrument: 0.84 (N = 199), 0.80 (N = 68), 0.87 (N = 54), 0.83 (N = 55), and 0.81 (N = 72).<sup>1,4,10</sup> The short-term stability

of the HSDI was demonstrated through a two-week test-retest correlation of 0.86 ( $N = 54$ ).<sup>4</sup>

The factorial validity (multidimensionality) of the HSDI has been confirmed in only one study, since sample sizes in the other studies were not sufficiently large to use factor analysis in a meaningful way. Four distinct factors—self-determined health judgments and behavior, competency, and internal-external cue responsiveness—accounted for 56% of the variance in the total measure ( $N = 199$ ); these factors corresponded identically with the theoretical conceptualization of health self-determinism. The reliability of the factored subscales was 0.75, 0.75, 0.67, and 0.70, respectively.<sup>1</sup>

The HSDI and its subscales have been previously examined for their covariance with selected sociodemographic variables. A person who is highly intrinsically motivated in health matters is more likely to be younger, female, and better educated. The same is true for persons scoring intrinsically on the Judgment and Internal-External Cue Responsiveness subscales. Age, gender, and income are the strongest predictors of the Behavior subscale; older people, males, and those with less income score more extrinsically. Finally, women and persons with higher incomes and more education are more apt to feel more competent in their health decisions and behaviors.<sup>4</sup>

The HSDI has been found to be associated with selected health status and health practice variables. In a recent study that examined the predictive validity of the HSDI in terms of the number and frequency of positive health behaviors practiced (eg, exercise, nutrition, and adequate

sleep), both the total HSDI score and the Competency subscale were significant predictors ( $N = 55$ ): 27% of the variance in positive behaviors practiced could be explained by the person's total score and Competency subscale scores.<sup>10</sup> In a study that examined the application of the Interaction Model of Client Health Behavior to at-risk elders, the HSDI was significantly associated with the elders' functional status and sense of general well-being: The higher the elder's functional status and level of well-being, the more intrinsically he or she scored on health self-determinism.<sup>3</sup>

While these early studies have been promising in terms of construct validation and reliability estimation of the HSDI, they represent only a beginning in the effort to develop a sound and relevant instrument to augment nursing research and practice. Other populations, with varying sociodemographic characteristics, are needed to further confirm and expand the initial findings. The relationship of the HSDI to health status and health behaviors must continue to be examined if more is to be learned about the construct's predictive abilities and the role of intrinsic motivation in health promotion interventions. Finally, the factorial validity, and, hence, multidimensionality of the construct, must not be assumed on the basis of just one factor

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*The HSDI must continue to be examined if more is to be learned about the construct's predictive abilities and the role of intrinsic motivation in health promotion interventions.*

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analysis. Repeated trials on succeeding samples are essential to test the accuracy of past interpretations.<sup>11</sup>

The major early psychometric evaluation of the HSDI used a random sample of the general adult population.<sup>1</sup> The study reported here extends the application of the instrument to a large and age-homogeneous population. Reliability, sociodemographic covariance, and factorial validity of the HSDI are replicated. Furthermore, three life-style behaviors—smoking and alcohol and tranquilizer use—are examined to see to what extent intrinsic motivation may be associated with their practice or nonpractice.

## STUDY METHODS

### Design, subjects, and sampling procedures

A cross-sectional survey using a face-to-face interview technique was implemented to obtain a comprehensive description of the well elderly. The study reported here represents a portion of the overall study.

The sampling procedure is reported in detail elsewhere.<sup>3,12</sup> Briefly, 379 elders were randomly selected from four specialized residences for the elderly in a large Midwestern city and its suburbs. The four sites were chosen specifically for their combined sociodemographic variance. The sample size was based on the analytical procedures to be performed on the total sample as well as on the subsamples of race and socioeconomic status.

### Measures

The procedure, instrument, and reliabilities of all the measures are reported in

detail elsewhere.<sup>3,12</sup> The majority of the measures are interval-level except for sex and race. While data on several additional nominal-level variables (eg, marital status, employment) were collected, the distributions were too skewed to be used meaningfully. Alcohol and tranquilizer use and income are measured on ordinal scales and are treated as interval data.<sup>13</sup> Whether or not the elder currently smoked is a dichotomy; the number of years as a smoker is an absolute number; and the number of cigarettes smoked is measured on a five-point ordinal scale in which 1 is equivalent to one to three cigarettes a day, and 5 represents two packs or more daily. Table 1 offers a descriptive summary of each of the variables referenced in this study. Where appropriate, the alpha coefficient obtained in this study appears under the variable.

