Published in final edited form as:

J Health Psychol. 2010 October ; 15(7): 1064–1074. doi:10.1177/1359105309360427.

Validity of the Multidimensional Health Locus of Control Scales in American Sign Language

Ninad Athale, MD^{1,2}, Arianna Aldridge, MS^{2,5}, Vanessa L. Malcarne, PhD^{2,4,5}, Melanie Nakaji, PhD², Waheeda Samady, MD^{1,2}, and Georgia Robins Sadler, BSN, MBA, PhD^{1,2,3,5}

¹University of California, San Diego, School of Medicine, La Jolla, California

²Moore's UCSD Cancer Center, La Jolla, California

³Department of Surgery, UCSD School of Medicine, La Jolla, California

⁴San Diego State University, Department of Psychology, San Diego, California

⁵San Diego State University/University of California, San Diego Joint Doctoral Program in Clinical Psychology, San Diego, California

Abstract

Few instruments have been translated and validated for people who use American Sign Language (ASL) as their preferred language. This study examined the reliability and validity of a new ASL version of the widely-used Multidimensional Health Locus of Control (MHLC) scales. Deaf individuals ($N = 311$) were shown the ASL version via videotape, and their responses were recorded. Confirmatory factor analysis supported the four-factor structure of the MHLC. Scale reliabilities (Cronbach's alphas) ranged from .60 to .93. There were no apparent gender or ethnic differences. These results provide support for the new ASL version of the MHLC scales.

Keywords

Health locus of control; assessment; American Sign Language; Deaf; psychometrics

More than 35 million Americans have some degree of hearing loss, making it one of the most prevalent chronic conditions in the United States (Holt, Hotto, & Cole, 1994; Lethbridge-Cejku, Rose, & Vickerie, 2006; Lucas, Schiller, & Benson, 2004). Those who communicate in American Sign Language (ASL) and associate with the Deaf community are culturally Deaf, a distinction implied by the word "Deaf" with an upper case "D" (Barnett, 1999). Between 550,000 and one million Deaf individuals are primary users of ASL (Mitchell, Young, Bachleda, & Karchmer, 2006; Pleis & Lethbridge-Cejku, 2006).

Corresponding Author: Vanessa L. Malcarne, PhD, SDSU/UCSD Joint Doctoral Program in Clinical Psychology, 6363 Alvarado Court, Suite 103, San Diego, CA 92120-4913, Phone: 619 594-6495, Fax: 619 594-6780, malcarne@sciences.sdsu.edu. A videotaped copy of the MHLC scales in American Sign Language can be obtained from the authors by contacting Dr. Georgia Robins Sadler at sadler@ucsd.edu.

The content of this article is solely the responsibility of the authors and does not represent the official views of any of the funding agencies.

The Deaf community faces many of the same linguistic, cultural, and socioeconomic challenges as other minority groups. The average reading level of the Deaf community is at the 4th to 5th grade level, compared to the national average of 8th grade, and as many as one-third are illiterate because English is learned as a second language and without the benefit of auditory reinforcement, if it is learned at all (Holt, 1994; Vernon & Miller, 1991). Additionally, because few hearing people are familiar with or competent in Deaf culture and languages, the Deaf community harbors varying degrees of distrust of people who hear. This distrust is magnified for members of the medical community, where deafness is viewed almost solely from a pathophysiologic rather than a socio-cultural perspective (Barnett, 1999; Brauer, 1993; Ralston & Zazove, 1996). Lower English language proficiency limits job options for Deaf people, and as a result, socioeconomic status is lower for the aggregate Deaf community than for the hearing community (e.g., Olkin, Abrams, Preston, & Kirshbaum, 2006). The combination of these factors contributes to health disparities between Deaf and hearing people that are comparable to those found between mainstream and ethnic minority communities (Ebert & Heckerling, 1995; Heuttel & Rothstein, 2001).

Contributing to these disparities is the dearth of health-relevant psychosocial instruments that are available for clinicians and researchers to apply with people who use ASL as their primary language. Virtually all commonly used measures have been designed, validated, and normed for individuals who can hear (Jones, Mallinson, Phillips, & Kang, 2006). This limits the degree of confidence that can be ascribed to data collected when these instruments are used with the Deaf community (Fellinger et al., 2005). Although many Deaf persons can read, their literacy rate is substantially lower than that which is required by many of the psychosocial instruments designed for use with adults. Instruments are typically designed for a minimum of 7th–8th grade literacy, and in reality often require much higher levels. Further, requiring persons who use ASL as their primary language to receive and respond to stimuli presented in written English presents the same problems widely reported for assessment of any persons in a secondary non-preferred language (Bravo, 2003; Okazaki & Sue, 1995; Padilla & Medina, 1996). The lack of psychosocial instruments that have been translated into ASL and validated for use compromises health research on this population, as it restricts Deaf people's participation in research studies or potentially misrepresents those who do participate, limiting the reliability and generalizability of findings. Further, the lack of validated instruments compromises patient care for people who rely upon ASL, because instruments are not available for diagnostic and descriptive purposes.

