DOCUMENT RESUME

ED 327 543 TM 014 347

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| TITLE | Validity of a Measure of Children's Health Locus of Control: A Second-Order Factor Analysis. |
| SPONS AGENCY | National Heart, Lung, and Blood Inst. (DHHS/NIH), Bethesda, MD. |
| PUB DATE | 28 Nov 89 |
| CONTRACT | NRDC-A-HL15103 |
| NOTE | 33p.; Paper presented at the Annual Meeting of the Southwest Educational Research Association (Austin, TX, January 25-27, 1990). |
| PUB TYPE | Speeches/Conference Papers (150) -- Reports - Research/Technical (143) |
| EDRS PRICE | MF01/PC02 Plus Postage. |
| DESCRIPTORS | *Elementary School Students; Factor Analysis; *Factor Structure; Grade 4; Grade 5; Grade 6; Health Education; Intermediate Grades; *Locus of Control; Psychological Testing; Student Attitudes; *Test Validity; Urban Schools |
| IDENTIFIERS | *Multidimensional Health Locus of Control Scales; *Second Order Effects |


ABSTRACT

The study reported in this paper investigated the structure of the health locus of control beliefs of elementary school children using second-order factor analysis and the measurement characteristics of the Multidimensional Health Locus of Control (MHLC) Scales. Changes of wording were made in 10 of the MHLC Scales items in order to improve the readability of the measure. Subjects were two groups of fourth- through sixth-grade students from four elementary schools in a large urban school district in the southern United States. All schools had average academic achievement profiles. The first sample included 1,028 subjects (501 males and 527 females) who completed the 18 items on the revised MHLC Scales. The second sample included 524 subjects (264 males and 260 females) who, 1 year later, completed the 18 MHLC Scales items and an additional six items (two per scale) developed by G. S. Parcel and M. P. Meyer (1978). A total of 248 subjects were common to both samples. Separate analyses were conducted for the two groups in order to examine result stability. The results shed light on the validity of the MHLC Scales as well as on the nature of locus of control beliefs in general. A 33-item list of references, 9 data tables, and 1 figure are provided. A checklist of items used in the study instrument is appended. (TJH)

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# VALIDITY OF A MEASURE OF CHILDREN'S HEALTH LOCUS OF CONTROL: A SECOND-ORDER FACTOR ANALYSIS

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Paper presented at the annual meeting of the Southwest Educational Research Association, Austin, TX, January, 1990. This research was supported by funds from the National Heart, Lung and Blood Institute of the United States Public Health Service, National Research and Demonstration Center--Arteriosclerosis (NRDC-A) grant HL15103, "Heart Smart" School Intervention Program. Address reprint requests to Gerald S. Berenson, Boyd Professor of Medicine, LSU Medical Center, 1542 Tulane Avenue, New Orleans, LA 70112-2822, or to Bruce Thompson, Research Professor of Education, College of Education, University of New Orleans, New Orleans, LA 70148.

*ABSTRACT*

*The present study investigated the structure of the health locus of control beliefs of children using second-order factor analytic methods. The Multidimensional Health Locus of Control (MHLC) measure may be used to place children in appropriate interventions, or by program evaluators to assess intervention effects. Subjects were two groups (n's = 1,028 and 524) of fourth through sixth graders. Separate analyses were conducted for the two groups so as to be able to examine result stability. The results shed light on the validity of the MHLC scales and as well on the nature of locus of control beliefs more generally.*

*Some research indicates that beliefs about the sources of health may affect health related behaviors and actual health outcomes (Riggs & Noland, 1984, p. 431). "Locus of control" has emerged as an important construct referring to individuals' beliefs about the origins of their situations. Locus of control constructs have been elaborated in social learning theory (Rotter, 1968) and can be assessed using a variety of measurement tools. 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.*

*Marsh and Richards (1987, pp. 39-40) suggest that, "During the last two decades locus of control has been one of the most widely studied of personality constructs." For example, Strickland (1973) cited 11 studies reporting 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, DeVillis, DeVillis, Wallston and Wallston (1980) found that information-seeking behaviors were associated in theoretically expected ways with locus of control scores.*

*Studies treating health locus of control as an outcome* variable have also suggested that the construct behaves in theoretically expected ways. For example, non-experimental status studies have generally reported expected results, i.e., people with chronic illness perceive themselves to have less control over their health than do healthy individuals. As Wallston and Wallston (1981, p. 217) summarize existing status-study research:

> Chronically ill patients look as expected with relatively low beliefs in health internality and relatively high beliefs in health externality, both chance and powerful others. Healthy adults differ from college students in their greater beliefs in powerful others and lower beliefs in health internality.

Thus, Winefield (1982, p. 617) reported that "Hospitalized acutely ill men [heart attack patients] expressed greater confidence than healthy controls that powerful others such as physicians can control their health; this seems likely to be an adaptive response to the dependence and uncertainty of their situation."