## STUDY RESULTS

### Sample characteristics

The elderly respondents ranged in age from 59 to 101 years, with a mean age of 76.2. Seventy-five percent of the sample were female; 66% were widowed; and 66% were white, 33% black, and 1% Hispanic or other. Income was normally distributed from completely inadequate to completely adequate. The mean number of years of formal education was 8.9.

### Descriptive summary and internal consistency of the HSDI

Table 2 provides a descriptive summary of the HSDI and its four subscales. The subscale construction is derived from the factor analysis presented in this article. As is evidenced by the relative equality of the mean, median, and mode, the total HSDI

Table 1. Descriptive summary of the sample (N = 379)

Variable	Mean	Mode	Median	SD	Range
General well-being (alpha = 0.88)	84.2	95.0	85.9	14.10	25-108
Perceived health status	4.1	5.0	4.3	1.30	1-6
Number of chronic conditions	1.8	2.0	1.8	1.20	0-6
Functional status (alpha = 0.86)	61.5	70.0	65.1	11.50	15-73
Number and intensity of symptoms (alpha = 0.84)	26.6	20.0	25.2	8.20	14-48
Size of social network	20.0	10.0	14.0	18.30	1-123
Number of years retired	14.1	15.0	12.4	9.10	0-66
Alcohol use (never to two or more drinks daily)	1.4	1.0	1.2	0.74	1-5
Tranquilizer use (never to two times daily)	1.4	1.0	1.1	0.98	1-5
Number of years smoked	42.9	50.0	49.6	17.08	3-71
Frequency or intensity of smoking (three ciga- rettes to two packs daily)	2.3	3.0	2.5		1-4
<b>Income level</b>	<b>% at level</b>				
Completely inadequate	8.9				
Mostly inadequate	26.1				
Adequate	52.4				
Mostly adequate	3.4				
Completely adequate	9.2				
<b>Do you smoke?</b>	<b>% of each category</b>				
Yes	20.3				
No	79.7				

and subscale scores are normally distributed.

Cronbach's alpha coefficient was used to assess the homogeneity of the HSDI. An alpha coefficient of 0.78 was obtained for the total 17-item scale. Six items (Table 3)

demonstrated less than the 0.30 ideal item-to-total correlation<sup>14</sup>; however, dropping them would decrease the overall alpha coefficient. While the alpha coefficient is the lowest to date, it still is considerably above the 0.70 standard for new scales.<sup>15</sup>

Table 2. Descriptive summary of the total HSDI and its subscales (N = 379)

	Mean	Median	Mode	SD	Range
Total HSDI	55.9	55.5	54.0	8.3	35-85
Judgment	16.3	16.0	12.0	4.8	6-30
Behavior	17.8	18.1	20.0	3.1	9-25
Competency	10.7	10.9	12.0	2.1	3-15
Internal-External Cue Responsiveness	7.3	7.8	8.0	1.6	2-10

Table 3. Means, standard deviations, and corrected item-to-total correlations for HSDI items (N = 379)

Abbreviated item content*	Mean	SD	Corrected item-to-total correlations
1. I need more willpower.	2.9	1.18	0.28
2. I know what to do without contacting MD.	3.8	0.90	0.37
3. Only MD knows if I'm in good health.	2.7	1.20	0.46
4. Some people think MD should decide about my health, but I think I should.	3.4	1.10	0.33
5. I worry about my health.	3.5	1.20	0.27
7. Whatever MD suggests is okay.	2.5	1.00	0.41
8. I know, without someone telling me, when I'm in good health.	4.0	0.76	0.23
9. I agree with MD and nurses instead of forming my own opinion.	2.6	1.10	0.54
10. I feel good about how I take care of my health.	4.1	0.79	0.19
12. I do things to help my health without MD/RN.	3.8	0.89	0.29
13. I'm never sure I'm doing the right things unless I check with MD.	3.1	1.20	0.55
14. My own ideas are better than those of MD.	2.9	1.10	0.42
15. I don't do as well at taking care of my health as others.	3.7	0.95	0.18
17. I prefer that MD/RN help me plan my health care.	2.6	1.10	0.46
18. I know, without MD/RN, that I'm doing the right things for my health.	3.6	1.00	0.40
19. What MD/RN thinks is more important than what I think.	2.7	1.20	0.47
20. I know what I'm doing when it comes to taking care of my health.	3.9	0.85	0.34

\*Items are numbered as they were in the original HSDI. Items 6, 11, and 16 have been dropped because of their poor performance.

