A Structural Evaluation of the Expanded Multidimensional Health Locus of Control Scale with a Diverse Sample of Caucasian/European, Native, and Black Canadian Women

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Abstract

The Multidimensional Health Locus of Control (MHLC) scale is a widely used measure of the factors that people believe exert some control over their health. The purpose of the research reported here is to provide an independent evaluation of the structural properties of the recently expanded MHLC. Specifically we sought to address the issue of the interdependence of the external locus of control scales (Powerful Others, God, and Chance) and the legitimacy of the addition of a measure of God control as a separate subscale in the expanded MHLC. The study is based on an ethnically diverse sample of 371 community women, recruited through a random digit dialing procedure, who responded to all the items on the expanded MHLC. Although, the three external factors (God, Powerful Others, and Chance) are substantially correlated, structural analyses indicate that a four-factor model consisting of the three external scales and the Internal control scale provides the best fit to the observed covariances among the items. We view this result as supporting the addition of the God subscale as a separate dimension of external health locus of control. We also find support in these results for the continued scoring of four subscales on the MHLC rather than combining the three external subscales on one dimension as some have suggested.

Keywords

confirmatory factor analysis, culturally diverse sample, locus of control scale

THE MULTIDIMENSIONAL Health Locus of Control Scale (MHLC) was developed in 1978 to assess beliefs about the source of reinforcements for health-related behaviors (Wallston, Wallston, & DeVellis, 1978). The original MHLC contained three subscales: Internal, Chance, and Powerful Others. Recently a fourth subscale that focuses on the belief that God is a source of reinforcement for health was added to the measure (Wallston et al., 1999). The purpose of the research reported here is to evaluate the new four-subscale structure of this expanded version of the MHLC on a diverse sample of healthy women using confirmatory factor analysis.

Structure of the original MHLC

There are two versions of the original MHLC. Most of the work with the MHLC scale in healthy populations has been with Form A, whereas Form B has been favored by those studying persons with chronic illnesses. Cronbach's coefficient alpha reliability for the three subscales of Form A of the MHLC in the development sample ranged from .67 for Powerful Others to .77 for Internal. The intercorrelation matrix for the MHLC scale revealed that the Internal and Powerful Others subscales are statistically independent, and the Internal and Chance subscales are only slightly negatively correlated. The Powerful Others and Chance subscales were positively correlated. Each of the three subscales of the MHLC significantly correlated with its counterpart on Levenson's (1981) Internal, Powerful Others, and Chance scales (Wallston et al., 1978).

Following the publication of Forms A and B of Wallston et al.'s MHLC scale, and before the addition of the God subscale, a number of independent structural evaluations of the MHLC were conducted. For example, Lynda Anderson (1989) found support for the three-factor model using LISREL VII to analyze data from Form A. The three-factor structure was found for both 520 persons with one or more major chronic health conditions and for 1504 persons who had no identifiable health problems. Several other studies confirmed this structure in both clinical (e.g. Hartke & Kunce, 1982; Russell & Ludenia, 1983; Talbot, Nowen, & Gauthier, 1996; Wall, Hinrichsen, & Pollack, 1989) and non-clinical populations (e.g. Casey, Kingery, Bowden, & Corbett, 1993; Marshall, Collins, & Crook, 1990; Robinson-Whelen & Storandt, 1992). However, a number of other studies failed to clearly support a three-factor structure of the original MHLC (e.g. Boyle & Harrison, 1981; Cooper & Fraboni, 1990; Gutkin, Robbins, & Andrews, 1985; Meyers, Donham, & Ludenia, 1982; O'Looney & Barrett, 1983; Rogers, 1995). In general these studies suggest that a two-factor structure (internal versus external) in which Chance and Powerful Others combine into one scale is correct.

The expanded four-subscale version of the MHLC for healthy populations

Although the initial item pool for the development of the MHLC contained a number of items assessing the extent to which God was perceived as responsible for the respondent's health status, none of those items were included in Form A or Form B of the MHLC scale. This was primarily because Wallston et al. (1978) wanted to maximize the orthogonality of the Powerful Others and Chance subscales, and the items concerning the role of God tended to correlate with items on both subscales. The recognition of the central role that a belief in God plays in the lives of many persons led Welton, Adkins, Ingle, and Dixon (1996) to add a six-item God subscale to Form A of the original MHLC. The initial psychometric evaluations of this scale in samples of undergraduates were promising. Wallston and his colleagues had also added a God subscale to a version of the MHLC that was tailored to persons with rheumatoid arthritis (Wallston, Stein, & Smith, 1994). The alpha reliability of the God Locus of Arthritis Control subscale was .91 in one sample of rheumatoid arthritis patients and .87 in a second sample (Wallston et al., 1999).

