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ABSTRACT

People's beliefs about the origins of their health, sometimes referred to as health locus of control, have been shown to influence a variety of important behaviors. The purpose of this study was to explore the structure of the health locus of control beliefs of children, using the Multidimensional Health Locus of Control Scales. Two samples of 4th- through 6th-grade students were utilized to allow for cross-validation of results. The first group had 780 subjects, the second group had 524 subjects. Confirmatory methods were employed in this study. Factor I emerged as a construct that might be labeled "Personal Initiative." The two items with the highest factor loadings were "If I take the right actions, I can stay healthy" and "If I take care of myself I can avoid illness." Factor II might be labeled "Luck" or "Chance" and the two items associated with this factor were "My good health is mostly a matter of good luck" and "Luck is mostly what determines how soon I will recover from an illness." Factor III might be labeled "Power of Others" since loadings suggested possible distinctions between the perceived power of doctors and other health care providers. The two items with the largest loadings were "I can only do what my doctor tells me to do about my health" and "Doctors and nurses control my health." (Contains 34 references and 5 tables.) (ABL)

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THE NATURE OF CHILDREN'S HEALTH LOCUS OF CONTROL BELIEFS

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ABSTRACT

People's beliefs about the origins of their health, sometimes referred to as health locus of control, have been shown to influence a variety of important behaviors, including the propensity to engage in effective health maintenance activities, and the willingness to seek and follow medical advise. The purpose of the present study was to explore the nature, i.e., the structure, of the health locus of control beliefs of children, using the Multidimensional Health Locus of Control Scales. The subjects ($\underline{n}_1$ = 780, $\underline{n}_2$ = 524) constituted two discrete samples. Confirmatory maximum-likelihood factor analyses were conducted and the relative fit of rival models was evaluated.

People's beliefs about the origins of their health, sometimes referred to as health locus of control, have been shown to influence a variety of important behaviors, including the propensity to engage in effective health maintenance activities, and the willingness to seek and follow medical advice (Riggs & Noland, 1984, p. 431). Before being conceptualized more narrowly, "locus of control" first emerged as a generalized construct referring to individuals' beliefs about the origins of their global situations (Rotter, 1968). According to social learning theory, persons who believe that they control their own destinies, i.e., Internals, behave in predictable ways in comparison with their External counterparts, i.e., persons who believe that chance or powerful others determine the outcomes in their lives.

But one consensus that has emerged from this literature is the view that prediction of generalized behavior (i.e., a general approach to life) requires general measures of expectancy, while more specific predictions require more specific measures (health outcomes as against life outcomes more generally, or weight or cardiovascular outcomes as against health outcomes more generally) of locus of control (Lefcourt, 1981, p. 386). B. Wallston, Wallston, Kaplan and Maides (1976, p. 584) argue that, "The more specific the instrument, the better the prediction of a particular behavior in a particular situation." In an empirical study confirming these theoretical expectations, Saltzer (1982, pp. 626-627) used both general and specific locus of control measures and reported that the outcome-specific measures predicted experimental outcomes while locus of control measures that did not deal with beliefs specifically about control of weight "would not have led to the predicted findings."

Strickland (1973) reviewed 11 studies investigating linkages between health locus of control beliefs and outcomes and reported that there are positive relationships between a more Internal locus of control and physical health or well being. In one of the first studies employing locus of control as a predictor variable, Seeman and Evans (1962) found that hospitalized tuberculosis patients who were more Internal knew more about their conditions, questioned health professionals more for information, and expressed less satisfaction about the information they were getting regarding their conditions. Similarly, in a study with epileptics, DeVellis, DeVellis, Wallston and Wallston (1980) found that information-seeking behaviors were associated in theoretically expected ways with locus of control scores.

K. Wallston, Wallston and DeVellis (1978) developed what is probably the most frequently used measure of beliefs about health locus of control, i.e., the Multidimensional Health Locus of Control (MHLC) Scales. As Russell and Ludenia (1983, pp. 453-454) note, "The MHLC Scales have been employed in a substantial number of studies that investigated various health conditions and health-related behaviors with a wide range of populations."

The purpose of the present study was to explore the nature, i.e., the structure, of the health locus of control beliefs of children, using the MHLC Scales. Several researchers have examined

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the measurement integrity of the MHLC Scales, or of revisions of the scales. For example, the internal consistency reliability of the Scales has been investigated (Marshall, Collins & Crooks, 1990; Thompson, Butcher & Berenson, 1987). The construct validity of the scales has also been investigated using various factor analytic methods, including principal components analysis (Marshall et al., 1990; Thompson, Butcher & Berenson, 1987), second-order exploratory factor analysis (Thompson, Webber & Berenson, 1990), and confirmatory first-order factor analysis (Thompson, Webber & Berenson, 1987, 1988).

But to date models have not been fit to data and then cross-validated with large, independent samples. Furthermore, all previous analyses with this measure focused on factors extracted from correlation matrices. As Cudeck (1989) has emphasized, the testing of covariance structures extrapolated from correlation matrices under some circumstances may modify the model being analyzed, may produce incorrect test statistics and indices of fit, and may yield incorrect standard errors.

Method

Work with Rotter's *general* locus of control measure (as against *health* more specifically) suggests that general locus of control is factorially complex and not unidimensional, although Rotter did not himself attempt to delineate a multidimensional model of his construct. Marsh and Richards (1987) reviewed 20 published studies in which exploratory factor analytic methods were employed with Rotter's measure, and then tested several models using confirmatory methods. They found empirical support for the fit of a model involving as many as six factors: General Luck, Political Control, Success via Personal Initiative, Interpersonal Control, Academic Situations, and Occupational Situations.