Without the ability to consistently administer a standardized psychosocial instrument in ASL, researchers cannot have confidence in the accuracy of the instrument's results, and it becomes difficult to validate the instrument. There are unique challenges presented by translating instruments into ASL. ASL is an independent language that has its own grammar and syntax; it is not simply a manual version of English (Valli, Lucas, & Mulrooney, 2005). ASL uses signs to represent more general concepts that are not direct representations of words. For example, the sign "my" contains all of the following parameters: 1) shape of the hand, "closed-5"; 2) orientation of the hand, palm face toward chest; 3) location of the hand, upper chest; 4) movement of the hands, with the hand moving from space to chest (Schein & Stewart, 1995). All parameters must be used to create a sign. Facial expressions, head movements, body language, and eye gaze also play a major role in ASL grammatical

structure (Smith, Lentz, & Mikos, 1988). For example, eyes are raised for yes/no questions and eyebrows are furrowed for who, what, where, when, and why questions.

Vernon and Miller (2001) reviewed several efforts to use interpreter-administered ASL versions of major instruments such as the MMPI and the Diagnostic Interview Schedule-IV and reported significant problems, including interpretations that could only be understood by persons with high education or fluency levels, variations across translators, and extensive time required for administration. Brauer (1992) showed that using interpreters to do live translations of the items of a psychosocial instrument is not a viable solution to this problem because each administration of the instrument will have slight to significant variations, based on the interpreter's familiarity with mental health terminology (among other factors), and this can introduce significant bias (the "signer effect"). One solution is to record a video version of the instrument, after translating it into ASL. This makes it possible to consistently administer the instrument in a standardized format. The opportunity for mounting such instrument translations on the Internet has decreased the barriers to disseminating and accessing ASL translations of instruments.

Translating instruments carefully is necessary to maintain validity and accuracy, as complementary vocabulary and cultural concepts are not always present between languages (Bravo, 2003; Geisinger, 1994). There are various methodological approaches to translating instruments, but the preferred method involves forward translation followed by back translation and review/reconciliation of the translation by independent highly proficient bilingual participants (Bravo, 2003; Butcher & Han, 1996; Geisinger, 1994).

The Multidimensional Health Locus of Control (MHLC) Scales

The MHLC scales, developed by Wallston and colleagues (Wallston, Wallston & DeVellis, 1978; Wallston, Wallston, Kaplan, & Maides, 1976), comprise what has become one of the most widely used instruments in health psychology research, to the point that a special issue of the *Journal of Health Psychology* was recently dedicated to research using the MHLC (Wallston, 2005a). Originally consisting of three independent scales of Internal, Powerful Others, and Chance control, the MHLC was later expanded to include a fourth scale measuring God-related health locus of control (Wallston et al., 1999). The psychometric properties of the MHLC, including its factor structure, have been supported in a variety of investigations (for reviews, see Luszczyńska & Schwarzer, 2005; Wallston, 2005b). However, most studies to date have been of persons who identified as Caucasian. Few studies have examined the validity of the MHLC in diverse ethnic or cultural groups in the United States, and few studies have confirmed cross-group invariance in English versions of the MHLC for groups that speak and write English (Malcarne, Fernandez, & Flores, 2005). In addition, few translations have been validated, and no translation into ASL has been available until the recent creation of an ASL version by Samady, Sadler, Nakaji, & Malcarne, 2008). Unfortunately, the psychometric properties of this new ASL version have not yet been evaluated. Having an ASL version of the MHLC that is validated for use with people who are deaf can help clinicians and researchers better understand the health-related beliefs of this population, as well as gain insights into prevention and intervention strategies that could improve the health and well being of the community.

The present study investigated the psychometric properties of the newly developed ASL version of the MHLC.

Method

Participants

Deaf individuals ($N = 311$) consented to participate and were administered the *MHLC-ASL*. Study eligibility included being a self-identified member of the Deaf community, being at least 18 years of age, being mentally competent to complete the consenting process, and using ASL as one's preferred mode of communication. ASL fluency was not formally assessed. Ages for the 130 men (42%) and 181 women (58%) ranged from 18 to 93 with a mean of 42.5 years ($SD = 14.98$). The ethnic composition was 70% Caucasian American (213), 12% Hispanic American (37), 6% African American (17), 5% Asian American (16), 1% Mixed (4), and 6% Other (19). Education levels were 4% never completed high school (12), 21% completed high school (65), 29% completed some college (88), 25% completed college (78), and 21% post-college education (63).

Measures

MHLC-ASL—The MHLC (the three original Form A scales combined with the God HLC scale) consists of 24 statements representing beliefs about control of one's general health outcomes (Wallston et al., 1978). For each statement, answers are given on a Likert-type scale (1 = strongly disagree to 6 = strongly agree). The MHLC contains four 6-item scales: Internal, Powerful Others, Chance, and God HLC. Scores for each scale are generated by adding the responses to each of the six items in the scale; the score can range from 6 to 36, with higher numbers indicating stronger belief in that particular locus of control. There is no total score for the MHLC.