The present study

The God subscale represents a major addition to the widely used MHLC. Thus, an evaluation of the structure of the expanded MHLC on an independent sample of 'healthy' persons is of some interest. The present study was designed to provide that evaluation. Specifically, we evaluate

several possible structural models of the expanded MHLC, including an evaluation of the alternate two-factor model (external versus internal) that has been found in some previous analyses of the three-subscale version of the original MHLC, as well as the predicted four-factor model. We also consider models in which the factors are independent and correlated. The data that were available for our analyses came from a diverse sample of healthy women (Barksdale, Willis, Davidson, Loppie, & Van Roosemalen, 1999) who participated in a survey of women's health concerns.

Method

Sample design and selection

To complete surveys with 300 Nova Scotia women, 75 Aboriginal women and 75 black women, a private survey company conducted telephone interviews with women from each corresponding group who were aged 18 years and older. The sample for each group was drawn using systematic sampling procedures from a list of randomly selected households compiled from listed provincial telephone numbers, drawn from a database that is updated quarterly. Samples were selected to match the geographical distribution of the population derived from Statistics Canada 1996 Census profiles. To minimize the margin of sampling error across county subsamples, the first sample frame comprised a province-wide random probability sample of 300 women stratified across the province's 18 counties. The remaining two sample sets were designed to target specific communities in Nova Scotia with the highest incidence of Aboriginal and black women. The sample of Aboriginal women was drawn from Nova Scotia reservation communities as defined by Statistics Canada proportionate to population. The incidence of Aboriginals in these communities ranged from 69 to 99 percent. The sampling frame for Black women was based on census divisions with an incidence of black population over 3 percent. Table 1 shows the percentage of women for the three ethnicity strata who were found and who were willing to complete the survey.

Participants

Table 2 provides a demographic description of the participants in this study. Not surprisingly, the Caucasian women reported having more education and a higher average household income than the native and black women. In addition, Caucasian women were more likely to have been married than the other two ethnic groups. The native women tended to be younger than the Caucasian or black women.

Procedure

A telephone survey lasting approximately 20 minutes was conducted by a telephone survey company. First, the interviewer identified

Table 1. Record of random-digit dialing calls made for the Nova Scotia Women's Health Survey

	Caucasian/European	*Native/Aboriginal*	*Black/African*
Original base			
Total calls	2224 (100%)	1897 (100%)	5880 (100%)
Invalid phone numbers	493 (22.2%)	386 (20.4%)	1269 (21.6%)
Did not qualify	91 (4.1%)	319 (16.8%)	760 (12.9%)
New base			
Valid phone numbers	1640 (100%)	1192 (100%)	3851 (100%)
No answers/busy/answering machines	385 (23.5%)	354 (29.7%)	1711 (44.4%)
Qualified but not available	61 (3.7%)	55 (4.6%)	171 (4.4%)
Language problem	7 (0.4%)	8 (0.7%)	35 (0.9%)
Quota full	17 (1.0%)	6 (0.5%)	46 (1.2%)
Callbacks	275 (16.8%)	264 (22.2%)	585 (15.2%)
Refused to complete	9 (0.6%)	3 (0.2%)	16 (0.4%)
Refusals	581 (35.4%)	411 (34.5%)	1197 (31.1%)
Duplicates	3 (0.2%)	10 (0.8%)	15 (0.4%)
Total number completed	302 (18.4%)	81 (6.8%)	75 (2.0%)

Table 2. Demographic characteristics of survey participants

Demographic variable	*Ethnicity*		
	Caucasian/European	*Native/Aboriginal*	*Black*
Age	45.4 (14.7)	37.7 (12.7)	45.5 (15.7)
Marital status			
Never married	9.7 (%)	34.6 (%)	30.6 (%)
Married/common-law	74.2	40.7	43.1
Divorced/widowed	11.7	16.0	15.3
Education			
≤ High school	42.6 (%)	59.2 (%)	57.0 (%)
Trade/tech./other school	26.4	4.8	15.3
Some university	8.0	16.0	15.3
≥ Graduated university	23.1	19.7	12.5
Household income			
< $20,000	22.7 (%)	39.5 (%)	26.4 (%)
$20,000–$49,999	39.8	17.3	40.3
≥ $50,000	22.7	7.4	9.7

herself, and asked to speak with a woman who lives in the household who is 18 years of age or older. Then, the interviewer briefly explained the purpose of the interview and attempted to obtain consent. If consent was given, respondents were asked their age and their major ethnic identity. We used a phone interview because the participants were selected by sampling from telephone numbers using random digit dialing. The phone administration of the MHLC is more representative of its applications as a research instrument. However, we have no a priori reason to expect that the individual administration of the instrument in clinical contexts would change the structural results reported here.