### Item analyses

Table 3 provides the means and standard deviations for the HSDI items. Ten of the 17 items means hover around 3.0, with standard deviations fluctuating around 1.0. Six item means are more intrinsically oriented (3.7 or above) and have standard deviations of less than 1.0. The latter items demonstrate minimal variability and may contribute to the lower item-to-total correlations.

An analysis of individual HSDI items

was conducted in an effort to see whether selected items were particularly sensitive to age and/or the functional and health disabilities experienced by the elder. Seventeen linear regression analyses were completed, with each HSDI item as the dependent variable and age as the independent variable. Only one item (item 19) was significantly associated with age—the older the person, the more important the health professional's opinion ( $\alpha = 3.61$ ,  $\beta = -0.12$ ,  $P \leq 0.05$ ).

Functional disability, number of chronic problems, and number and intensity of symptoms were added to the multivariate model in a stepwise hierarchical format. Variables were entered according to the strength of their correlation coefficients (Table 4). The HSDI item that was sensitive to age in the preceding regression equation ("What MD/RN thinks is more important than what I think") was not sensitive to age or to any other variable in the multivariate model. When the three other variables were added to the equation, the effects of age as a significant predictor were diluted.

Age did emerge with symptomatology,

**Table 4.** Regression of the HSDI items on functional abilities, symptomatology, chronic problems, and age

Item	Beta	F	P
Item 1			
Symptoms	−0.32	44.5	.001
Item 2			
Functional ability	0.13	6.6	.010
Item 3			
Symptoms	−0.18	12.7	.001
Item 5			
Symptoms	−0.32	42.3	.001
Item 9			
Symptoms	−0.13	6.7	.010
Item 10			
Symptoms	−0.13	6.1	.005
Age	0.09	3.3	.050
Item 12			
Symptoms	0.23	14.3	.001
Functional ability	0.15	7.2	.001
Chronic problems	−0.13	5.0	.005
Item 13			
Symptoms	−0.22	19.2	.001
Age	0.13	6.3	.005
Item 17			
Symptoms	−0.22	15.6	.001
Chronic problems	−0.15	7.1	.001

however, as a significant predictor of response on two items (item 10, "I feel good about how I take care of my health," and item 13, "I'm never sure I'm doing the right things unless I check with MD"). The more symptoms experienced by the elder, the less competent he or she felt, and the older the person, the more assured he or she was about his or her health behaviors. Elders who have fewer symptoms and are older are more confident about what they do for their health.

While only two items showed a sensitivity to age, many other items showed a sensitivity to other variables. In addition to items 10 and 13, as previously discussed, the responses to items 1, 3, 5, and 9 were all predicted by number and intensity of symptoms. The response to item 12 ("I do things to help my health without professional input") was predicted by symptoms, chronic problems, and functional ability. This was the only item in which the number and frequency of symptoms were positively associated with a more intrinsic motivational orientation. The response to item 17 ("I prefer that MD/RN help me plan my health care") was predicted by the symptoms and number of diagnosed chronic problems. Finally, item 2 ("I know what to do without contacting MD") was sensitive to only functional ability. In short, nine of the 17 HSDI items show a marked and independent singular and/or combined sensitivity to symptomatology, chronic illness, functional limitations, and age.

### Factorial validity

The computer program *FACTOR* was applied to the 17-item HSDI using the

principal components extraction method.<sup>16</sup> Kaiser's criterion (eigen value of 1 or greater) determined which factors were meaningful to extract and rotate.<sup>17</sup>

While a number of factor solutions were attempted, a four-factor solution supported the most meaningful factor pattern, with the least loss of information. This solution was consistent with the original factor analysis and accounted for 50.1% of the variance in the total measure. Because theoretically the factors are assumed to be somewhat correlated, an oblique rotation was applied to the significant factors. If a correlation exists between factors, an oblique rotation will reveal it.