Related previous inquiry regarding the nature of health locus of control beliefs more specifically has met with less success in delineating the structure underlying MHLC responses. Therefore, three strategies not previously taken in this area of inquiry were employed in the present study. These involved the sample, the instrumentation, and the analytic strategies used in the study.

Subjects

Two samples of fourth- through sixth-grade students were utilized, to allow the cross-validation of results. Cross-validations in which more model parameters are fixed have more degrees of freedom, meaning there are more ways in which the models are potentially falsifiable, and so represent more rigorous tests of our conceptions of latent constructs (Mulaik, 1987, 1988). It is increasingly being recognized that covariance structure analyses require relatively large samples (Baldwin, 1989; Bentler, in press), so large samples were employed in both studies.

The demographic characteristics of the two samples are described in Table 1. The two samples had no subjects in common. The second sample participating in the study completed instrumentation one year after the first sample, but consisted of students from the same four schools. The second sample excluded the previous year's sixth-graders, included newly promoted fourthgraders, and included new fifth- and sixth-graders new to the schools or absent at the initial testing one year previously. The Table 1 data suggest that the two samples were reasonably similar in their makeup.

INSERT TABLE 1 ABOUT HERE.

Instrumentation

Unfortunately, the MHLC Scales were developed for use by adults, although the items were written at a 5th-6th grade reading level, as assessed by the Dale-Chall "readability" formula (K. Wallston, Wallston & DeVellis, 1978, p. 162). Since the present study investigated the nature of health locus of control when elementary students are subjects, some wording changes were made in 10 of the 18 MHLC items (see Appendix A for the items) to improve the usability of the measure with this age group. Test-retest reliability coefficients for scores from the reworded items have been previously reported (Thompson, Butcher & Berenson, 1987). The reworded items used here have also been employed in some previous factor analytic work (e.g., Thompson, Butcher & Berenson, 1987; Thompson, Webber & Berenson, 1990).

Most of the wording changes involved simplifying sentence structure. Only minimal changes were made to facilitate the use of the MHLC Scales with both children and adults so that results of substantive studies could be generalized across groups via the use of the same instrument or very similar instruments. Four-point Likert scales ("disagree very much" = 1 to "agree very much" = 4) were employed to maximize response variance and thus reliability; other researchers have tended to employ "yes-no" response formats.

The second sample of subjects, who participated one year later, completed the same 18 MHLC items and an additional six items (two per scale) from the measure developed by Parcel and Meyer (1978). Although the Parcel and Meyer (1978) measure has been criticized on several grounds (Thompson, Webber & Berenson, 1987, pp. 81-82), primarily for too much redundancy in item wording, these additional six items were employed to better mark the positions of the factors in factor space. The six items selected were highly correlated with scale scores on the Parcel and Meyer measure, and were not exactly the same in their wording, so that factors would not emerge as an artifact of wording similarity.

The importance of exploring factor structure across independent samples of subjects and variations in item pools was noted by Gorsuch (1983, p. 335):

> To the extent that invariance can be found across systematic changes in *either variables or individuals* [or both], then the factors have a wider range of applicability as generalized constructs. The subpopulations over which the factor occurs could--and probably would--differ in their mean scores or variances across the groups, but the pattern of relationships among the variables would be the same. The factors would be applicable to the several populations and could be expected to

generalize to other similar populations as well.

Analysis

It was decided to employ confirmatory methods in these investigations, because previous studies (Marshall, Collins & Crooks, 1990; Thompson, Butcher & Berenson, 1987) suggest that children may not yield data with quite the reliability one might prefer, and confirmatory methods provide strategies for both empirically estimating measurement error and testing the invariance of various aspects of complex models across samples and item pools. Confirmatory maximum-likelihood model tests were conducted with the LISREL 7.16 program described by Jöreskog and Sörbom/SPSS (1989).

The rival models tested in a confirmatory manner in Study 1 were derived from theory and previous related empirical work, though most previous studies (a) extracted structure from correlation matrices and (b) used exploratory methods with rotation to the varimax criterion.

Model 1A. Many measures of general locus of control (Lefcourt, 1981) have used scoring strategies in which a unidimensional bipolar construct in presumed. Items presumed to measure the Internal pole are scored in one direction, items presumed to measure the External pole are scored in the opposite direction, and then item scores are summed to create a single total score. However, as Marsh and Richards (1987) point out, Rotter's original thinking seemed to reflect an interest in defining a multidimensional construct, but he was unwilling or unable to delineate the construct in this fashion.

Model 1B. The period around 1980 saw the rethinking of several major constructs that had previously been viewed as bipolar and unidimensional. For example, Constantinople (1973) suggested that the scales of masculinity-femininity embedded in various personality measures operationalized a bipolar construct, but that masculinity and feminity might be defined as two separate factors. This view led to a series of androgyny studies summarized by various researchers (e.g., Thompson, 1989).

Similarly, in 1984 Kerlinger published a book synthesizing several decades of his research, involving R and Q technique methods and both exploratory first- and second-order and confirmatory analyses, that suggested to him the view that liberalism and conservatism should be defined as separate factors. Indeed, Kerlinger (1984; Thompson, 1985) argued that social attitudes generally are organized in this manner. Thus, it is conceivable that Internal and External factors should be defined as separate, though potentially correlated, factors.

Model 1C. Most of the previous studies (K. Wallston et al., 1976, 1978) using the MHLC scales have tested a model presuming three uncorrelated factors, i.e., Internal, Chance, and Powerful Others, with each factor being defined univocally by six items. This is the model operationalized in the recommended scoring system.