One consensus that has emerged from this literature is the view that prediction of generalized behavior requires general measures of expectancy, while more specific predictions require more specific measures of locus of control (Rotter, 1975, 1982). 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." Lefcourt (1981, p. 386) reviewed locus of control research and concluded that *"global measures afford only weak predictive power to the assumed criteria. The more specific a measure, the greater will be the power of that measure in predicting the relevant criteria." 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."*

*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. The MHLC Scales consider three origins of health: (a) Powerful Others (PO), (b) Chance (C), and (c) Internal (I). 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." But as Wolf, Sklov, Hunter and Berenson (1982, p. 334) argued, "The bulk of the research on locus of control has been conducted with adults; however, it is important to assess childhood antecendents of this orientation." 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 (Wallston, Wallston & DeVellis, 1978, p. 162).*

*The present study investigated the measurement characteristics of the Multidimensional Health Locus of Control Scales when the Scales are used with elementary school children.*

As noted previously, the 18-item MHLC measure was written at an elementary school reading level. Some wording changes were made in 10 of the items in order to improve the readability of the measure. Most of these changes involved simplifying sentence structure. 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.

Some previous research has evaluated the measurement integrity, including the test-retest reliability and the construct validity, of the revised MHLC scales (Thompson, Butcher & Berenson, 1987; Thompson, Webber & Berenson, 1987, 1988, 1989). But what is needed is more research into the nature of children beliefs about the origins of health, not unlike the classical "The nature of..." factor analytic studies conducted in other areas of inquiry (e.g., Guilford, 1967; Rokeach, 1973). That is, what is needed is a model of the construct of health locus of control.

Previous research does not yet clearly indicate how strongly the three scales are correlated with each other. If the Powerful Others, Chance, and Internal scales are somewhat correlated in the population universe of true scores, then the three constructs exist as somewhat discrete dimensions that may be subsumed by an overarching higher-order subset of scales or dimensions. The results from previous studies presented in Table 1 suggest that (a) the three scales may be somewhat correlated and thus are partially discrete, but also may be subsumed by higher-order dimensions, and that (b) results are not entirely consistent across previous studies.

INSERT TABLE 1 ABOUT HERE.

Many researchers acknowledge the prominent role that factor analysis can play in efforts to develop a structural model relating constructs and in validating measures of constructs. For example, Nunnally (1978, p. 111) notes that "construct validity has been spoken of as 'trait validity' and 'factorial validity.'" Similarly, Gorsuch (1983, pp. 350-351) suggests that

> A prime use of factor analysis has been in the development of both the theoretical constructs for an area and the operational representatives for the theoretical constructs... If a theory has clearly defined constructs, then scales can be directly built to embody those constructs. However, it is often the case that the theories in a particular area are sufficiently undeveloped so that the constructs are not clearly identified.

In short, "factor analysis is intimately involved with questions of validity... Factor analysis is at the heart of the measurement of psychological constructs" (Nunnally, 1978, pp. 112-113). The purpose of the present study was to employ factor analytic methods to evaluate whether first-order health locus of control constructs are subsumed at a second-order level by a smaller number of overarching dimensions or metaconstructs.

## Method

### Subjects

Subjects in the study were students from four different elementary schools in a large urban school district in the southern United States. The schools were selected partly due to their comparable achievement profiles and the similarity of student bodies with respect to socioeconomic status. All four schools had academic achievement profiles that were average.

Two samples were employed in the analysis. As Gorsuch (1983, p. 335) notes:

> To the extent that invariance can be found across systematic changes in either variables or individuals, 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.

The first sample consisted of 1,028 subjects who completed the 18 items on the revised Multidimensional Health Locus of Control (MHLC) scales (Wallston et al., 1978). The second sample consisted of 524 subjects who one year later completed the 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), we have found that using additional items on each scale helps to improve the psychometric properties of the MHLC scales and also allows generalization across measures. Table 2 presents descriptive information regarding the two samples; 248 of the subjects were common to both samples.*

*INSERT TABLE 2 ABOUT HERE.*

## Analysis

*Many researchers are familiar with the extraction of principal components from either a variance-covariance matrix or a correlation matrix. However, the factors extracted from such matrices, called first-order factors, can be rotated obliquely such that the rotated factors themselves are correlated. This interfactor matrix can then, in turn, also be subject to factor analysis. These "higher order" factors would be termed second-order factors.*

*As Kerlinger (1984, p. xivv) noted, "while ordinary factor analysis is probably well understood, second-order factor analysis, a vitally important part of the analysis, seems not to be widely known and understood." Example applications of second-order factor analysis are reported by Kerlinger (1984), Thompson and Borrello (1986), and by Thompson and Miller (1981).*

*For the analysis involving 18 variables and 1,028 subjects, the first seven first-order prerotation eigenvalues (Thompson,* *1989) were 2.97, 1.76, 1.31, 1.18, 1.01, 0.98, and 0.93. Five principal components were extracted from the intervariable correlation matrix. These components were then obliquely rotated using the promax method developed by Henrickson and White (1964). The "pivot" power used in promax rotation impacts how highly the first-order factors are correlated. In the present study the conventional pivot power of 3.0 was employed.*

*The next step of the analysis involves the extraction of second-order factors from the matrix of correlations among the first-order promax-rotated components. Again, several criteria can be employed to decide the number of second-order factors to extract. However, the eigenvalue-greater-than-one rule can be useful in guiding this decision (Gorsuch, 1983, p. 244). In the present example the prerotation eigenvalues (Thompson, 1989) for the first three second-order principal components were 1.47, 1.13, and 0.91. Therefore, two second-order components were extracted from the first-order interfactor correlation matrix and then rotated to the varimax criterion.*