The ASL version of the MHLC (the *MHLC-ASL*) was created via forward and back-translation by focus groups of bilingual (ASL/English) individuals with reconciliation (the translation process is described in greater detail in Samady et al., 2008). Ten individuals were recruited to participate in two focus groups of five members each. Half were native signers who were themselves Deaf and used ASL as their primary mode of communication, and the other half were ASL interpreters. The first group (three native signers, two interpreters) forward-translated the MHLC statements. The second group (two native signers, three interpreters) back-translated the instrument, then compared it to the original written version of the MHLC and reconciled all differences as a group. A final version – designated as the *MHLC-ASL* – was agreed upon by the second group and captured on video according to ASL signing protocol for filming signers to assure clarity and quality of signing (Hooper, Miller, Rose, & Veletsianos, 2007; K International, 2009; Neidle, Sclaroff, & Athitsos, 2001; Signing Books, 2009).

Procedures

This study was fully approved by the universities' Institutional Review Boards. IRB-approved recruitment flyers were delivered to potentially eligible participants via e-mail or were distributed at events. In addition, people receiving emails or attending events were

asked to distribute flyers or verbal information about the study to persons they knew who might be eligible. Participants were recruited from southern California (San Diego, the greater Los Angeles metropolitan area, and Riverside), northern California (the San Francisco Bay area), and the Washington, D.C. metropolitan area.

After participants completed the informed consent (presented in written English, as there is no written version of ASL, and simultaneously translated into ASL by the study's research assistant who is a native signer), they were asked to respond to a brief sociodemographic survey and then administered the videotaped version of the *MHLC-ASL*. The videotape began with ASL instructions from a native signer on how to respond to the Likert-type questions of the *MHLC-ASL* and then depicted each of the final agreed-upon translations of the 24 statements. After each statement, there was a pause in the videotape for subjects to record their answers, which they did on an original paper version of the MHLC. Participants were given specific instructions to attend to the questions as they were presented in ASL on the videotape rather than focusing on the English statements on paper. They were told that the English paper version was to guide them to record their answer on the correct line, and that the goal of the study was to test the usefulness of the signed questions. They were told the video presentation of each item could be repeated upon request. This mixed method of administering the MHLC survey was intentionally selected because it most closely reflects the most widely used approach to accessing information within the Deaf community. While some members of the Deaf community rely solely upon English or ASL, the majority have varying levels of reliance on both sources of information (Grosjean, 1996; Padden, 1996). The goal of the study was to develop a version of the MHLC that would be valid for people who were primary users of ASL, or who preferred to use a combination of ASL and English. The time required from the beginning of the consenting process to the completion of the *MHLC-ASL* was approximately 30 minutes. Participants were given \$25 as a token of appreciation for their participation.

Statistical Analysis

The four-factor model of the *MHLC-ASL* was tested for this sample of Deaf participants ($N = 311$) using a maximum likelihood confirmatory factor analysis (CFA) procedure in EQS. The four factors represented Internal, Chance, Powerful Others, and God HLC, with each factor indicated respectively by six observed variables. Evaluating model fit focuses on two aspects that include: (1) goodness of fit of the model as a whole (e.g., descriptive fit indices) and (2) goodness of fit of individual parameter estimates (e.g., practical fit indices; Byrne, 2005). Since there are a wide variety of fit indices to choose from, Byrne (2005) suggests that only one or two global fit indices (e.g., RMSEA) need to be reported along with other fit-related indicators (e.g., parameter estimates such as factor loadings). Therefore, two descriptive and several practical fit indices were used to determine optimal model fit in this sample of participants. The χ^2 likelihood ratio test was reported but not used to assess model fit as it has been deemed unsatisfactory for numerous reasons (Tanaka, 1993). Because of these limitations, many researchers (Byrne, 2006; Hoyle, 2000; Sobel & Bohrnstedt, 1985; Tanaka, 1993) have suggested using multiple measures of model fit, including both global/descriptive and practical fit indices. In evaluating the statistical significance of individual model parameters (e.g., factor loadings, interfactor correlations) to determine practical fit, a

more stringent statistical significance level of .001 was employed. Furthermore, both descriptive and practical fit become more salient when the data are distributed non-normally, when conducting item analysis, and because the chi-square fit statistic is a function of sample size (i.e., large sample size inflates the chi-square statistic) (Byrne, 2005; Hu & Bentler, 1998; Jöreskog & Sörbom, 1993; MacCallum & Austin 2000). The data in the current study were non-normally distributed (Mardia's coefficient; $z = 30.14$), thus both descriptive (e.g., RMSEA) and practical fit indices were weighted more heavily than statistical fit in determining model fit.