Model 1D. Most researchers define constructs as being sufficiently discrete to be worth distinguishing, and for the factors qua factors to be invariant. But generally we do not expect factor variances or covariances to be invariant, since they can change with sampling and restriction of range effects (Mulaik, 1972). In fact, previous studies (Larde & Clopton, 1983; Russell & Ludenia, 1983; Thompson, Butcher & Berenson, 1987; K. Wallston et al., 1978) examining bivariate correlations among scale scores created by summing six item responses per scale indicate that the correlations among raw scores are variable, supporting a view that factor covariances also might not be expected to be invariant. This view suggests the definition of a model in which three correlated factors are posited.

After these four models were tested in a confirmatory manner, the modification indices and related results were examined, and the fits of other models to the Study 1 data were explored. These Study 1 results were then used to create, *a priori* to the Study 2 analyses, models used with the data from Study 2.

Results

Study 1

The variance/covariance matrix from Study 1 is reported in Table 2 for researchers who may wish to further explore these results. Table 3 presents the factor (LAMBDA X) and the factor covariance (PHI) matrices from these analyses, along with selected test statistics. Freed values are presented in italics. Factor variances were all constrained to be unity to identify the models.

INSERT TABLES 2 AND 3 ABOUT HERE.

Prior to freeing any model constraints, the largest modification indices for the fit of Model 1D to the Study 1 data were for freeing LAMBDA X(4,1) (38.0), LAMBDA X(14,1) (28.3), LAMBDA X(12,2) (27.2), and LAMBDA X(17,1) (24.2). When automatic model modification was run, the parameters freed and the respective changes in χ^2 were: (a) LAMBDA X(4,1), 38.1; (b) LAMBDA X(12,2), 30.4; (c) LAMBDA X(15,1), 30.2; (d) LAMBDA X(11,1), 38.1; (e) LAMBDA X(17,1), 33.3; (f) and LAMBDA X(14,2), 12.8.

These results were interpreted as reflecting a misassociation of item 12 with the Internal factor as against the Chance factor. The decision was taken to free three Powerful Others items (4, 11 and 15) and one Chance item (17) to allow them to also be associated with the Internal factor posited in Model 1D. This new exploratory model was designated 1E'.

Table 4 presents the 18 items and the 22 (18 + 4) factor loadings from this analysis. Factor variances (i.e., the diagonal of PHI) were constrained to unity to identify the model. The factor covariances/correlations for the test of Model 1E' were: I with II, -.006; I with III, -.102; and II with III, +.648. The model seemed to provide a reasonable fit to the data (χ^2 = 309.78; df = 128; noncentrality parameter = 309.78 - 128 = 181.78; 181.78/128 = 1.42). The LISREL goodness-of-fit index (GFI) was .96. The parsimony ratio (Mulaik et al., 1989) associated with the GFI was .75; the parsimonious GFI (i.e., the PGFI = GFI times the parsimony ratio) was .87. The Bentler (1990) comparative fit index (CFI) was .87 (((1519.24 - 153) - (309.78 - 128)) / (1519.24 - 153)). The parsimony ratio associated with the CFI was .84; the parsimonious

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CFI (PCFI) was .72.

INSERT TABLE 4 ABOUT HERE.

Study 2

The results presented in Tables 3 and 4 were consulted in the *a priori* formulation of the models tested in Study 2. The Study 1 models with a somewhat better fit to the Study 1 data included Model 1D (GFI = .93, PGFI = .77; CFI = .74, PCFI = .64), a model suggested by scoring keys and positing three correlated factors with six loadings per factor, and the model (1E') developed from the ancillary analysis reported in Table 4 (GFI = .96, PGFI = .72; CFI = .87, PCFI = .72).

Five models were specified for evaluation in Study 2. The first two models were the least parsimonious, and were evaluated to explore the consequences of using models to 1D and 1E', but freeing relevant factor loadings. The remaining models were more parsimonious, were the same in structure to the first pair of models, but fit to Study 2 data the actual factor loadings derived from Study 1 results. Thus, in these models no degrees of freedom were lost for estimating LAMBDA X parameters. These were the analyses of greatest interest in the study, because they evaluated more parsimonious models and the invariance of factors, and were thus more potentially falsifiable.

Model 2A. This model was the direct analog of Model 1D. Thus, conventional MHLC scoring keys were again the basis for freeing factor loadings. This model posited eight loadings per factor, with no items loading on more than one factor (i.e., univocality). Factor variances were fixed at unity to identify the model; factor covariances were freed and estimated. Given the emphasis in the study on replicating factor structure from Study 1 in Study 2, this model was mainly used as a baseline for comparative evaluation of the remaining models. The model involved 24 (18 + 6) LAMBDA X, three PHI, and 24 THETA DELTA parameter estimates.

Model 2B. This model freed exactly the same parameters as were freed in the Study 1 model 1E', except that the factor loadings for the six additional items were also estimated. Thus, 28 (22 + 6) LAMBDA X, three PHI, and 24 THETA DELTA parameters were estimated. This was the least parsimonious model evaluated in Study 2.

Model 2C. The 22 parameter estimates from the Study 1 ancillary model, 1E', reported in Table 4, were fixed. The six loadings for the additional Study 2 items were freed. Since neither the factor variances nor covariances were presumed to be invariant, and since the model was identified using the 22 fixed factor loadings, the three diagonal and the three off-diagonal PHI entries were freed. Thus, 36 (6 LAMBDA X + 6 PHI + 24 THETA DELTA) parameters were estimated.