*At this point some researchers consider the analysis to be complete and move to interpret the results. However, how best to conduct this interpretation is open to discussion. Even some very sophisticated researchers attempt to interpret the second-order factors using only the first-order factors (Thompson, 1985, p. 430). But as Gorsuch (1983, p. 245) argues,*

> *Interpretations of the second-order factors would need to be based upon the interpretations of the first-order factors that are, in turn, based upon the interpretations of the variables... To avoid*

*basing interpretations upon interpretations, the relationships of the original variables to each level of the higher-order factors are determined.*

*Gorsuch (1983, p. 247) suggests that one way to avoid "interpretations of interpretations" is to postmultiply the first-order factor pattern matrix by the orthogonally rotated second-order factor pattern matrix. However, if rotation is used to facilitate interpretation of other structures, it also seems plausible to rotate the product matrix itself to the varimax criterion. Table 4 presents the 18x2 varimax-rotated second order factor matrix.*

*INSERT TABLE 4 ABOUT HERE.*

*Another useful interpretation aid involves the manipulations proposed by Schmid and Leiman (1957) and also explained by Gorsuch (1983, pp. 248-254). This solution "orthogonalizes" the two levels of analyses to each other and also allows interpretation of both levels of analysis in terms of the observed variables. Table 5 presents the Schmid-Leiman solution for these data. It should be noted that the first two columns in Table 5 are also equivalent to the unrotated product matrix that Gorsuch (1983, p. 247) suggests can be interpreted without rotation.*

*INSERT TABLE 5 ABOUT HERE.*

*For the second sample of 524 subjects responding to the pool of 24 (18 + 6) items one year later, the first several first-*

*order prerotation eigenvalues (Thompson, 1989) were 3.03, 2.56, 1.87, 1.36, 1.10, 1.06, 1.04, and 0.94. Seven first-order principal components were extracted and rotated to the promax criterion. The first four prerotation eigenvalues of the interfactor correlation matrix were 1.86, 1.28, 1.05, and 0.82. Because the previous research summarized in Table 1 suggests that at most two scales of the health locus of control contruct ever share appreciable common variance, in one analysis with these data only two second-order factors were extracted in analyses associated with Tables 6 and 7. However, to evaluate the effects of extracting an additional second-order factor, the results reported in Tables 8 and 9 were also conducted.*

*INSERT TABLES 6 THROUGH 9 ABOUT HERE.*

## Discussion

*Correlated scale score or factors always imply the potential utility or even the necessity of higher order analysis. As Gorsuch (1983, p. 255) notes, "Rotating obliquely in factor analysis implies that the factors do overlap and that there are, therefore, broader areas of generality than just a primary factor. Implicit in all oblique rotations are higher-order factors." Thus, the previous research findings summarized in Table 1 suggested that second-order factor analysis might be useful in developing a model of health locus of control constructs.*

*The first analysis involved responses of 1,028 subjects to 18 Multidimensional Health Locus of Control (MHLC) (Wallston et* *al., 1978) scale items. The varimax-rotated product of the first-order 18x5 promax-rotated factor pattern matrix times the second-order 5x2 varimax-rotated factor pattern matrix, reported in Table 4, indicates that five of the six Chance (C) items are most highly correlated with second-order factor I. Three of the six Powerful Others (PO) items are also most highly correlated with second-order factor I, and the correlations with factor I of the three remaining Powerful Others items are still potentially noteworthy, ranging from +.176 to +.264. Five of the six Internal items are most highly correlated, and negatively so, with second-order factor II. Three Powerful Others items, on the other hand, are positively correlated with factor II.*

*As noted previously, the first-two columns of Table 5 are equivalent to the unrotated product of the first- and second-order matrices. In this matrix five of six Powerful Others items and five of six Chance items have the highest absolute values for coefficients on second-order factor I. Four of the six Internal items have the highest absolute values for coefficients, though they are negative, on factor II, and one Internal item (12) has the largest absolute value coefficient on factor II, but the coefficient is positive (+.445).*

*The columns in Table 5 headed "A" through "E" are the first-order factors orthogonalized for variance in the second-order factors. These results inform the researcher what, if anything, is "left behind" in the first-order factors after the second-order factors have been created. Factors "A" through "C" measure Chance, Powerful Others, and Internal, respectively. Factor "D" has a noticeable amount of trace (0.76) and is a "doublet" factor* involving two Chance items (16 and 3). These two items appear to be somewhat discrete from the remaining four Chance items that were most associated with residualized first-order factor "A". Items 16 and 3 both include the phrase "no matter what I do" and appear to suggest overtones of fatalism with respect to health outcomes, while the remaining items appear to emphasize the randomness of health origins. This distinction is lost at the second-order level, since the Chance items tended to aggregate together on second-order factor I. The finding illustrates how first-order and second-order analyses can yield different perspectives on the same data.

It is noteworthy that factor "B" has the most trace (1.11) left at the first-order level, as reported in Table 5. This suggests that variance in Powerful Others items is somewhat disproportionately represented at the first-order as against the second-order level.