In this analysis, the following measures were employed: (a) the Standardized Root Mean Square Residual (SRMR) (Byrne, 2005; Hu & Bentler, 1998; MacCallum & Austin, 2000), with values less than 0.08 indicating reasonable model fit and (b) Root Mean Squared Error of Approximation (RMSEA) with values less than 0.8 indicating reasonable model fit, especially if the interfactor correlation is high (Bentler, 1990; Steiger, 1990). SRMR represents the average value across all standardized residuals or the average discrepancy between the observed sample and hypothesized correlation matrices (Byrne, 2006; Hu & Bentler, 1995), and is a good indicator of fit. RMSEA has been recognized as one of the most informative criteria in covariance structure modeling because it is sensitive to model complexity and sample size (Byrne, 2006). MacCallum and Austin (2000) strongly recommend using RMSEA in evaluating model fit as: (1) it is adequately sensitive to model misspecification (Hu & Bentler, 1998); (2) commonly used interpretative guidelines yield appropriate conclusions about model quality (Hu & Bentler, 1998, 1999); and (3) confidence intervals can be built around the RMSEA values (Byrne, 2006). A model was determined to fit well if two or more criteria were met.

Interfactor correlations were examined to determine degree of independence between factors. Cronbach reliability coefficients were determined for the four scales of the MHLC (Nunnally & Bernstein, 1994). Analyses of variance were used to examine demographic differences.

Results

Missing Values

Of the 311 participants, only 10 had any missing values in their MHLC responses. Given the small number of omissions, all participants were included in the CFA for the four-factor model. However, for reliability and group comparisons, only participants who answered every question for a particular scale were included in the analysis for that scale.

Confirmatory Analyses

Results indicated the four-factor model of health locus of control did not fit the data well statistically ($\chi^2 [246, N = 311] = 544.62, p < .0001$), but did fit well descriptively (SRMR = .066, RMSEA = .064; RMSEA 90% CI ranged from .56 to .71). According to the interpretation of model fit guidelines aforementioned, the assessment of substantive and practical significance, such as a significant SRMR or RMSEA, as well as item loadings greater than $|.30|$, indicates adequate model fit. All but one of the standardized factor

loadings were generally large and statistically significant ($r > .30$) for the four factors including: Internal (.173 to .710), Chance (.323 to .708), Powerful Others (.445 to .638) and God HLC (.609 to .888) (see Table 1).

Interfactor correlations were examined utilizing the Pearson correlation coefficient in SPSS 15.0. The interfactor correlations among the four factors ranged from small to moderate and all but two were statistically significant. There was a negative and non-significant relationship between Internality and God/Religious ($r = -.065$, $p > .05$) as well as Internality and Chance ($r = -.004$, $p > .05$). A positive and significant relationship emerged between Internality and Powerful Others ($r = .135$, $p < .05$), God/Religious and Powerful Others ($r = .452$, $p < .001$), God/Religious and Chance ($r = .254$, $p < .001$), and finally Powerful Others and Chance ($r = .360$, $p < .001$).

Reliability of the Scales

The reliability coefficients indicating scale internal consistency (Cronbach's alpha) were high for God HLC ($\alpha = 0.93$), acceptable for Chance ($\alpha = 0.71$), and moderate for Powerful Others ($\alpha = 0.68$) and Internal ($\alpha = 0.60$).

Group Comparisons

Table 2 shows the mean and the range of scores for each scale of the *MHLC-ASL*, as well as how many participants answered each question for a given scale. There were no significant gender or ethnic differences (all p s $> .05$). However, significant differences emerged for education level related to God HLC ($p < .001$), Powerful Others ($p < .001$), and Chance scales ($p = .01259$), with a Bonferroni alpha of 0.0125. Post-hoc analyses were conducted with Bonferroni correction (alpha = .0025), yielding significant differences only for the God HLC and Powerful Others scales. For God HLC, individuals who never completed college had significantly higher scores than those with more than college ($p = .001$) and with any college ($p = .002$). Individuals who had a high school education had significantly higher scores than those with more than college, any years of college, and who completed college (all p s $< .001$), respectively. For Powerful Others, those who never completed high school scored significantly higher than individuals with more than college, who completed college, and those with any years of college (all p s $< .001$), respectively. Individuals with a high school education had significantly higher scores than those with more than college and who completed college (all p s $< .001$), respectively.

Discussion

The present results suggest that the MHLC scales were successfully translated into an ASL version that can be used with the American Deaf community. Confirmatory factor analysis provided support for the predicted four-factor structure. The fact that every item but one ("When I get sick, I am to blame") loaded significantly on its designated scale suggests that the constructs being measured by this questionnaire were similar to those of the original English MHLC. In a previous evaluation of the structure of the written English version of the MHLC, Chaplin et al. (2001) also confirmed the four-factor model. Interestingly, Chaplin et al. identified the same internal item as loading poorly. This may be because this

item is qualitatively different from the other five items on the Internal scale, in that it asks respondents to endorse blaming themselves for getting sick (a negative outcome; e.g., “When I get sick, I am to blame”), while the other five items ask respondents to attribute control to themselves for positive outcomes (e.g., “If I take the right actions, I can remain healthy”). Although there have been few examinations of the structure of this instrument across diverse populations, there is evidence that the core constructs consistently emerge. For example, Malcarne et al. (2005) assessed the factorial validity of the original MHLC (18 items with 6 items per scale, not including the God HLC scale) across three ethnic groups – Caucasian, Filipino, and Latino groups. Using confirmatory factor analysis, they determined that the original model did not fit well for these three ethnic groups. However, subsequent exploratory factor analysis yielded three largely independent scales correlating to Internal, Powerful Others, and Chance, albeit with fewer items loading significantly on each.