Model 2D. This model posited the same factor structure as Model 2A, but the 18 factor loadings for Model 1D reported in Table 3 were fit to the Study 2 data, and the six loadings for the new items used in Study 2 were fixed as .5's. These six estimates were used for the six new items based on *a priori* expectations that the items would be associated with expected factors, that the loadings would have the same signs as their companion items from the MHLC Scales, and that careful selection of these items might yield loadings comparable to the largest loadings for Model 1D reported in Table 3. Since neither the factor variances nor covariances were presumed to be invariant, and since the model was identified using the 24 fixed factor loadings, the three diagonal and the three off-diagonal PHI entries were freed. Thus, 30 (6 PHI + 24 THETA DELTA) parameters were estimated.

Model 2E. This model posited the same factor structure as Models 2B and 2C, but the 22 factor loadings for Model 1E' reported in Table 4 were fit to the Study 2 data, and the six loadings for the new items used in Study 2 were fixed as .5's. The three PHI diagonal and the three off-diagonal entries were freed. Thus, 30 (6 PHI + 24 THETA DELTA) parameters were estimated.

Table 5 presents the maximum-likelihood parameter estimates for Models 2A through 2C. Associated fit statistics are also presented for the three models.

INSERT TABLE 5 ABOUT HERE.

The variances for factors I through III for Model 2D were .832, 1.041, and .746, respectively. The factor covariances for the test of Model 2D were: I with II, +.082; I with III, -.157; and II with III, +.286. χ^2 with 270 degrees of freedom was 703.73 (noncentrality parameter = 703.73 - 270 = 433.73; 433.73/270 = 1.61). The LISREL goodness-of-fit index (GFI) was .89. The parsimony ratio (Mulaik et al., 1989) associated with the GFI was

.90; the parsimonious GFI (i.e., the PGFI = GFI times the parsimony ratio) was .80. The Bentler (1990) comparative fit index (CFI) was .70 (((1706.97 - 276) - (703.73 - 270)) / (1706.97 - 276)). The parsimony ratio associated with the CFI was .98; the parsimonious CFI (PCFI) was .68.

The variances for factors I through III for Model 2E were .758, 1.020, and .716, respectively. The factor covariances for the test of Model 2D were: I with II, +.167; I with III, -.049; and II with III, +.349. χ^2 with 270 degrees of freedom was 664.20 (noncentrality parameter = 664.20 - 270 = 394.20; 394.20/270 = 1.46). The LISREL goodness-of-fit index (GFI) was .90. The parsimony ratio (Mulaik et al., 1989) associated with the GFI was .90; the parsimonious GFI (i.e., the PGFI = GFI times the parsimony ratio) was .81. The Bentler (1990) comparative fit index (CFI) was .72 (((1706.97 - 276) - (664.20 - 270)) / (1706.97 - 276)). The parsimony ratio associated with the CFI was .98; the parsimonious CFI (PCFI) was .71.

Discussion

As Neale and Liebert (1986, p. 290) emphasize, it is important to recognize that

> No one study, however shrewdly designed and carefully executed, can provide convincing support for a causal hypothesis or theoretical statement in the social sciences... How, then, does social science theory advance through research? The answer is, by collecting a diverse body of evidence about

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any major theoretical proposition.

One positive feature of the present study was the attempt to address such concerns by analyzing two discrete sets of data.

Confirmatory methods were employed in the present study. Exploratory factor analysis yields indeterminate common factors, so even if methods could somehow create meaning or define constructs, certainly exploratory common factor analysis can not do so. As Mulaik (1987, p. 301) notes, "It is we who create meanings for things in deciding how they are to be used. Thus we should see the folly of supposing that exploratory factor analysis will teach us what intelligence is, or what personality is." Confirmatory analysis forces us to ourselves do the best job we can of creating the meaning of our constructs, presumably using available theory and previous empirical research. The latent variables we define then represent a more objective conception of our constructs.

A host of fit statistics can be consulted to us help evaluate the fit of our definitions to data. These statistics include the LISREL goodness-of-fit index (GFI), the parsimonious GFI (PGFI), the Bentler comparative fit index (CFI), and the parsimonious CFI (PCFI), among others.

With respect to the relative utility of GFI versus CFI indices, though they are grounded in different theory, they often yield comparable results (Mulaik et al., 1989). But GFI evaluates fit to both the variances and the covariances of the observed variables, while CFI evaluates fit to only the covariances among the observed variables. As researchers employ more observed variables, the ratio of the v diagonal entries in the covariance matrix to the (v * (v - 1) / 2) off-diagonal matrix entries decreases rapidly, so to some extent the two indices may tend to be more similar in these circumstances.

With respect to the indices ignoring model parsimony as against those considering it (Mulaik et al., 1989), it seems reasonable to place more emphasis on indices that consider the parsimony of the models that we are testing. When we "free" a parameter in a confirmatory analysis, we get an exact fit to the data for this estimate. So fit is partially a function of how many parameters we free. Our most realistic estimates of fit arise when try to fit the parameters we want to emphasize from one study to the data from another study, so that fit is less artifactual. Indices that consider model parsimony give credit for evaluating the invariance across studies of the parameter estimates we wish to interpret, by favoring models with more degrees of freedom.

Study 1 represented an attempt to explore the fit to the data of various definitions of health locus of control. All four *a priori* Study 1 models had similar fits to the Study 1 data, as reported in Table 3, though a somewhat better fit was realized for Model 1D (GFI = .83; PGFI = .71; CFI = .74; PCFI = .64). This was the model positing the factor structure operationalized in the MHLC scoring keys, but allowing the factors to be correlated. Of course, it is important to consider the fit of rival models, because even an excellent fit for a model does not deny the existence of other models that might yield equal or even better fit.