With respect to the varimax-rotated product matrix presented in Table 6 for the second sample of 524 subjects who completed 24 rather than 18 items, one second-order factor again emerges as a predominantly Internal dimension. Three Powerful Others items (4, 11, 24) were most correlated with this factor, but the three items differ from two of the three items (4, 5, 15) most correlated with the Internal factor reported in Table 4. All eight Chance items and five of the eight Powerful Others items were positively related with second-order factor II.

Essentially the same results occur with respect to the unrotated product matrix reported as the first two columns of

*Table 7. With respect to the first-order factors in Table 7, labelled "A" through "G", the factors represent elements of Chance, Powerful Others, Internal, Chance, Internal, Powerful Others, and Internal, respectively. Factor "D", a Chance factor, again involves items 3 and 16 and has overtones of fatalism as against randomness (factor "A") as an origin of health.*

*Item 12, an Internal item, again behaves somewhat anomalously--in the Table 4 and 6 varimax-rotated product matrices this item has a different sign with the second-order factor than did all the other Internal items. Item 12 states, "When I get sick, I am to blame." The other Internal items merely make objective statements about health originating in one's own behavior. Thus, item 12 and factor "E" appears to involve a unique component of guilt. Internal items 2 and 7 are primary consituents of factor "C"; the items respectively contain the phrases "my own actions" and "what I do", and thus have a connotation of activity with respect to Internal origins of health. Internal items 9 and 19 define factor "G"--these items both involve Internal origins of health emphasizing the prevention of illness.*

*Items (4, 11, 21, and 24) delineating Powerful Others factor "B" appear to differ somewhat from Powerful Others items 5, 14, and 18, which define factor "F". The first four items involve going to see doctors or nurses, while the last three items involve directly attributing health to origins in the behavior of family members or health care providers. Thus, the subjects perceived nuances between making a decision to help seeking from a health care provider versus making a general external* attribution that these external sources were the origins of health.

When three second-order factors were extracted, the three dimensions of Internal, Chance, and Powerful Others emerge as clear and distinct dimensions, as reported in Table 8. The first-order factors reported in Table 9 in the columns headed "A" through "G" represent the same dynamics reflected for these factors in Table 7, but the first-order factors have less trace variance since variance from the first-order has now been moved into the third second-order factor. This shift in trace (1.66 vs 0.83, and 0.89 vs 0.49) is most noticeable for first-order Powerful Others factors "B" and "F", since the emergence of a discrete Powerful others second-order factor absorbs first-order variance.

In the aggregate these results suggest that two external factors, Chance and Powerful Others, tend to be somewhat correlated and are generally distinct from the Internal dimension. However, each of the three postulated components can be identified as an uncorrelated second-order factor with multiple first-order elements. This finding suggests the possible model for health locus of control constructs presented in Figure 1.

INSERT FIGURE 1 ABOUT HERE.

In general, the structures underlying responses to the revised version of the Multidimensional Health Locus of Control (MHLC) Scales across samples and item pools are sensible although *they are somewhat complex. The findings suggest that the measure has reasonable validity. The results suggest that the measure may have important applications in school settings. For example, the measure might be used to evaluate intervention programs designed to affect students' health attitudes or behaviors. As Parcel and Meyer (1978, p. 149) note,*

> *A frequently stated goal for health education programs for children is development of self-responsibility for health behavior. How well health education programs meet this goal is difficult to assess. The expected impact of such a health education program is often remote from the time the program occurs. Changes in intermediate variables such as knowledge and attitudes are often sought.*

*Thus, the measure might be used to evaluate changes in an important intermediate attitude variable, i.e., feelings of self-responsibility for health.*

*The measure might also be used by counselors or teachers for diagnostic purposes, i.e., to assign students to intervention methods that are most likely to achieve desired outcomes. As Riggs and Noland (1984, p. 434) observe:*

> *For students who are internal, health instruction could emphasize decision-making skills and could provide opportunities to take responsibility for one's own health. For students who are external and have beliefs in powerful others, an attempt might be made to involve a peer, parent, school nurse, or teacher in the learning process and in attempts to*

change health behavior.

In conclusion, the revised version of the Multidimensional Health Locus of Control (MHLC) Scales apparently should be useful in further research. Additional research regarding the nature of health locus of control and the testing of models such as the one posited in the present study also appears to be warranted.

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Table 1
Bivariate Correlation Coefficients
Among Raw Scale Scores in Previous Studies

| Study | Internal and Chance | Internal and Powerful Others | Chance and Powerful Others |
|---|---|---|---|
| Larde & Clopton (1983) | -.06 ( 0%) | +.18 ( 3%) | +.53 (28%) |
| Russell & Ludenia (1983) | -.13 ( 2%) | +.26 ( 7%) | +.05 ( 0%) |
| Wallston et al. (1978) | -.34 (12%) | +.15 ( 2%) | +.06 ( 0%) |

Note. Coefficients of determination, expressed as percentages of common variance between variables, are presented in parentheses.