The often-cited criterion of 0.30 as the minimum acceptable factor loading was used in the original factor analysis of the HSDI.<sup>1</sup> Because the sample size in this study was nearly twice that of the first study, the 0.40 level was chosen as the minimum acceptable loading.<sup>14,15,18,19</sup> Table 5 illustrates the factor pattern and loadings for the HSDI items. The average significant loadings for the four factors were 0.62, 0.49, 0.47, and 0.42 in the order in which the factors are presented in the table.

Sixteen of the 17 variables loaded on one of the four factors. There was no cross-loading of items on factors. Four of the six items loading on factor I represent self-determination in health judgment and are consistent with the previous factor analysis.<sup>1</sup> Both items 13 ("I'm never sure I'm doing the right things unless I check with MD") and 17 ("I prefer that MD/RN help me plan my health care") were developed for the Internal-External Cue Responsiveness scale (factor IV) and thus would appear to load inappropriately on factor I

**Table 5.** Four-factor solution factor pattern and factor loadings for the HSDI (N = 379)\*

HSDI item	Factor			
	I	II	III	IV
3	0.57			
7	0.50			
9	0.64			
13	0.56			
17	0.71			
19	0.71			
4		-0.41		
8		-0.47		
14		-0.47		
18		-0.54		
20		-0.57		
1			0.47	
10			0.48	
15			0.46	
2				-0.40
5				-0.43

\*Minimum acceptable factor loading = 0.40 ( $P \leq .01$ ).

(self-determined health judgments). Five items loaded on factor II and collectively support self-determination in health behavior. Four of the five items were again consistent with the previous factor analysis done on the HSDI. Item 4 ("Some people think MD should decide what to do about their health, but I think I should decide") did not load at all in the earlier factor analysis. Although it was written for the Competency subscale (factor III), it appears to be interpreted here more as a behavioral item (factor II) than one that reflects confidence and competency.

Factor III (Competency subscale) has three items loading on it, each written specifically for this subscale. Two of the three items are consistent with the earlier factor analysis. Item 1 ("It takes more willpower than I have to do the things that are right for my health") failed on the



previous factor analysis to reach an acceptable item-to-total correlation and significantly reduced the alpha coefficient of the total HSDI. As a result, it was not included in the first factorial validity examination. However, it performed well in the item-to-total correlation and the contribution to the alpha level in subsequent studies and the study reported here. Furthermore, the item loaded on the subscale for which it was designed (Competency).

The fourth factor (Internal-External Cue Responsiveness subscale), while only composed of two items, explained 6% of the variance in the total HSDI measure. For this reason it was retained as an interpretable factor. Only item 5 ("I worry about my health") was consistent with the original factor analysis. Items 13 and 17 as discussed under factor I were developed for the Internal-External Cue Responsiveness subscale (factor IV), but they did not reach a significant factor loading score for this factor.

Only one of the 17 items on the HSDI ("I do things to help my health without a doctor or nurse suggesting them") failed to load significantly on any of the four factors. The standard deviation for this item was small (0.89), and the item mean was markedly skewed toward the intrinsic pole (3.8), suggesting minimal variability for this sample. It was originally developed for the Self-determined Health Behavior subscale (factor II).

### Factor invariance

In an effort to determine the extent to which the factors obtained in this study corresponded with those obtained in the first factor analysis of the HSDI,<sup>1</sup> Tucker's Coefficient of Congruence<sup>20</sup> was computed for each of the four factors. This measure

represents the sum of the cross products of the loadings for the two factors under consideration, divided by the square root of the product of the sums of the squared loadings. The coefficient is computed for the entire factor structure matrix, not just the significant loadings. A coefficient of congruence ranges from +1.00 for perfect agreement to -1.00 for perfect inverse agreement; a coefficient of 0 means there is no agreement whatsoever. Major criticisms of the measure center on the lack of tests of significance and its resulting ambiguous interpretation.<sup>21</sup> Coefficients in the 0.90 range are interpreted as definitely congruent. Tucker rejects a 0.459 value as "definitely low so that this factor will not be considered as a congruent factor."<sup>22(p19)</sup> Despite these criticisms, the coefficient of congruence is regarded as one of the most feasible invariance indices.<sup>23,24</sup>

In this study the Tucker congruence coefficients were 0.75, 0.96, 0.92, and 0.72 for factors I through IV, respectively. These data suggest then that the items and their associated loadings on the factors are acceptably congruent from one study sample to the next. The Behavior and Competency subscales (factors II and III) appear to be the most congruent, with the Judgment and Internal-External Cue Responsiveness subscales (factors I and IV) being acceptable but clearly less congruent than the other two factors. With larger sample sizes in subsequent studies, confirmatory factor analysis would be the ideal approach to determine factor similarity.