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The factors generated in the exploratory evaluation of Model 1E' were intriguing. These factors appear to emerge as measures of different constructs than those envisioned in the rather general conceptualizations ("Internal", "Chance" and "Powerful Others") presented by the authors of the MHLC Scales. All the Model 1E' factor loadings, reported in Table 4, were several times the largest standard error (.047) for the factor matrix.

Factor I emerged as a construct that might be labelled, "Personal Initiative," and which may resemble the "Personal Initiative" factor isolated by Marsh and Richards (1987) in their confirmatory analysis of data from a general locus of control measure. In the present study the two items with the highest factor loadings were: "If I take the right actions, I can stay healthy." (.535); and "If I take care of myself I can avoid illness" (.371). Items involving reliance on others, as with medical checkups involving a system of people (item 4) or a general system of others ("family, friends, doctors, or nurses" in item 15) had the next highest loadings in absolute value, respectively -.358 and -.311. Persons scoring high on this factor may feel hostile to the notion of relying on others.

Factor II might be labelled "Luck" or "Chance", and might be associated with the "General Luck" dimension isolated by Marsh and Richards (1987). The two items most associated with the factor were: "My good health is mostly a matter of good luck." (.660); and "Luck is mostly what determines how soon I will recover from an illness." (.599). These two items had loadings that were roughly twice as large as the third largest loading (.314). Thus, issues such as fatalism (items 16 and 17) were associated with the factor, but did not saturate as much of this factor space.

Factor III might be labelled "Power of Others", since the loadings suggest possible distinctions between the perceived power of doctors and other health care providers. The two items with the largest loadings were "I can only do what my doctor tells me to do about my health." (.707); and "Doctors and nurses control my health." (.654). Items involving family (item 5), family and others (item 15), or medical checkups without the players being explicitly named (item 4) were less associated with the factor.

Though interpretation of these factors suggests some intriguing subtleties in meaning, the critical question is whether the factors and these subtleties are invariant across samples and across item pools. The Study 2 results provided a basis for addressing these concerns.

Just as the Study 1 model (1D) operationalized in the recommended MHLC Scales scoring keys had a reasonable fit to the Study 1 data (GFI = .93; CFI = .74), the Study 2 analog model, 2A, had a reasonable fit to the Study 2 data (GFI = .90; CFI = .74). These models estimate one loading per variable, with an equal number of loadings for each of three factors.

However, the best fit in Study 2 was for Model 2B, the analog of Model 1E' (GFI = .91; CFI = .77). Model 2C, fitting the 22 factors loadings from the test of Model 1E' to the Study 2 data, but estimating the factor loadings for the additional six items, had similar fit to the Study 2 data (GFI = .90, CFI = .73). As reported in Table 5, the six additional items employed in this study had noteworthy factor loadings (+.516, +.294; +.491, +.575; and +.608, +.466).

Models 2D and 2E both had 270 degrees of freedom, and no factor loadings were estimated. Model 2D, fitting 18 Model 1D factor loadings and six .5's to the Study 2 data, had the poorest fit (GFI = .89, CFI = .70) to the Study 2 data, but was only somewhat worse in fit than other models. Model 2E, fitting 22 Model 1E' factor loadings and six .5's to the study 2 data, had a somewhat better fit (GFI = .90, CFI = .72).

However, although the ratios of chi-squares to degrees of freedom and the GFIs for tests of Study 2 models were reasonably supportive of conclusions that the models fit, the CFIs were uniformly lower for these models. And one might hope that all the indices had been more definitive.

To some extent these results reflect the limits of the literature in this area. Notwithstanding the fact that "during the last two decades locus of control has been one of the most widely studies of personality constructs" (Marsh & Richards, 1987, pp. 39-40), we are still in the infancy of elaborating relevant theory and developing measures of theory. As Hendrick and Hendrick (1986, p. 393) have noted, "theory building and construct measurement are joint bootstrap operations." The results of the present study suggest that the development of larger and more diverse item pools measuring more constructs might be useful in exploring the structure of health locus of control beliefs. Such item pools would allow the identification of more factors, and the exploration of more complex, hierarchical factor structures. Structures with more factors, isolated with more items, might yield more favorable results as regards fit.

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Table 1
Sample Characteristics

	Study #1 (n_1=780)			Study #2 (n_2=524)	
Gender					
403	(51.7%)	Females	258	(49.2%)	Females
Race					
371	(47.6%)	White	351	(67.0%)	White
306	(39.2%)	Black	117	(22.3%)	Black
43	(5.5%)	Hispanic	44	(8.4%)	Hispanic
59	(7.6%)	Oriental	11	(2.1%)	Oriental
1	(.1%)	Other	1	(.2%)	Other
Grade					
270	(34.6%)	4th	158	(30.2%)	4th
259	(33.2%)	5th	199	(38.0%)	5th
251	(32.2%)	6th	167	(31.9%)	6th

Table 2
Estimated Variance/Covariance Matrix
(n_1 = 780; n_2 = 524)