Table 2
Sample Demographics for Both Measurement Occasions

| Variable | Fa Yr. #1 (n = 1028) | | Fa Yr. #2 (n = 524) | | Only Fa #2 (n = 276) | |
|---|---|---|---|---|---|---|
| Sex | | | | | | |
| Boy | 501 | 48.7% | 264 | 50.4% | 143 | 51.8% |
| Girl | 527 | 51.3% | 260 | 49.6% | 133 | 48.2% |
| Race | | | | | | |
| White | 530 | 51.6% | 356 | 67.9% | 192 | 69.6% |
| Black | 364 | 35.4% | 117 | 22.3% | 59 | 21.4% |
| Hispanic | 66 | 6.4% | 41 | 7.8% | 21 | 7.6% |
| Indian | 1 | 0.1% | 0 | 0.0% | 0 | 0.0% |
| Oriental | 67 | 6.5% | 10 | 1.9% | 3 | 1.1% |
| School | | | | | | |
| A | 277 | 26.9% | 302 | 57.6% | 161 | 58.3% |
| B | 254 | 24.7% | 222 | 42.4% | 115 | 41.7% |
| C | 268 | 26.1% | 0 | 0.0% | 0 | 0.0% |
| D | 229 | 22.3% | 0 | 0.0% | 0 | 0.0% |
| Grade | | | | | | |
| Fourth | 396 | 38.5% | 158 | 30.2% | 155 | 56.2% |
| Fifth | 376 | 36.6% | 199 | 38.0% | 72 | 26.1% |
| Sixth | 256 | 24.9% | 167 | 31.9% | 49 | 17.8% |

Table 3
Classification of Items into Three Scales

| Item | PO | Factor C | I | Expected Construct | |
|---|---|---|---|---|---|
| 1 | .0 | .0 | 1.0 | Internal | (I) |
| 2 | .0 | .0 | 1.0 | Internal | (I) |
| 3 | .0 | 1.0 | .0 | Chance | (C) |
| 4 | 1.0 | .0 | .0 | Powerful Others | (PO) |
| 5 | 1.0 | .0 | .0 | Powerful Others | (PO) |
| 6 | .0 | .0 | 1.0 | Internal | (I) |
| 7 | .0 | .0 | 1.0 | Internal | (I) |
| 8 | .0 | 1.0 | .0 | Chance | (C) |
| 9 | .0 | .0 | 1.0 | Internal | (I) |
| 10 | .0 | 1.0 | .0 | Chance | (C) |
| 11 | 1.0 | .0 | .0 | Powerful Others | (PO) |
| 12 | .0 | .0 | 1.0 | Internal | (I) |
| 13 | .0 | 1.0 | .0 | Chance | (C) |
| 14 | 1.0 | .0 | .0 | Powerful Others | (PO) |
| 15 | 1.0 | .0 | .0 | Powerful Others | (PO) |
| 16 | .0 | 1.0 | .0 | Chance | (C) |
| 17 | .0 | 1.0 | .0 | Chance | (C) |
| 18 | 1.0 | .0 | .0 | Powerful Others | (PO) |
| 19 | .0 | .0 | 1.0 | Internal | (I) |
| 20 | .0 | 1.0 | .0 | Chance | (C) |
| 21 | 1.0 | .0 | .0 | Powerful Others | (PO) |
| 22 | .0 | 1.0 | .0 | Chance | (C) |
| 23 | .0 | .0 | 1.0 | Internal | (I) |
| 24 | 1.0 | .0 | .0 | Powerful Others | (PO) |

*Note*. Items 19 through 24 are items 3, 6, 11, 14, 16 and 18 from Parcel and Meyer (1978).

Table 4
Varimax-Rotated Product Matrix
(n=1,028, v=18)

| Item | I | II | $h^2$ |
|---|---|---|---|
| 14 (PO) | .669 | -.006 | .447 |
| 18 (PO) | .617 | .098 | .390 |
| 16 (C) | .497 | -.030 | .248 |
| 8 (C) | .485 | .167 | .263 |
| 13 (C) | .481 | .187 | .266 |
| 3 (C) | .406 | .033 | .166 |
| 11 (PO) | .391 | .288 | .236 |
| 10 (C) | .271 | .259 | .141 |
| 12 (I) | -.466 | .313 | .315 |
| | | | |
| 6 (I) | .023 | -.554 | .307 |
| 1 (I) | .073 | -.436 | .196 |
| 2 (I) | .036 | -.385 | .150 |
| 7 (I) | -.219 | -.273 | .122 |
| 9 (I) | .008 | -.197 | .039 |
| 4 (PO) | .199 | .314 | .138 |
| 15 (PO) | .176 | .466 | .248 |
| 5 (PO) | .264 | .480 | .300 |
| 17 (C) | .234 | .518 | .323 |
| | | | |
| Trace | 2.40 | 1.89 | 4.29 |