Following some questions concerning their health, Form A of the MHLC scale (Wallston et al., 1978), with the newly developed God Locus of Health Control subscale items (Wallston et al., 1999) randomly interspersed, was verbally administered to each woman. Finally, 14 questions regarding pertinent demographic information were asked. These questions assessed family status, work history, educational background, and socioeconomic status.

Results

Preliminary analyses

Prior to evaluating the structure of the 24 items of the expanded MHLC we considered the extent to which missing values might compromise our analyses. In addition, we evaluated the characteristics of the four a priori subscales (i.e. Internal, Chance, God, and Powerful Others).

Missing values

A substantial number of the 458 research participants did not respond to at least one of the 24 health locus of control items. The number of missing responses ranged from 0 (n = 371) to 10 (n = 1). Of the 87 participants with missing responses, 66 had only one or two missing responses, 14 had three or four missing responses, and the remaining seven had between five and 10 missing responses. Because of the potential statistical problems and conceptual issues raised by replacing missing values with an estimate (e.g. mean substitution) we elected to exclude all participants who had any missing values. This reduced our sample to 371 participants (248 Caucasians, 67 African Americans, and 56 Native Americans).

To gain some insight into the extent to which this decision might bias our results, we created a variable to indicate if a participant was excluded from our analyses (1 = excluded, 0 = not excluded) and correlated this variable with the scale scores, item responses, and age. The correlations between this index of exclusion and the scale scores ranged from –.12 to .05, whereas for the item responses the range was from –.11 to

.06. Although the correlation between the Internal scale and exclusion ($r = -.12$) was statistically significant ($p = .01$), indicating that participants with a more internal health locus of control are slightly less likely to be excluded, the relation is small, accounting for slightly more than 1 percent of the variance. Further none of these correlations was statistically significant using a Bonferroni correction. There was, however, a small but statistically significant correlation between exclusion and age ($r = .18$) with older participants being more likely to be excluded. Finally, we considered whether exclusion was related to the ethnicity of the participant. There was no evidence that participants from one ethnic group were more likely to be excluded (based upon a missing response) than those from another (chi-square with 2 degrees of freedom = 2.36, $p = .31$).

Analyses of the subscale scores

Prior to the structural analyses, we considered the basic descriptive and psychometric properties of the four proposed subscales. In Table 3 we report the descriptive statistics for the four subscales and in Table 4 we report the correlations among the four subscales. As shown in Table 3, participants generally scored higher on the Internal Health Locus of Control subscale than they do on any of the external subscales, and among the three external subscales they score highest on Powerful Others. For the overall multivariate analysis of repeated measures to compare these for subscales, Wilks lambda =.42, $F_{3, 368} = 170, p < .01$). For the contrast between the Internal subscale and the three external subscales, $F_{1, 370} = 405$, $p < .01$. For the contrast between Powerful Others and the remaining two external subscales, $F_{1, 370} = 136, p < .01$. For the remaining contrast between God and Chance the difference was not significant.

Although all of the subscale intercorrelations in Table 4 are positive and all but one are statistically significant, the Internal subscale is relatively independent from the other three subscales. The subscales that represent different forms of external control (Chance, God, and Powerful Others) are all substantially positively correlated. This finding suggests that for community populations such as the one we studied, combining these three subscales into a general External subscale might be justified. This is one of the possible structures we evaluate in our structural analyses of the items.

Structural analyses

The focus of this article is on the structure of the 24 health locus of control items in a diverse sample of women. In addition to the possibility of a general control factor (a one-factor model) as the basis for participants' responses to the items and a four-factor model that is consistent with the proposed scoring of the expanded MHLC, we also evaluate a two-factor model that combines the God, Chance, and Powerful Others into a single External factor. All the structural analyses reported here were done as confirmatory factor analyses using EQS (Bentler, 1995).