	1	2	3	4	5	6	7	8	9	10
1	0.864									
	0.816									
2	0.086	0.843								
	0.127	*0.803*								
3	-0.060	-0.011	1.057							
	0.043	*0.035*	*0.942*							
4	-0.017	-0.024	0.040	0.753						
	-0.091	*-0.025*	*-0.058*	*0.731*						
5	0.001	-0.043	0.062	0.110	1.096					
	-0.074	*-0.079*	*0.087*	*0.068*	*1.221*					
6	0.148	0.060	0.007	-0.203	-0.079	0.675				
	0.154	*0.098*	*0.041*	*-0.141*	*-0.063*	*0.566*				
7	0.089	0.122	-0.100	-0.105	-0.083	0.164	0.917			
	0.069	*0.139*	*0.015*	*-0.088*	*-0.034*	*0.112*	*0.940*			
8	-0.011	0.062	0.059	0.028	0.186	-0.033	-0.016	1.195		
	0.004	*0.034*	*0.133*	*-0.026*	*0.280*	*-0.033*	*0.051*	*1.120*		
9	0.089	0.097	-0.034	-0.153	0.043	0.208	0.088	0.080	0.899	
	0.155	*0.132*	*0.144*	*-0.100*	*-0.031*	*0.194*	*0.043*	*0.105*	*0.931*	
10	-0.146	-0.006	0.078	0.043	0.124	-0.059	-0.071	0.143	-0.083	0.992
	-0.068	*-0.042*	*0.099*	*-0.030*	*0.107*	*-0.028*	*-0.042*	*0.315*	*-0.003*	*0.880*
11	-0.049	-0.005	0.062	0.266	0.211	-0.148	-0.157	0.135	-0.094	0.072
	-0.087	*-0.007*	*-0.025*	*0.255*	*0.097*	*-0.106*	*-0.075*	*0.040*	*-0.076*	*-0.052*
12	0.001	0.004	-0.065	-0.011	-0.068	-0.007	0.106	-0.148	0.073	-0.093
	0.055	*0.075*	*-0.089*	*0.071*	*0.106*	*0.009*	*0.113*	*0.018*	*-0.022*	*-0.046*
13	-0.055	0.002	0.093	0.039	0.149	-0.041	-0.070	0.451	0.018	0.185
	-0.004	*0.022*	*0.108*	*0.015*	*0.212*	*-0.048*	*0.007*	*0.432*	*0.068*	*0.220*
14	0.042	0.043	0.145	0.125	0.241	-0.010	-0.072	0.347	0.046	0.130
	0.058	*0.084*	*0.105*	*0.018*	*0.250*	*0.018*	*0.038*	*0.280*	*0.100*	*0.094*
15	-0.048	0.002	0.065	0.177	0.181	-0.186	-0.093	0.027	-0.077	0.084
	-0.051	*0.021*	*-0.007*	*0.177*	*0.162*	*-0.090*	*-0.024*	*0.028*	*-0.090*	*0.024*

16	0.003	-0.063	0.278	0.030	0.080	0.036	-0.083	0.137	0.036	0.053
	0.052	0.021	0.278	-0.035	0.038	0.081	-0.064	0.113	0.145	0.041
17	-0.088	0.010	0.074	0.123	0.163	-0.151	-0.066	0.180	-0.051	0.129
	-0.080	0.050	0.028	0.120	0.185	-0.087	-0.035	0.245	-0.075	0.136
18	-0.036	0.044	0.146	0.225	0.211	-0.067	-0.094	0.281	0.044	0.126
	-0.032	-0.023	0.043	0.086	0.202	-0.045	-0.014	0.203	0.030	0.053
19	0.097	0.106	0.077	-0.115	-0.025	0.195	0.063	0.115	0.288	0.016
20	0.019	-0.001	0.135	-0.151	0.125	0.029	0.087	0.318	0.085	0.172
21	-0.035	0.020	0.049	0.168	0.049	-0.125	-0.062	0.083	-0.036	-0.012
22	0.049	-0.016	0.100	-0.043	0.109	0.004	0.054	0.393	0.056	0.189
23	0.197	0.140	0.008	0.048	-0.090	0.082	0.147	0.024	0.220	-0.064
24	-0.061	0.042	-0.049	0.227	0.027	-0.093	-0.126	0.049	-0.025	-0.009

	11	12	13	14	15	16	17	18	19	20
11	0.980									
	0.986									
12	-0.019	0.841								
	0.050	0.960								
13	0.128	-0.120	0.955							
	0.076	-0.042	0.824							
14	0.248	-0.172	0.265	1.076						
	0.142	-0.002	0.224	0.944						
15	0.285	0.022	0.076	0.166	0.866					
	0.238	0.033	0.041	0.138	0.790					
16	0.112	-0.121	0.115	0.167	0.001	1.056				
	0.023	-0.042	0.056	0.047	-0.043	1.017				
17	0.147	-0.044	0.195	0.124	0.149	0.090	0.824			
	0.160	0.001	0.164	0.067	0.118	0.057	0.880			
18	0.341	-0.165	0.234	0.464	0.211	0.163	0.208	1.179		
	0.189	0.080	0.178	0.340	0.132	0.064	0.144	1.076		
19	-0.114	0.094	0.006	0.032	-0.139	0.113	-0.036	0.121	0.864	
20	-0.084	-0.114	0.262	0.196	-0.038	0.098	0.093	0.105	0.092	0.736
21	0.369	0.042	0.079	0.162	0.186	0.079	0.095	0.243	-0.044	-0.014
22	0.049	-0.065	0.310	0.153	0.026	0.101	0.166	0.177	0.116	0.331
23	0.004	0.082	-0.021	0.125	-0.019	0.059	-0.087	0.119	0.175	0.026
24	0.311	-0.023	0.022	0.064	0.160	0.038	0.071	0.141	-0.067	-0.030

	21	*22*	*23*	*24*
21	*1.086*			
22	*-0.020*	*1.038*		
23	*0.004*	*-0.006*	*1.060*	
24	*0.407*	*-0.018*	*-0.023*	*1.014*

Note. *Values in italics were from study 2 (n_2 = 524; v_2 = 24).* Values not italicized were from study 1 (n_1 = 780; v_1 = 18).