Table 5

Schmid and Leiman Solution for $n$=1,028 and $v$=18

| Item | I | II | A | B | C | D | E | $h^2$ |
|---|---|---|---|---|---|---|---|---|
| 14 (PO) | .632 | -.219 | .248 | -.285 | .159 | .114 | -.084 | .635 |
| 18 (PO) | .616 | -.103 | .170 | -.397 | .083 | .079 | -.075 | .596 |
| 13 (C) | .516 | .024 | .480 | .045 | -.037 | -.036 | -.054 | .504 |
| 8 (C) | .513 | .004 | .493 | .014 | .057 | -.063 | .010 | .514 |
| 11 (PO) | .462 | .149 | -.007 | -.500 | -.011 | .041 | .047 | .489 |
| 16 (C) | .462 | -.187 | -.011 | .004 | .033 | .538 | -.031 | .540 |
| 10 (C) | .339 | .160 | .301 | .059 | -.210 | -.013 | -.084 | .286 |
| 5 (PO) | .403 | .371 | .146 | -.134 | .014 | .166 | .346 | .486 |
| 3 (C) | .396 | -.098 | -.069 | -.025 | -.013 | .508 | -.003 | .430 |
| 4 (PO) | .288 | .235 | -.095 | -.505 | -.112 | -.062 | .009 | .419 |
| 7 (I) | -.[illegible]95 | -.189 | .027 | .139 | .291 | -.167 | .111 | .267 |
| 6 (I) | -.154 | -.532 | .032 | .264 | .379 | .105 | -.037 | .534 |
| 1 (I) | -.069 | -.437 | -.145 | -.137 | .397 | .053 | .004 | .396 |
| 2 (I) | -.089 | -.377 | .073 | -.147 | .313 | -.300 | -.113 | .377 |
| 9 (I) | -.055 | -.189 | .118 | .184 | .362 | .048 | .223 | .269 |
| 15 (PO) | .315 | .385 | 0.001 | -.402 | -.065 | -.029 | .208 | .458 |
| 17 (C) | .386 | .417 | .252 | -.146 | -.172 | -.063 | .145 | .462 |
| 12 (I) | -.342 | .445 | -.170 | -.029 | .064 | -.120 | .451 | .567 |
| Trace | 2.74 | 1.55 | .82 | 1.11 | .75 | .76 | .49 | 8.23 |

Note. The row after the orthogonalized matrix presents the sum of the entries in a given column. The first two columns represent the second order factors. The next five columns represent the first order solution, based on variance orthogonal to the second order (Gorsuch, 1983, pp. 248-254).

Table 6
Varimax-Rotated Product Matrix
($\underline{n}$=524, $\underline{v}$=24)

| Item | I | II | $h^2$ |
|---|---|---|---|
| 1 (I) | -.513 | .013 | .264 |
| 9 (I) | -.511 | .169 | .290 |
| 6 (I) | -.482 | -.011 | .232 |
| 23 (I) | -.476 | -.005 | .227 |
| 19 (I) | -.365 | .099 | .143 |
| 7 (I) | -.328 | .008 | .107 |
| 2 (I) | -.271 | .102 | .084 |
| 12 (I) | .163 | -.007 | .027 |
| 24 (PO) | .201 | .124 | .056 |
| 11 (PO) | .287 | .231 | .136 |
| 4 (PO) | .441 | .057 | .198 |
| 8 (C) | .002 | .608 | .370 |
| 13 (C) | -.004 | .562 | .315 |
| 14 (PO) | -.282 | .516 | .346 |
| 3 (C) | -.169 | .512 | .290 |
| 5 (PO) | .232 | .499 | .302 |
| 20 (C) | -.295 | .462 | .300 |
| 22 (C) | -.100 | .438 | .202 |
| 16 (C) | -.093 | .427 | .191 |
| 17 (C) | .422 | .423 | .358 |
| 18 (PO) | -.046 | .394 | .157 |
| 10 (C) | .165 | .362 | .158 |
| 15 (PO) | .236 | .274 | .131 |
| 21 (PO) | .131 | .265 | .087 |
| Trace | 2.19 | 2.78 | 4.97 |