The interfactor correlations found for the MHLC-ASL suggested only moderate independence across the scales. According to the theoretical model, the four scales should be orthogonal to each other with little interfactor correlation; however, in reality this independence has not often been found. The initial validation study by Wallston et al. (1976) found that the Internal scale was independent of Powerful Others but negatively correlated with Chance, and the two external scales were positively correlated with each other. Chaplin et al. (2001) further confirmed this by showing that Powerful Others, Chance, and God HLC were intercorrelated while the Internal scale was very weakly related to the other three. The present analysis of the ASL version found some degree of overlap among the various scales, especially Powerful Others with Chance and God HLC. The weakest relationships (all $< .28$) were between Internal and the other scales, consistent with prior findings. Overall, these findings support the continued operationalization and use of the MHLC as four separate scales.

The reliability analysis found alpha coefficients that mirrored those reported in previous studies. Internal consistency coefficients for the three original scales (Internal, Chance, and Powerful Others) have consistently been reported in the range of .6 to .8 (e.g., Chaplin et al., 2001; Malcarne et al., 2005; Masters & Wallston, 2005; Moshki, Ghofranipour, Hajizadeh, & Azadfallah, 2007), similar to those found for the ASL version. Studies examining internal consistency of the God HLC scale have reported higher alphas (.88 in Chaplin et al., 2001; .93 in Masters & Wallston, 2005; .91 in Wallston et al., 1999), again consistent with the findings here.

Mean scores on the MHLC scales for the Deaf participants in this study followed a pattern commonly seen in studies using the three original scales of the MHLC (e.g., Malcarne et al., 2005; Moshki et al., 2007). The highest scores were found for the Internal scale, followed by Powerful Others, while Chance control was endorsed least strongly. Given that a score of 21 would represent an absolute midpoint on the scale, scores from the present sample would reflect mild positive endorsement of personal and powerful others' control, versus lower endorsement of the role of chance or God in controlling one's health.

There were no significant gender or ethnic differences for any of the scales on the *MHLC-ASL*. Education differences that were found are consistent with previous findings that

persons with less formal education are more likely to endorse more “external” sources of control over their health (e.g., Bell, Quandt, Arcury, McDonald, & Vitolins, 2002; Kuwahara et al., 2004).

Limitations

Participants were volunteers recruited from only three regions of the United States (two in California and all urban). The sample was more highly educated than the Deaf community overall. The demonstration of the new *MHLC-ASL*’s psychometric properties was limited primarily to structural validity, and confirmation of the four-factor structure does not necessarily confirm construct validity. Therefore, the *MHLC-ASL* should be administered in conjunction with other validated instruments in ASL measuring constructs predicted to have convergent or divergent relationships with health locus of control. Wallston (2005b) described the difficulties in validating the MHLC while suggesting that one method is to interact locus of control with various other related constructs, such as self-efficacy or perceived instrumentality. In reality, locus of control does not play a significant role in explaining health behavior by itself, but more likely in combination with several other constructs. In the Deaf population, this will be particularly difficult to investigate because so few instruments have been translated into ASL and validated.

Conclusion and Future Directions

The *MHLC-ASL*, a new ASL version of the MHLC, has been shown to be reliable and valid in a sample of Deaf individuals who use ASL as their preferred mode of communication. Although further examination of the *MHLC-ASL*’s psychometric properties is needed, this represents an important first step in supporting the use of this instrument in research and clinical settings. Future efforts could include the creation of a web-compatible form of the instrument that can be shown on computers using streaming video, thus yielding a form that can be consistently administered free of “signer effect.” Having a computer-accessible version of the *MHLC-ASL* should facilitate research to enhance the well being of the Deaf community and make it possible to use the MHLC to provide better tailored health promotion and care for Deaf patients. Also, every country has its own version of sign language, and therefore sign language translations of the MHLC scales would need to be developed and validated separately for international use.

Acknowledgments

The authors are especially grateful to the members of the Deaf community who participated in this study, as well as the following community members who assisted with the translation of the MHLC into ASL: Mala Poe, Danny Nakaji, Shane Marsh, Geri Mu, Rain Bosworth, Jennifer Raymond, Rory Osbrink, Karina Pederson, and Heather Ruth. The authors would like to thank: Patricia Branz, Shane Marsh, and Anna Schuster for recruiting the participants for this research study; Deborah Jenkins for filming and editing the MHLC/ASL; and Adam Stone for editing the final footage of the ASL-MHLC. In addition, this project was aided by the support of students. The authors also wish to acknowledge the supportive guidance given by: I. King Jordan, Ph.D. (Past-President, Gallaudet University); Linda Lytle, Ph.D. and the late Barbara Brauer, Ph.D. (Professors at Gallaudet University); Nancy Bloch (CEO of the National Association of the Deaf); Heidi Booth (Director of Health Education Services of Greater Los Angeles Agency on Deafness, Inc.); Leslie Elion, J.D. (Executive Director for Deaf Community Services of San Diego, Inc.); and Thomas Galey and Raymond Trybus, PhD (past Executive Directors, of Deaf Community Services of San Diego, Inc.).