Table 3

Tests of Rival Models 1A Through 1D With *Freed* Values Presented in Italics

(n_1 = 780; v_1 = 18)

Item/ Statistic	Model 1A LAMBDA X G Factor	Model 1B LAMBDA X Internal	Model 1B LAMBDA X External	Model 1C LAMBDA X Internal	Model 1C LAMBDA X Chance	Model 1C LAMBDA X Others	Model 1D LAMBDA X Internal	Model 1D LAMBDA X Chance	Model 1D LAMBDA X Others
1	*0.101*	*0.276*	0.000	*0.286*	0.000	0.000	*0.267*	0.000	0.000
2	*0.008*	*0.174*	0.000	*0.201*	0.000	0.000	*0.169*	0.000	0.000
6	*0.215*	*0.498*	0.000	*0.486*	0.000	0.000	*0.512*	0.000	0.000
7	*0.225*	*0.362*	0.000	*0.332*	0.000	0.000	*0.356*	0.000	0.000
9	*0.077*	*0.354*	0.000	*0.395*	0.000	0.000	*0.356*	0.000	0.000
12	*0.206*	*0.117*	0.000	*0.073*	0.000	0.000	*0.104*	0.000	0.000
3	*-0.222*	0.000	*0.218*	0.000	*0.170*	0.000	0.000	*0.212*	0.000
8	*-0.452*	0.000	*0.458*	0.000	*0.641*	0.000	0.000	*0.625*	0.000
10	*-0.264*	0.000	*0.257*	0.000	*0.271*	0.000	0.000	*0.293*	0.000
13	*-0.421*	0.000	*0.423*	0.000	*0.677*	0.000	0.000	*0.604*	0.000
16	*-0.247*	0.000	*0.245*	0.000	*0.219*	0.000	0.000	*0.258*	0.000
17	*-0.356*	0.000	*0.353*	0.000	*0.302*	0.000	0.000	*0.361*	0.000
4	*-0.316*	0.000	*0.312*	0.000	0.000	*0.364*	0.000	0.000	*0.354*
5	*-0.390*	0.000	*0.393*	0.000	0.000	*0.374*	0.000	0.000	*0.390*
11	*-0.491*	0.000	*0.493*	0.000	0.000	*0.570*	0.000	0.000	*0.546*
14	*-0.564*	0.000	*0.574*	0.000	0.000	*0.533*	0.000	0.000	*0.561*
15	*-0.351*	0.000	*0.352*	0.000	0.000	*0.403*	0.000	0.000	*0.390*
18	*-0.639*	0.000	*0.647*	0.000	0.000	*0.653*	0.000	0.000	*0.660*
	PHI G Factor	PHI Internal	PHI External	PHI Internal	PHI Chance	PHI Others	PHI Internal	PHI Chance	PHI Others
G / I / I / I	1.000	1.000		1.000			1.000		
E / C / C		*-0.359*	1.000	0.000	1.000		*0.215*	1.000	
O / O				0.000	0.000	1.000	*0.376*	*-0.609*	1.000
χ^2	648.90	565.16			645.67			488.93	
df	135	134			135			132	
GFI	.899	.915			.909			.926	
CFI	.624	.684			.626			.739	

Table 4
Item Loadings ($\underline{n}_1$ = 780; $\underline{v}_1$ = 18) for Model 1E'

Loading	Item		
			Factor I: "Personal Initiative"
.535	6*	"I"	If I take the right actions, I can stay healthy.
.371	9*	"I"	If I take care of myself I can avoid illness.
-.358	4	"O"	The best way to keep from getting sick is to have regular medical checkups.
-.311	15	"O"	When I get well it's usually because other people (like family, friends, doctors, or nurses) have been taking care of me.
-.297	11	"O"	Whenever I don't feel well, I should see a doctor or a nurse.
.293	7	"I"	The main thing which affects my health is what I do.
-.239	17*	"C"	If it's meant to be, I will stay healthy.
.224	1*	"I"	I am in control of my own health.
.134	2	"I"	My own actions mostly determine how soon I will recover from an illness.
			Factor II: "Luck"
.660	8	"C"	My good health is mostly a matter of good luck.
.599	13	"C"	Luck is mostly what determines how soon I will recover from an illness.
.314	17*	"C"	If it's meant to be, I will stay healthy.
.277	10*	"C"	Most things that affect my health happen to me by accident.
.277	16	"C"	I am likely to get sick no matter what I do.
-.241	12*	"I"	When I get sick, I am to blame.
.213	3*	"C"	No matter what I do, if I am going to get sick I will get sick.
			Factor III: "Power of Others"
.707	18	"O"	I can only do what my doctor tells me to do about my health.
.654	14	"O"	Doctors and nurses control my health.
.421	11	"O"	Whenever I don't feel well, I should see a doctor or a nurse.
.378	5*	"O"	My family has a lot to do with my becoming sick or staying healthy.
.263	15	"O"	When I get well it's usually because other people (like family, friends, doctors, or nurses) have been taking care of me.
.215	4	"O"	The best way to keep from getting sick is to have regular medical checkups.

Note. Items with no wording changes from the original MHLC Scales are designated with asterisks. With respect to item identification with the three scales, suggested by the MHLC authors, "I" = Internal; "C" = Chance; "O" = Powerful Others. The largest standard error was .047 for LAMBDA X (8,2).