## Table 7
## Schmid and Leiman Solution for *n*=524 and *v*=24

| Item | I | II | A | B | C | D | E | F | G | $h^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 (I) | -.510 | .060 | -.048 | -.040 | .318 | .046 | -.062 | -.060 | -.106 | .390 |
| 9 (I) | -.493 | .216 | .025 | .043 | .075 | .159 | -.023 | -.035 | -.399 | .485 |
| 6 (I) | -.481 | .034 | -.066 | -.181 | .184 | .135 | .040 | .012 | -.245 | .383 |
| 23 (I) | -.474 | .040 | -.051 | .115 | .210 | -.109 | .043 | -.166 | -.263 | .397 |
| 19 (I) | -.354 | .133 | .089 | -.041 | -.046 | .015 | .219 | .015 | -.580 | .540 |
| 7 (I) | -.326 | .039 | .065 | -.222 | .470 | -.123 | .102 | -.057 | .093 | .419 |
| 2 (I) | -.260 | .127 | .070 | .142 | .601 | .058 | .078 | .187 | -.025 | .514 |
| 12 (I) | .162 | -.022 | -.088 | -.088 | .118 | -.099 | .611 | -.074 | -.203 | .486 |
| 24 (PO) | .212 | .104 | .031 | .672 | -.016 | -.024 | -.138 | .054 | -.042 | .534 |
| 15 (PO) | .260 | .250 | -.050 | .253 | .156 | .062 | .058 | -.231 | .313 | .380 |
| 11 (PO) | .308 | .203 | -.017 | .557 | .028 | .009 | .027 | -.107 | .075 | .465 |
| 4 (PO) | .445 | .016 | -.051 | .448 | -.002 | -.055 | .176 | .019 | .050 | .438 |
| 17 (C) | .460 | .382 | .306 | .163 | .132 | .078 | .220 | .154 | .072 | .579 |
| 8 (C) | .058 | .605 | .478 | .012 | .046 | -.003 | .072 | -.091 | -.093 | .623 |
| 13 (C) | .049 | .559 | .440 | .044 | .036 | -.019 | -.055 | -.129 | .024 | .533 |
| 14 (PO) | -.233 | .540 | .104 | .082 | .049 | .031 | -.047 | -.531 | .046 | .653 |
| 3 (C) | -.120 | .525 | -.014 | -.066 | .040 | .578 | -.090 | -.088 | .038 | .648 |
| 20 (C) | -.251 | .487 | .402 | -.129 | .022 | .001 | -.221 | -.160 | -.007 | .553 |
| 5 (PO) | .277 | .475 | .052 | -.177 | -.142 | .164 | .311 | -.397 | .108 | .650 |
| 22 (C) | -.059 | .445 | .453 | .008 | .030 | -.073 | -.092 | -.035 | -.076 | .429 |
| 16 (C) | -.052 | .434 | -.024 | .102 | -.059 | .540 | -.008 | .038 | -.183 | .532 |
| 18 (PO) | -.009 | .397 | .085 | .218 | -.193 | -.074 | .126 | -.445 | -.186 | .504 |
| 10 (C) | .198 | .345 | .378 | -.069 | -.067 | .025 | .006 | .086 | -.009 | .319 |
| 21 (PO) | .155 | .251 | -.013 | .599 | -.010 | .060 | -.084 | -.125 | -.010 | .473 |
| Trace | 2.19 | 2.79 | 1.09 | 1.66 | .90 | .77 | .74 | .89 | .90 | 11.93 |

*Note*. The row after the orthogonalized matrix presents the sum of the entries in a given column. The first two columns represent the second order factors. The next seven columns represent the first order solution, based on variance orthogonal to the second order (Gorsuch, 1983, pp. 248-254).

Table 8
Varimax-Rotated Product Matrix
with Three Second-Order Factors
($n$=524, $v$=24)

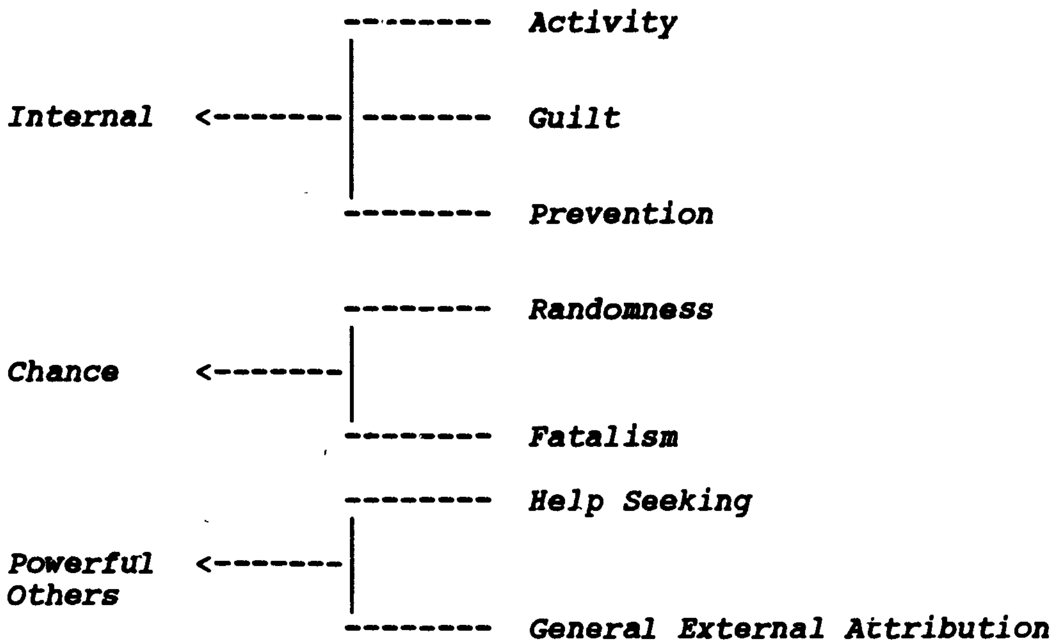
| Item | I | II | III | $h^2$ |
|---|---|---|---|---|
| 23 (I) | -.571 | -.104 | .100 | .347 |
| 1 (I) | -.515 | -.001 | -.106 | .276 |
| 9 (I) | -.456 | .212 | -.208 | .296 |
| 14 (PO) | -.455 | .361 | .383 | .484 |
| 6 (I) | -.390 | .062 | -.304 | .248 |
| 7 (I) | -.371 | -.040 | .024 | .140 |
| 2 (I) | -.338 | .036 | .100 | .126 |
| 19 (I) | -.299 | .153 | -.207 | .156 |
| 3 (C) | -.082 | .599 | -.153 | .389 |
| 8 (C) | -.027 | .595 | .147 | .376 |
| 13 (C) | -.045 | .536 | .166 | .317 |
| 20 (C) | -.238 | .517 | -.123 | .339 |
| 16 (C) | -.008 | .512 | -.143 | .283 |
| 22 (C) | -.085 | .459 | .006 | .218 |
| 10 (C) | .231 | .435 | -.056 | .245 |
| 5 (PO) | .132 | .423 | .334 | .308 |
| 17 (C) | .349 | .375 | .308 | .358 |
| 11 (PO) | .044 | .019 | .618 | .385 |
| 15 (PO) | .012 | .079 | .570 | .332 |
| 4 (PO) | .235 | -.121 | .549 | .371 |
| 21 (PO) | -.082 | .077 | .524 | .287 |
| 18 (PO) | -.235 | .228 | .451 | .310 |
| 24 (PO) | .020 | -.036 | .451 | .205 |
| 12 (I) | .035 | -.121 | .310 | .112 |
| Trace | 1.89 | 2.56 | 2.46 | 6.91 |