Funding. This study was funded by the National Cancer Institute [grant numbers R25 CA101317, R25 CA108731, R25 CA65745, P30 CA023100, 1U54CA132379, and 1U54CA132384]; the National Institutes of Health, Division

of National Center on Minority and Health Disparities-sponsored [grant number P60 MD000220]; the UCSD Comprehensive Research Center in Health Disparities; the UCSD Academic Senate Grant; the Susan G. Komen for the Cure Foundation, a San Diego Affiliate grant award; the Alliance Healthcare Foundation; and the California Endowment.

References

- Barnett S. Clinical and cultural issues in caring for Deaf people. *Family Medicine*. 1999; 31:17–22. [PubMed: 9987607]
- Bell RA, Quandt SA, Arcury TA, McDonald J, Vitolins MZ. Health locus of control among rural older adults: Associations with demographic, health and preventive health characteristics. *Gerontology & Geriatrics Education*. 2002; 22(4):69–89.
- Bentler PM. Comparative fit indices in structural models. *Psychological Bulletin*. 1990; 107:38–246.
- Brauer BA. The signer effect on MMPI performance of Deaf respondents. *Journal of Personality Assessment*. 1992; 58:380–388. [PubMed: 1578332]
- Brauer BA. Adequacy of a translation of the MMPI into American Sign Language for use with Deaf individuals: Linguistic equivalency issues. *Rehabilitation Psychology*. 1993; 38:247–260.
- Bravo, M. Instrument development: Cultural adaptations for ethnic minority research. In: Bernal, G.; Trimble, JE.; Burlew, AK.; Leong, FTL., editors. *Handbook of racial & ethnic minority psychology*. Thousand Oaks, CA: Sage; 2003. p. 220-236.
- Butcher, JN.; Han, K. Methods of establishing cross-cultural equivalence. In: Butcher, JN., editor. *International adaptations of the MMPI-2: Research and clinical adaptations*. Minneapolis, MN: University of Minnesota Press; 1996. p. 44-63.
- Byrne BM. Factor analytic models: viewing the structure of an assessment instrument from three perspectives. *Journal of Personality Assessment*. 2005; 85:17–32. [PubMed: 16083381]
- Byrne, BM. Basic concepts, applications, and programming. 2. Mahwah, NJ: Lawrence Erlbaum Associates, Inc; 2006. *Structural equation modeling with EQS*.
- Chaplin WF, Davidson K, Sparrow V, Stuhr J, van Roosmalen E, Wallston KA. A structural evaluation of the expanded Multidimensional Health Locus of Control scale with a diverse sample of Caucasian/European, Native, and Black Canadian women. *Journal of Health Psychology*. 2001; 6:447–455. [PubMed: 22049392]
- Ebert DA, Heckerling PS. Communication with deaf patients: Knowledge, beliefs, and practices of physicians. *JAMA*. 1995; 273:227–229. [PubMed: 7807662]
- Fellinger J, Holzinger D, Dobner U, Gerich J, Lehner R, Lenz G, Goldberg D. An innovative and reliable way of measuring health-related quality of life and mental distress in the deaf community. *Social Psychiatry and Psychiatric Epidemiology*. 2005; 40:245–50. [PubMed: 15742231]
- Geisinger KF. Cross-cultural normative assessment: Translation and adaptation issues influencing the normative interpretation of assessment instruments. *Psychological Assessment*. 1994; 6:304–312.
- Grosjean, F. Living with two languages and two cultures. In: Parasnian, I., editor. *Cultural and language diversity and the deaf experience*. New York: Cambridge University; 1996. p. 20-37.
- Heuttel KL, Rothstein WG. HIV/AIDS knowledge and information sources among deaf and hearing college students. *American Annals of the Deaf*. 2001; 146:280–286. [PubMed: 11523204]
- Holt JA. Stanford Achievement Test, 8th ed: Reading comprehension subgroup results. *American Annals of the Deaf*. 1994; 138:172–175.
- Holt, J.; Hotto, S.; Cole, K. Demographic aspects of hearing impairment: questions and answers. Center for Assessment and Demographic Studies, Gallaudet University; 1994. Retrieved April 29, 2008 at <http://gri.gallaudet.edu/Demographics/factsheet.html>
- Hooper S, Miller C, Rose S, Veletsianos G. The effects of digital video quality on learner comprehension in an American Sign Language assessment environment. *Sign Language Studies*. 2007; 8:42–58.
- Hoyle, R. Confirmatory factor analysis. In: Brown, H., editor. *Handbook of applied multivariate statistics and mathematical modeling*. New York, NY: Academic Press; 2000. p. 465-497.
- Hu, LT.; Bentler, PM. Evaluating model fit. In: Hoyle, RH., editor. *Structural equation modeling: Concepts, issues, and applications*. Thousand Oaks, CA: Sage; 1995. p. 76-99.