Table 5

Tests of Models 2A Through 2C With *Freed* Values Presented in Italics

(n_2 = 524; v_2 = 24)

Item/ Statistic	Model 2A Internal	Model 2A LAMBDA X Chance	Model 2A Others	Model 2B Internal	Model 2B LAMBDA X Chance	Model 2B Others	Model 2C Internal	Model 2C LAMBDA X Chance	Model 2C Others
1	*0.336*	0.000	0.000	*0.323*	0.000	0.000	0.224	0.000	0.000
2	*0.279*	0.000	0.000	*0.235*	0.000	0.000	0.134	0.000	0.000
6	*0.386*	0.000	0.000	*0.379*	0.000	0.000	0.535	0.000	0.000
7	*0.230*	0.000	0.000	*0.213*	0.000	0.000	0.293	0.000	0.000
9	*0.514*	0.000	0.000	*0.521*	0.000	0.000	0.371	0.000	0.000
12	*0.096*	0.000	0.000	0.000	*-0.066*	0.000	0.000	-0.241	0.000
19	*0.479*	0.000	0.000	*0.488*	0.000	0.000	*0.516*	0.000	0.000
23	*0.380*	0.000	0.000	*0.336*	0.000	0.000	*0.294*	0.000	0.000
3	0.000	*0.220*	0.000	0.000	*0.229*	0.000	0.000	0.213	0.000
8	0.000	*0.738*	0.000	0.000	*0.733*	0.000	0.000	0.660	0.000
10	0.000	*0.384*	0.000	0.000	*0.377*	0.000	0.000	0.277	0.000
13	0.000	*0.567*	0.000	0.000	*0.560*	0.000	0.000	0.599	0.000
16	0.000	*0.180*	0.000	0.000	*0.192*	0.000	0.000	0.277	0.000
17	0.000	*0.299*	0.000	*-0.246*	*0.355*	0.000	-0.239	0.314	0.000
20	0.000	*0.463*	0.000	0.000	*0.471*	0.000	0.000	*0.491*	0.000
22	0.000	*0.563*	0.000	0.000	*0.564*	0.000	0.000	*0.575*	0.000
4	0.000	0.000	*0.356*	*-0.246*	0.000	*0.279*	-0.358	0.000	0.215
5	0.000	0.000	*0.246*	0.000	0.000	*0.269*	0.000	0.000	0.378
11	0.000	0.000	*0.596*	*-0.198*	0.000	*0.534*	-0.297	0.000	0.421
14	0.000	0.000	*0.298*	0.000	0.000	*0.379*	0.000	0.000	0.654
15	0.000	0.000	*0.382*	*-0.188*	0.000	*0.335*	-0.311	0.000	0.263
18	0.000	0.000	*0.387*	0.000	0.000	*0.455*	0.000	0.000	0.707
21	0.000	0.000	*0.595*	0.000	0.000	*0.586*	0.000	0.000	*0.608*
24	0.000	0.000	*0.515*	0.000	0.000	*0.483*	0.000	0.000	*0.466*

	Model 2A PHI Internal	Model 2A PHI Chance	Model 2A PHI Others		Model 2B PHI Internal	Model 2B PHI Chance	Model 2B PHI Others		Model 2C PHI Internal	Model 2C PHI Chance	Model 2C PHI Others
I	1.000			I	1.000			I	*0.824*		
C	*0.118*	1.000		C	*-0.215*	1.000		C	*-0.177*	*0.989*	
O	*-0.242*	*0.196*	1.000	O	*0.074*	*-0.282*	1.000	O	*0.072*	*-0.329*	*0.686*

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χ^2	623.80	573.71	482.09
df	249	245	264
GFI	.903	.911	.897
PGFI	.749	.744	.789
CFI	.738	.770	.848
PCFI	.666	.683	.811

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APPENDIX A: Expected Structure for Items

Category/ No.	Item
Internal	
1*	I am in control of my own health.
2	My own actions mostly determine how soon I will recover from an illness.
6*	If I take the right actions, I can stay healthy.
7	The main thing which affects my health is what I do.
9*	If I take care of myself I can avoid illness.
12*	When I get sick, I am to blame.
19#	I can do many things to prevent illness. (Parcel & Meyer #11)
23#	I can make choices about my health. (Parcel & Meyer #16)
Chance	
3*	No matter what I do, if I am going to get sick I will get sick.
8	My good health is mostly a matter of good luck.
10*	Most things that affect my health happen to me by accident.
13	Luck is mostly what determines how soon I will recover from an illness.
16	I am likely to get sick no matter what I do.
17*	If it's meant to be, I will stay healthy.
20#	Bad luck makes people get sick. (Parcel & Meyer #3)
22#	People who never get sick are just plain lucky. (Parcel & Meyer #6)
Powerful Others	
4	The best way to keep from getting sick is to have regular medical checkups.
5*	My family has a lot to do with my becoming sick or staying healthy.
11	Whenever I don't feel well, I should see a doctor or a nurse.
14	Doctors and nurses control my health.
15	When I get well it's usually because other people (like family, friends, doctors, or nurses) have been taking care of me.
18	I can only do what my doctor tells me to do about my health.
21#	I always go to the nurse right away if I get hurt at school. (Parcel & Meyer #14)
24#	Whenever I feel sick, I go to see the school nurse right away. (Parcel & Meyer #18)

Note. Items with no wording changes from the original MHLC Scales are designated with asterisks. Items from Parcel and Meyer (1978) are designated with pound signs. The item categorizations here reflect those suggested by recommended scoring keys.