### Correlation of the factors and reliability of the HSDI subscales

The correlation between factors was examined in an effort to provide further support of the instrument's multidimen-

sional. Low to moderate correlations between the factors would confirm the distinctiveness of the factors and negate redundancy in measurement. The intercorrelations among the factors are presented in Table 6. The correlations are between factor structures and should not be interpreted as the correlation between subscales. Of note is that the highest correlation occurs between factor I and IV ( $r = -0.39$ ). The reader is reminded that two of the items intended for and loading previously on factor IV (Internal-External Cue Responsiveness subscale) loaded on factor I (Self-determined Health Judgments subscale) for this study sample.

Cronbach's alpha coefficient was computed for each of the subscales according to their factor pattern in this study. Respective alpha coefficients for each subscale were: factor I (Self-determined Health Judgments), 0.80; factor II (Self-determined Health Behavior), 0.63; factor III (Perceived Competency), 0.47; and factor IV (Internal-External Cue Responsiveness), 0.34. The last two subscales contain only three and two items, respectively. The average inter-item correlations for the subscales were 0.56, 0.39, 0.30, and 0.21. With the exception of the first subscale, the interitem correlations are low and suggest either a poor correspondence with that factor or

minimal variability of the sample on items within the subscales.

### Sociodemographic and health status predictors

Using hierarchical stepwise multiple regression, the sociodemographic and health status measures were entered as predictors of the HSDI and subscales according to the magnitude of their correlation coefficients. General well-being, education, perceived health status, race (only blacks and whites), and sex were the significant predictors of the elders' total HSDI score. The total scale score and its predictors are discussed extensively elsewhere.<sup>3</sup> Table 7 includes all the significant

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*General well-being, education, perceived health status, race, and sex were the significant predictors of the elders' total HSDI score.*

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Table 6. Intercorrelations among HSDI factors (N = 379)

	Factor II	Factor III	Factor IV
Factor I	-0.26	-0.02	-0.39
Factor II		-0.13	0.20
Factor III			-0.16

predictors of each of the subscales. If a variable did not add significantly to the variance explained, it was dropped from the equation. While prediction and not explained variance was the objective of these analyses, it is noteworthy that 24% of the variance in the Internal-External Cue Responsiveness subscale could be accounted for by the elders' sense of general well-being, perceived health status, and number or intensity of symptoms.

### Health behavior correlates

Three health behaviors were examined for their covariance with the total HSDI score and its four subscale scores: avoidance of alcohol, smoking, and the use of

**Table 7.** Stepwise hierarchical regression of the HSDI subscales on sociodemographic and health status variables (N = 379)

Subscale	$r^2$	RSQ change	Beta	F	P
Judgment					
Education	0.07		0.26	26.1	.001
Perceived health status	0.10	0.03	0.20	15.7	.001
Social network size	0.12	0.02	-0.13	7.0	.001
Behavior					
General well-being	0.03		0.33	23.0	.001
Symptoms	0.06	0.03	0.23	11.5	.001
Competency					
General well-being	0.10		0.24	11.2	.001
Symptoms	0.11	0.01	-0.15	4.5	.025
Years retired	0.12	0.01	0.11	3.5	.025
Internal-external cue responsiveness					
General well-being	0.21		0.42	43.4	.001
Perceived health status	0.23	0.02	0.21	12.9	.001
Symptoms	0.24	0.01	0.12	3.1	.025

tranquilizers or "nerve medicine." Interesting significant bivariate correlations and chi-square values emerged. The more self-determined (intrinsically motivated) the elder's health behavior, the greater the likelihood that he or she did not smoke ( $\chi^2 = 5.7$ ;  $df = 1$ ;  $P = .016$ ). The total HSDI score and the Judgment and Internal-External Cue Responsiveness subscales were negatively associated with taking tranquilizers ( $r = -0.15$ ,  $P = .01$ ;  $r = -0.15$ ,  $P = .01$ ; and  $r = -0.22$ ,  $P = .001$ ). In other words, the more responsive the elder to internal cues, the more self-determined his or her health judgment. Similarly, the greater the elder's overall intrinsic orientation on the HSDI, the more unlikely he or she was to use tranquilizers.