- Hu LT, Bentler PM. Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods*. 1998; 3:424–453.
- Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*. 1999; 6:1–55.
- Jones EG, Mallinson RK, Phillips L, Kang Y. Challenges in language, culture, and modality: Translating English measures into American Sign Language. *Nursing Research*. 2006; 55:75–81. [PubMed: 16601619]
- Jöreskog, KG.; Sörbom, D. LISREL 8: Structural equation modeling with the SIMPLIS command language. Chicago, IL: Scientific Software; 1993.
- K International. Sign language video/dvd. 2009. Retrieved April 2, 2009, from http://www.k-international.com/sign_language_video
- Kuwahara A, Nishino Y, Ohkubo T, Tsuji I, Hisamichi S, Hosokawa T. Reliability and validity of the Multidimensional Health Locus of Control scale in Japan: Relationship with demographic factors and health-related behavior. *Tohoku Journal of Experimental Medicine*. 2004; 203:37–45. [PubMed: 15185970]
- Lentz, EM.; Mikos, K.; Smith, C. Signing naturally. San Diego, CA: DawnSign Press; 1988.
- Lethbridge-Cejku M, Rose D, Vickerie J. Summary health statistics for U.S. Adults: National Health Interview Survey, 2004. National Center for Health Statistics. 2006; 10:1–164.
- Lucas JW, Schiller JS, Benson V. Summary health statistics for U.S. adults: National Health Interview Survey, 2001. National Center for Health Statistics. 2004; 10(218):1–134.
- Luszczynska A, Schwarzer R. Multidimensional health locus of control: Comments on the construct and its measurement. *Journal of Health Psychology*. 2005; 10:633–642. [PubMed: 16033785]
- MacCallum RC, Austin JT. Applications of structural equation modeling in psychological research. *Annual Review of Psychology*. 2000; 51:201–226.
- Malcarne VL, Fernandez S, Flores L. Factorial validity of the Multidimensional Health Locus of Control scales for three American ethnic groups. *Journal of Health Psychology*. 2005; 10:657–667. [PubMed: 16033787]
- Masters KS, Wallston KA. Canonical correlation reveals important relations between health locus of control, coping, affect and values. *Journal of Health Psychology*. 2005; 10:719–729. [PubMed: 16033793]
- Mitchell RE, Young TA, Bachleda B, Karchmer MA. How many people use ASL in the United States? Why estimates need updating. *Sign Language Studies*. 2006; 6:306–335. Retrieved April 29, 2008 at http://gri.gallaudet.edu/Publications/ASL_Users.pdf.
- Moshki M, Ghofranipour F, Hajizadeh E, Azadfallah P. Validity and reliability of the Multidimensional Health Locus of Control scale for college students. *BMC Public Health*. 2007; 7:295. [PubMed: 17942001]
- Neidle C, Sclaroff S, Athitsos V. SignStream: A tool for linguistic and computer vision research on visual-gestural language data. *Behavior Research Methods, Instruments & Computers*. 2001; 33:311–320.
- Nunnally, JC.; Bernstein, IH. Psychometric theory. New York, NY: McGraw-Hill, Inc; 1994.
- Olkin R, Abrams K, Preston P, Kirshbaum M. Comparison of parents with and without disabilities raising teens: Information from the NHIS and two national surveys. *Rehabilitation Psychology*. 2006; 51:43–49.
- Okasaki S, Sue S. Methodological issues in assessment research with ethnic minorities. *Psychological Assessment*. 1995; 7:367–375.
- Padden, C. Early bilingual lives of deaf children. In: Parasnis, I., editor. Cultural and language diversity and the deaf experience. New York: Cambridge University; 1996. p. 99-116.
- Padilla, AM.; Medina, A. Cross-cultural sensitivity in assessment: Using tests in culturally appropriate ways. In: Suzuki, LA.; Meller, JP.; Ponterotto, JG., editors. Handbook of multicultural assessment: Clinical, psychological, and educational applications. San Francisco: Jossey-Bass; 1996. p. 3-28.
- Pleis, JR.; Lethbridge-Cejku, M. Summary health statistics for US adults: National Health Interview Survey, 2005. National Center for Health Statistics; 2006.