Before assessing the goodness of fit of the various models to the observed covariances among the items, we evaluated the data for multivariate normality. The normalized estimate of Mardia's coefficient was 32.8, suggesting a possible violation of the assumption of multivariate normality. Thus, we used a robust maximum likelihood procedure to evaluate the fit of the different models. We report both standard chi-squares and comparative fit indices (CFI) and their robust counterparts (e.g. Sattorra-Bentler scaled chi-squares and robust CFI) available in EQS. All the models evaluated

Table 3. Descriptive statistics for the four Health Locus of Control scales

Scale	*M*	*SD*	*Coefficient alpha*	*Range of corrected item–total correlations*
Internal	4.35	.65	.60	.14–.45
Chance	3.26	.80	.68	.35–.47
God	3.28	1.10	.88	.47–.77
Powerful Others	3.78	.80	.65	.10–.49

N =371. There are six items on each scale. Ratings were made on a six-point scale where higher values indicate more control

Table 4. Correlations among the four Health Locus of Control subscales

Subscale	*1*	*2*	*3*	*4*
1. Internal	–	.10	.14	.14
2. Chance		—	.54	.50
3. God			—	.43
4. Powerful Others				–

$N = 371$. Correlations larger than .11 are significant at the .05 level, two-tailed test

were fit after fewer than 10 iterations and none of the models resulted in unusual parameter estimates.

Evaluation of the models Table 5 summarizes the goodness of fit of seven different models to the observed covariance matrix. The independence model represents the 'null' hypothesis that all the items are uncorrelated; that is, there is no structure underlying the 24 health locus of control items. Not surprisingly, this model yields a chi-square that is much larger than any of the alternative models and can be rejected. A one-factor model, implying that participants' responses to the items are influenced by a general control factor, provides a better fit to the data, but the fit of this model is still not acceptable.

We next considered the four-factor model that represents the proposed scoring of the scale when administered to healthy samples. Although treating the four factors as totally independent did not provide a good fit to the data, relaxing the constraint that the four factors be independent resulted in a marginally acceptable fit. Thus, this model provides some justification for the proposed scoring of four separate subscales, with the understanding that the scores might not be strictly independent. Inspection of the estimated correlations among the latent factors for this model indicated that the Internal factor is largely independent of the other three factors (the estimated correlations were all .09), whereas the estimated correlations among the three external factors are substantial (.77, .71, and .56). This finding is consistent with the correlations shown in Table 4 and suggests that a more parsimonious scoring scheme might be to reduce the God, Chance, and Powerful Others subscales to a single External subscale.

However, as can be seen in Table 5, neither a two-independent nor a two-correlated factor model provide an acceptable fit to the correlations among our participants' responses to the 24 health locus of control items. Therefore, collapsing the three external subscales into a single External subscale is not supported by these structural analyses. The last model considered in Table 5 maintains the distinction among the four factors but adds the constraint that the Internal factor be independent of the three external factors. Adding this constraint to the four correlated factor model did not reduce the fit of the model substantially. (The difference between the chi-squares of the two models is 2.4, which, with 3 degrees of freedom is not significant.)

Thus, the model that provides the most compelling characterization of the structure of the expanded MHLC in this sample of Canadian women is a four-factor model with the three external dimensions correlated. The

Table 5. Summary of the goodness of fit indices for different structural models of the Health Locus of Control items

Model	*Degrees of freedom*	*Chi-square*	*S-B scaled Chi-square*	*CFI*	*Robust CFI*	*Standardized RMSR*
Independence	276	2679.7	–	–	–	–
1 factor	252	963.4	763.4	.704	.722	.089
4 independent factors	252	763.3	625.3	.787	.797	.156
4 correlated factors	246	490.4	399.6	.898	.916	.067
2 independent factors (internal vs external)	252	764.3	610.8	.787	.805	.084
2 correlated factors	251	762.0	609.6	.787	.805	.082
4 factors with three external factors correlated	249	492.8	401.2	.899	.917	.069

$N = 371$. S-B = Sattora-Bentler; CFI = comparative fit index; RMSR = root mean squared residual

standardized estimates of the path coefficients for this model are presented in Table 6.

Discussion

The addition of the God Locus of Health Control (GLHC) subscale

Although the God subscale is substantially correlated with the Chance and Powerful Others subscales in this population, our structural analyses support treating it as a separate source of women's beliefs about factors that control their health. In addition, the God subscale has a higher degree of internal consistency than the other three subscales. One possible reason for the higher internal consistency of the God subscale is the greater variance of scores on this subscale. Although the average degree to which women attribute their health outcomes to God is significantly lower than the degree to which they attribute health outcomes to internal factors or

Table 6. Standardized estimates of the path coefficients for the four-factor model with the 'external' factors correlated for the HLCS