Alcohol use did not follow the patterns described above. The more responsive the elder to internal cues, the more likely he or

she was to drink ( $r = 0.10$ ,  $P = .05$ ). It must be noted, however, that the mean alcohol consumption was less than one drink a week, and only 8% of the elders reported drinking on a daily basis.

## DISCUSSION

The findings from this study support the overall reliability of the HSDI and the multidimensionality of the construct as evidenced by a clean four-factor solution with low to moderate correlations among the factor structures. Factor congruency from one study population to the next was supported. Furthermore, the total scale and selected subscales were shown to be associated in various combinations with the practice or nonpractice of certain health-related habits.

The age and gender homogeneity of the sample, however, did reveal a number of

significant issues that need consideration in future research. Six items (2, 8, 10, 12, 15, 20) had item-to-total correlations below 0.30. Five of these six items (2, 8, 10, 12, 20) are written in an intrinsic mode and raise the question of response bias for this particular population. Four of the six items (8, 10, 12, 15) demonstrated intrinsically skewed responses and minimal response variance in this sample—substantially below that observed in a random sample of the general population. Three of these same items (2, 10, 12) together with six other HSDI items demonstrated a marked sensitivity to either age, symptomatology, functional ability, and/or number of chronic illnesses.

Clearly, the elderly are the most prone among the general population to have a constellation of complex chronic illnesses, increased number and intensity of symptoms, and functional limitations. The age homogeneity of this sample suggests a greater likelihood of the existence of these negative health manifestations. The sample then reflects not only age homogeneity but also more homogeneity in the health predictors of the HSDI items. The cumulative result, then, is that this population is more apt to be plagued by multiple factors that induce a selected response tendency. This results in decreased variance and attenuated item-to-total correlations. Because of its state-versus-trait specificity and item sensitivity to health-related factors, the HSDI could potentially produce a lower reliability coefficient when applied to a sample of elders.

In each study to date that has used the HSDI with sample sizes over 50 and with equal gender representation, women consistently have scored more intrinsically

than men. Nine HSDI items in this study had response means of 3.5 or greater—a definite intrinsic orientation. It would appear then that this sample's responses may have been inflated because of the gender proportions of this study.

These findings immediately raise the issue of the instrument's reliability in selected clinical populations that may be more homogeneous in their symptoms, complexity of illness, functional capacity, and even gender. If indeed these factors induce a response tendency resulting in decreased variance, then a lower, albeit acceptable, alpha coefficient might be anticipated.

Whereas decreased variance in response had a negative effect on the internal consistency of the HSDI, greater homogeneity of the sample contributed to a well-defined and clean four-factor solution. No cross-loading of items was seen in this study and only one item failed to reach a significant factor loading score. Multidimensionality and factor invariance were supported in this study. The Behavior and Competency subscales were associated with high factor congruency coefficients. The Judgment and Cue Responsiveness subscales, while meeting acceptable standards on this criterion, were markedly below the other two subscales.

In the comparison of factor structures between the original factorial examination of the HSDI on the general random sample and that reported here, items 13 and 17 loaded originally on the Internal-External Cue Responsiveness subscale (factor IV), but when used with elders, both items loaded on the Judgment subscale (factor I). While intended for the Internal-External scale, one can see how the items could be

interpreted more as judgmental considerations; this clearly implicates the items as conceptually confounded. Item 19 cross-loaded on both the Judgment and Internal-External scales in the first study, though it loaded higher on the former. In this study it loaded very high on only the Judgment subscale.

With the sharing of items between factors I and IV as evidenced now in two separate studies, it is not surprising that the highest factor correlation would be seen between these two factors ( $r = -0.39$ ). They are sharing a variance that may be directly attributable to items that are not conceptually distinct for this sample. In fact, the correlation between factors suggests that while they are not redundant, they are the most alike of all the factors.

Despite the performance of factors I and IV, the sample of elders appears to have helped clarify the construction of the subscales; however, the internal consistency of the Competency and Cue subscales is clearly unacceptable. The low reliability is, of course, directly attributable to the number of items comprising these subscales, as well as to the decreased response variance on the particular items. For example, on the Competency subscale, two of the three items had low-to-total correlations and low variance. The same circumstances occurred for one of the two items that comprised the Cue Responsiveness subscale. The alpha coefficient level of the Behavior subscale was below 0.70. Again, two of the items were among the six HSDI items that had low variance and skewed distributions.