- Ralston E, Zazove P. Physicians' attitudes and beliefs about Deaf patients. *Journal of the American Board of Family Practice*. 1996; 9:167–173. [PubMed: 8743229]
- Samady W, Sadler GR, Nakaji M, Malcarne VL. Translation of the Multidimensional Health Locus of Control scales for users of American Sign Language. *Public Health Nursing*. 2008; 25:480–489. [PubMed: 18816365]
- Schein, JD.; Stewart, DA. *Language in motion: Exploring the nature of sign*. Washington, DC: Gallaudet University Press; 1995.
- Signing Books. *Filming the signer* [Electronic version]. 2009. Retrieved April 2, 2009, from <http://www.sign-lang.uni-hamburg.de/signingbooks/sbrc/grid/d71/guide12.htm>
- Sobel, ME.; Bohrnstedt, GW. Use of null models in evaluating the fit of covariance structure models. In: Tuma, NB., editor. *Sociological Methodology*. San Francisco: Jossey-Bass; 1985. p. 152-178.
- Steiger J. Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioral Research*. 1990; 25:173–180.
- Tanaka, J. Multifaceted conceptions of fit in structural equation models. In: Long, JBJ., editor. *Testing structural equation models*. Newbury Park, CA: Sage; 1993. p. 10-39.
- Valli, C.; Lucas, C.; Mulrooney, KJ. *Linguistics of American Sign Language*. 4. Washington, DC: Gallaudet University Press; 2005.
- Vernon M, Miller K. Interpreting in mental health settings: Issues and concerns. *American Annals of the Deaf*. 2001; 146:429–434. [PubMed: 11865573]
- Wallston BS, Wallston KA, Kaplan GD, Maides SA. The development and validation of the Health Locus of Control (HLC) scale. *Journal of Consulting and Clinical Psychology*. 1976; 44:580–585. [PubMed: 939841]
- Wallston KA. Overview of the special issue on research with the Multidimensional Health Locus of Control (MHLC) scales. *Journal of Health Psychology*. 2005a; 10:619–621.
- Wallston KA. The validity of the Multidimensional Health Locus of Control scales. *Journal of Health Psychology*. 2005b; 10:623–631. [PubMed: 16033784]
- Wallston KA, Malcarne VL, Flores L, Hansdottir I, Smith CA, Stein MJ, Weisman MH, Clements PJ. Does God determine your health? The God Locus of Health Control scale. *Cognitive Therapy and Research*. 1999; 23:131–142.
- Wallston KA, Wallston BS, DeVellis R. Development of the Multidimensional Health Locus of Control (MHLC) scales. *Health Education Monographs*. 1978; 6:160–170. [PubMed: 689890]

Table 1

Standardized Factor Loadings for the Four-Factor Model

Scale Items	Factor Loadings			
	I	II	III	IV
<i>Internal</i>				
1 my own behavior	.352			
7 I am in control	.323			
10 I am to blame	.173*			
15 what I myself do	.616			
17 If I take care of myself	.613			
22 If I take the right actions	.710			
<i>Chance</i>				
2 No matter what I do		.398		
5 by accident		.323		
11 Luck plays a big part		.617		
14 good fortune		.708		
19 No matter what I do		.463		
21 If it's meant to be		.674		
<i>Powerful Others</i>				
3 contact with physician			.448	
6 consult ... a professional			.516	
9 my family			.506	
13 health professionals			.445	
18 other people			.638	
23 what my doctor tells me			.564	
<i>God</i>				
4 it is up to God				.776
8 happen because of God				.609
12 God is ... responsible				.847
16 is God's will				.884
20 is up to God				.888
24 God is in control				.876

Note. All factor loadings are significant at $p < .05$. The item with an asterisk did not load significantly on any factor. Key words from each item are included for reference. Complete copies of the written English versions of the MHL scales, with full item wording, can be downloaded at <http://www.vanderbilt.edu/nursing/kwallston/mhlc scales.htm>.

Table 2

Mean Scale Scores for Total Sample and Gender, Ethnicity, and Education Separately

Demographics	<i>MHLC Scales</i>											
	Internal			Chance			Powerful Others			God/Religious		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD
TOTAL	310	24.4	3.61	309	14.2	4.03	304	23.3	5.33	310	16.8	8.68
<i>Gender</i>												
Male	130	24.0	3.91	129	14.6	3.72	127	23.8	5.10	129	17.2	8.98
Female	180	24.7	3.35	180	14.0	4.24	177	23.0	5.49	181	16.5	8.48
<i>Ethnicity</i>												
White	212	24.2	3.64	211	14.2	3.88	207	23.1	5.23	212	16.3	8.83
African American	17	25.1	3.51	17	13.2	4.77	17	24.8	5.46	17	14.6	7.17
Asian	16	25.4	3.14	16	14.8	3.24	16	24.4	5.84	16	19.1	9.22
Hispanic	37	23.7	3.45	37	14.9	3.62	36	23.6	4.68	37	17.7	8.13
Mixed	4	27.0	2.16	4	15.5	6.95	4	23.3	4.65	4	11.3	4.99
Other	19	25.4	3.78	19	13.8	5.75	19	23.1	7.23	19	20.0	8.58
<i>Education</i>												
Never Completed High School	12	25.8	2.22	12	15.0	3.36	12	29.0	3.70	11	24.9	10.3
High School	65	23.3	4.38	65	15.3	3.88	62	25.6	5.16	65	21.4	7.76
Any Years of College	88	24.5	3.68	88	14.6	4.22	86	22.8	5.34	88	15.1	7.94
Completed College	77	24.6	3.21	77	14.1	4.04	76	22.2	5.21	78	15.6	8.93
More than College	63	24.7	3.08	62	12.9	3.76	63	22.0	4.58	63	13.9	7.38

Note. Valid N represents subjects who completed each question of the given scale with no omissions. M = mean scale scores, SD = standard deviation.