	Factor				
Item	*Internal*	*Chance*	*God*	*Powerful Others*	*Error*
I1	.36				.93
I2	.35				.94
I3	.14*				.99
I4	.58				.81
I5	.58				.81
I6	.73				.68
C1		.46			.89
C2		.41			.91
C3		.53			.85
C4		.55			.84
C5		.47			.88
C6		.60			.80
G1			.73		.68
G2			.49		.87
G3			.78		.63
G4			.78		.62
G5			.84		.54
G6			.83		.56
P1				.47	.89
P2				.50	.87
P3				.10*	.99
P4				.61	.79
P5				.60	.80
P6				.72	.70

Correlations among the factors

	Chance	God	Powerful Others
Chance	–		
God	.71	–	
Powerful Others	.77	.56	–

$N = 371$. I = Internal, C = Chance, G = God, P = Powerful Others. Items are grouped by factor. The number of the item corresponds to the order it appears on the MHLC. All paths are statistically significant except for those marked with an asterisk(*)

powerful others, the greater variance on the God subscale indicates that, for some women, God is viewed as an important influence on their health. Thus, the addition of the God subscale to the MHLC is justified psychometrically and it appears to assess a factor that for some women is a major source of control beliefs of health. Of course, the predictive and construct validity of the God subscale must be further assessed in studies that focus on the relation of this scale to various psychological and health outcomes. Thus far, evaluations of the validity and utility of this new subscale appear promising (Wallston et al., 1999; see also Welton et al., 1996).

Two factors versus four factors

The results of these analyses provide support for a four-factor structure of the 24 items on the expanded MHLC. Although the three factors that represent external causes (Chance, God, and Powerful Others) are substantially correlated in these data, our structural analyses clearly support the continued separation of these factors rather than their aggregation into a single External factor as has been suggested by some analyses of the original MHLC (e.g. Boyle & Harrison, 1981; Gutkin et al., 1985; O'Looney & Barrett, 1983). Thus, the current scoring of the expanded MHLC on four separate subscales remains our recommendation. However, the substantial correlation among the three external subscales must be considered when interpreting results obtained from these measures. In particular, if these subscales are used together as predictor variables in a multiple regression analysis the multicollinearity of these subscales may pose some statistical and interpretive problems.

Sample diversity

Although our sample suffers from the same volunteer bias as nearly all studies in psychology, we view the ethnic diversity and community recruitment of our sample as one of the unique strengths of the study we report here. The difference between our sample and the more usual college student samples used in psychological research can be appreciated by comparing the responses of our sample to those of a sample of 441 college women recently collected by Willis and Wallston (1999). The college students in this sample had substantially lower mean scores on the Chance (2.73 vs 3.26, $t_{810} = 9.56$) and Powerful Others (2.81 vs 3.78, $t_{810} = 16.99$) scales, and slightly higher scores on the Internal (4.46 vs 4.35, $t_{810} = 2.28$) and God (3.49 vs 3.28, $t_{810} = 2.40$) scales than did our community sample. (All above t-values are statistically significant at the .05 level, two-tailed test.)

Of greater importance for the structural results reported here is that the correlations among the four subscales suggest more scale homogeneity for the community sample than for the college sample. For example, in the community sample the correlations shown in Table 4 are all positive, whereas in the above college sample the correlations between the Internal scale and the three external sales are negative. Moreover, the correlations among the external scales, although still positive, are lower in the college sample (averaging .26) than in the community sample (averaging .49). The homogeneity of the scales in the community sample would generally serve to increase the goodness of fit of a one- or two-factor solution. Yet despite this homogeneity we still found the best support for the four-factor solution in our community sample. This underscores the robustness of the solution across non-college student samples.

Limitations

Although our sample is diverse and based on a sophisticated sampling scheme, it has some obvious limitations. First, it consists only of women. The reason for this limitation was that the study in which the data presented here were collected focused on women's concerns about their health (Barksdale et al., 1999). Restricting the psychometric and structural analyses to a sample of women is not unreasonable because there is some evidence that the factor structure of the MHLC differs for men and women (O'Looney & Barrett, 1983). However, an evaluation of the expanded MHLC on a sample of men is an obvious target for future research. The focus and sampling scheme of the study also precluded the collection of criterion information against which the predictive validity of the MHLC scales could be evaluated.

A second limitation is that this study was conducted in Canada. Health care systems differ substantially across different countries, and the availability and national philosophy of health care could plausibly influence women's beliefs about health locus of control. The extent of this

influence will limit the cross-cultural generality of these findings. Another target for future research would be the evaluation of the expanded MHLC in different countries.

Conclusion

Despite the limitations of the research reported here, we believe that the support we found for including God as an additional factor in women's beliefs about the locus of control for their health is impressive. Likewise, our results endorse the continued scoring of the three 'external' subscales as separate, but related, constructs rather than combining them into a single External subscale.

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