This study has added significantly to those preceding it relative to the factors that predict the subscale scores. Three of

the four subscales were predicted by general well-being and symptomatology: Behavior, Competency, and Cue Responsiveness. Clearly, elders are better able to be more self-determined in their choice of health behaviors, feel more competent about their decisions or actions, and respond more to inner-directed forces if they have a greater sense of well-being. The symptoms measure was positively associated with both the Behavior and Cue Responsiveness subscales and was negatively associated with the Competency subscale. The perceived health care competency of the elder is decreased as symptoms become more numerous and frequent. Increased symptoms may well be forcing the elder to become more self-reliant and to take steps to ameliorate these symptoms without medical intervention. In fact, item 12 ("I do things to help my health without MD/RN") was positively associated with and predicted by the number and intensity of symptoms experienced by the elder. Only the number and frequency of occurrence of symptoms were measured—not the complexity or need for medical intervention. Elders may be quite adept at determining what self-care measures they should implement to treat their symptoms and are not overly concerned about the appearance of symptoms and self-treatment approaches used to alleviate them.

Perceived health status was a positive predictor of both self-determined judgment and internal cue responsiveness. Better health is more apt to allow for independent decision making and self-reliance in the elder. Level of education and the size of the social network (number of persons with whom the elder has regular contact

during one month) were associated with self-determined health judgments: More education facilitated independent decision making; and a smaller network forced independent decision making.

Finally, the number of years the elder had been retired was positively associated with feelings of competency in health matters. This would seem to coincide with other study findings that demonstrate increased stability and well-being with increasing years after retirement.<sup>3</sup>

The elder who was intrinsically motivated in health behavior was less apt to smoke. One who was overall intrinsically motivated as well as intrinsic in judgment and cue responsiveness was less apt to use tranquilizers. While the correlations are small, they are remarkable given that only 8% of this sample used tranquilizers at all.

This sample of elders was close to the national estimates in their drinking behavior.<sup>25</sup> The national sample reports 59% of those 60 years and older never drinking, 11% drinking daily, and 5% drinking more than two drinks daily. The breakdown for this study sample was 69%, 8%, and 0.3%, respectively. The positive association between intrinsic motivation and alcohol consumption may have several explanations. First, a very small number of persons actually reported drinking, and those who did reported very modest intakes. Such moderation is not seen as a health risk—in fact, it is cited as a positive adjunct to health.<sup>26</sup> Second, it was the Cue Responsiveness subscale that correlated with alcohol consumption. The elders scoring high on this subscale are very inner directed and have a great ability to hold their needs in abeyance and invoke their will. Alcohol consumption for these persons may be a

part of their overall sociability; it is held in check and is not viewed as a health-threatening habit. Finally, the question of social desirability and self-reporting of alcohol consumption may be operative here.

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The HSDI has retained its overall reliability and invariant multidimensionality when applied to a sample of elders. Because of several items' sensitivity to symptomatology, presence of chronic illness, and functional ability or disability, the reliability may be compromised slightly when applied to study or clinical populations who manifest these problems. Similarly, despite random selection, the gender bias and low educational level of the elders in this sample may well be significant determinants of the study findings.

While the homogeneity of the sample clearly helped to more strongly and sharply define the factorial validity of the HSDI, it also pointed to problematic items and the need to develop additional items to flesh out the subscales. Items that comprised the Cue Responsiveness subscale in an earlier study loaded on the Judgment subscale in this study. This raises the question of conceptual confounding within items. Finally, the homogeneity of the sample was evidenced in skewed distributions on some items, which contributed to significantly reduced subscale reliabilities. To what extent this distribution reflects a response bias tied specifically to the HSDI or to the sample warrants further investigation.

This study supports the HSDI as a sensitive, multidimensional, and internally consistent instrument that demonstrates

logical associations with the practice or nonpractice of selected health behaviors. While advances have been made, the instrument is still not sufficiently refined to be used as a clinical diagnostic aid. New item development, further construct validation, and the descriptive application of the HSDI to multiple samples in varied settings are critical to strengthening the

index for clinical application. With these efforts, the HSDI can be used successfully to tailor nursing interventions to the patient's motivational orientation, thereby potentially increasing adherence to treatment and health promotion regimens, fostering positive health outcomes, and enhancing patients' satisfaction with their care.

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