Table 9
Schmid and Leiman Solution for $n$=524 and $v$=24
with Three Second-Order Factors

| Item | I | II | III | A | B | C | D | E | F | G | $h^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 (PO) | -.634 | .256 | .128 | .096 | .058 | .044 | .026 | -.045 | -.393 | .045 | .658 |
| 23 (I) | -.527 | -.202 | -.168 | -.048 | .082 | .188 | -.090 | .041 | -.123 | -.261 | .484 |
| 18 (PO) | -.448 | .156 | .292 | .079 | .154 | -.173 | -.061 | .120 | -.330 | -.184 | .531 |
| 1 (I) | -.403 | -.078 | -.328 | -.045 | -.028 | .284 | .038 | -.059 | -.045 | -.105 | .378 |
| 2 (I) | -.348 | -.027 | -.065 | .064 | .100 | .537 | .048 | .074 | .138 | -.024 | .456 |
| 7 (I) | -.329 | -.102 | -.146 | .060 | -.156 | .421 | -.101 | .097 | -.042 | .093 | .375 |
| | | | | | | | | | | | |
| 3 (C) | -.108 | .586 | -.183 | -.013 | -.047 | .035 | .477 | -.085 | -.065 | .038 | .633 |
| 8 (C) | -.194 | .572 | .109 | .442 | .009 | .041 | -.002 | .068 | -.068 | -.092 | .591 |
| 16 (C) | -.032 | .512 | -.140 | -.023 | .072 | -.053 | .446 | -.008 | .028 | -.182 | .524 |
| 13 (C) | -.208 | .509 | .119 | .407 | .031 | .034 | -.016 | -.052 | -.096 | .024 | .497 |
| 20 (C) | -.244 | .478 | -.226 | .372 | -.091 | .019 | .001 | -.210 | -.118 | -.007 | .544 |
| 10 (C) | .151 | .469 | .048 | .350 | -.049 | -.060 | .021 | .006 | .064 | -.009 | .378 |
| 22 (C) | -.157 | .438 | -.040 | .419 | .006 | .027 | -.060 | -.088 | -.026 | -.075 | .412 |
| 5 (PO) | -.108 | .417 | .350 | .048 | -.125 | -.127 | .136 | .296 | -.294 | .107 | .546 |
| | | | | | | | | | | | |
| 4 (PO) | -.020 | -.117 | .597 | -.047 | .317 | -.002 | -.045 | .167 | .014 | .049 | .506 |
| 11 (PO) | -.243 | -.014 | .571 | -.015 | .393 | .025 | .008 | .026 | -.079 | .074 | .553 |
| 15 (PO) | -.259 | .043 | .513 | -.046 | .178 | .140 | .051 | .055 | -.171 | .310 | .516 |
| 21 (PO) | -.321 | .029 | .428 | -.012 | .423 | -.009 | .049 | -.080 | -.093 | -.010 | .484 |
| 17 (C) | .101 | .406 | .427 | .283 | .115 | .118 | .065 | .209 | .114 | .071 | .531 |
| 24 (PO) | -.179 | -.061 | .411 | .029 | .475 | -.014 | -.020 | -.131 | .040 | -.042 | .452 |
| 12 (I) | -.087 | -.134 | .294 | -.081 | -.062 | .106 | -.082 | .581 | -.055 | -.201 | .521 |
| 19 (I) | -.196 | .116 | -.323 | .082 | -.029 | -.041 | .013 | .208 | .011 | -.575 | .539 |
| 9 (I) | -.343 | .148 | -.395 | .023 | .030 | .067 | .131 | -.021 | -.026 | -.395 | .476 |
| 6 (I) | -.216 | .017 | -.448 | -.061 | -.128 | .164 | .111 | .038 | .009 | -.243 | .368 |
| | | | | | | | | | | | |
| Trace | 1.97 | 2.39 | 2.55 | .93 | .83 | .72 | .52 | .67 | .49 | .88 | 11.95 |

Note. The row after the orthogonalized matrix presents the sum of the entries in a given column. The first three columns represent the second order factors. The next seven columns represent the first order solution, based on variance orthogonal to the second order (Gorsuch, 1983, pp. 248-254).

*Figure 1*
*A Model of Health Locus of Control*



## APPENDIX A:
## Expected Structure for Items

Category/
No. Item

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)

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)

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)

Note. Items with no wording changes from the original MHLC Scales are designated with asterisks. Item from Parcel and Meyer (1978) are designated with pound signs.