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An American Study of the Inter-rater Reliability of the Swedish Housing Enabler

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Abstract

There is currently a lack of psychometrically sound home assessments in the field of occupational therapy. This study addresses this problem in an ecologically sensitive analysis of inter-rater reliability of the Housing Enabler, a Swedish home environmental assessment. Two independent raters administered the Enabler in the homes of ten participants discharged from a sub-acute rehabilitation facility. The participants had a mean age of 73.6 years ($SD = 7.5$) and resided in a variety of housing structures. The participants also had a mean Mini-Mental Status Exam score of 26.6 ($SD = 1.5$). The first assessment was conducted at the same time as a regularly scheduled home safety assessment by a registered occupational therapist, and the second was performed within three weeks by an occupational therapy doctoral student. The results of this study indicate a mean Enabler score of 194.5 ($SD=139.5$) out of a possible range from 0 to 2,129. Statistical analysis revealed that the raters achieved a very high level of agreement on the overall Enabler score as indicated by an ICC of .91. On individual items indicating functional limitations within the Enabler, the raters obtained a mean *kappa* score of .64 ($SD = .36$) and a 92% level of agreement ($SD = 9\%$). A mean *kappa* score of .50 ($SD = .36$) and a 92% agreement ($SD = 14\%$) were computed based on agreement levels for individual items indicating environmental barriers. The results of this study show a potential value of the Housing Enabler as a reliable instrument for use in this country. However, a discussion of the limitations of this study, especially the small sample size, suggests that further research concerning this instrument's reliability is needed in this country.

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Reliability of the Swedish Housing Enabler

As part of occupational therapy practice, home modifications are currently being used in the United States by occupational therapy practitioners as a stand-alone home intervention or as part of a larger intervention strategy (American Occupational Therapy Association, 2005, p.6). This role within the profession is likely to increase due to the rise of community-dwelling adults advancing in age within the United States (Gitlin, 2003). The American Occupational Therapy Association defines the home modification process as, “ the confluence of activities and delivery of services, including assessing needs, identifying solutions, implementing solutions, training in use of solutions, and evaluating outcomes, that contribute to any alteration, adjustment or addition to the home environment through the use of specialized, customized, off-the-shelf, or universally designed technologies, equipment, products, hardware, controls and cues, finishes, furnishings, and other features that affect the layout and structure to improve functional capacity of or minimize environmental demands on individuals and their caregivers to meet the situational needs for promoting performance of daily activities as independently as possible” (AOTA, 2005, p.4).

When conducting clinical assessments of older persons, there are many factors to consider as a basis for decision-making process (Kane, 1993). Theoretically, the importance of providing these home modification interventions can be conceptualized by using Nelson’s Conceptual Framework of Therapeutic Occupation (CFTO). Occupational performance is dependent on the interaction between the occupational form and the developmental structure. In essence, when there is an aspect of the developmental structure inhibiting the occupational performance of an individual, the occupational form may need to be re-synthesized in a manner which better promotes functional occupational performance (Nelson, 1987). For many aging adults, the home contributes to barriers

inhibiting functional occupational performance and re-synthesizing the occupational form through home modification can significantly decrease these barriers. (Stark, 2004; Nelson 1987).

Stark (2004) conducted a pre-test-posttest no control group study that researched the effectiveness of home modification interventions on 16 older adults who had at least one functional limitation as indicated by the Functional Independence Measure (FIM). The subjects' home environment was evaluated using the Environmental Functional Independence Measure (Enviro-FIM). The Canadian Occupational Performance Measure (COPM) was utilized to measure self-reported performance and satisfaction of occupational performance pre- and post-intervention. Using the COPM, Stark (2004) found that self reported performance and satisfaction of performance significantly increased as indicated by pre-test mean scores of 2.24 and post-test mean scores of 7.69 ($p=.0001$). However, the Stark (2004) study had a small sample size, no control group, and other limitations that limit the claim to internal validity.

As suggested tentatively by the Stark (2004) study, home modification interventions can increase self-perceived satisfaction and quality of occupational performance. However, Gitlin (2003) suggests that the theory base for home environmental research is restricted by the lack of psychometrically sound assessment measures. This shortcoming in the profession of occupational therapy not only limits the theory base, but also inhibits the establishment of health care policy or reimbursement structure (Mann, Ottenbacher, Fraas, Tomita, & Granger, 1999). As a result, there are no specific billing codes for home modification intervention. In order to secure reimbursement for clients and patients in the future, the profession of occupational therapy must strive to develop assessments that are demonstrated to be reliable and valid through psychometric analysis.

There are a few existing environmental safety assessments available which are currently being researched psychometrically to determine reliability and validity. The Swedish Housing Enabler is an example of such a project as well as the area of focus in this study. Iwarsson and

Isacson (1996) carried out a study designed to examine the inter-rater reliability of the Housing Enabler. The study involved 30 experienced Swedish occupational therapists, who were in post-graduate training, as raters. Each was asked to locate a patient discharged from his or her caseload within the past 12 months. Exclusion criteria were: dementia, mental retardation, terminal illness, or bedridden status. The participants were assessed in their homes independently by pairs of raters using a formerly current version of the Housing Enabler. The data was analyzed using Cohen's *kappa* statistic for inter-rater reliability. Inter-rater agreement of functional limitations and dependency on mobility of assistive devices was rated at "very good" (mean *kappa* = .87). The environmental barriers rate at "good" (mean *kappa* = .68).

In 2005, Iwarsson, Nygren & Slaug published a study designed to investigate the inter-rater reliability of the Housing Enabler, however this time the study was expanded in many ways. It was designed to determine the inter-rater reliability of raters from the different countries of Sweden, Germany, Latvia, The United Kingdom, and Hungary. The raters were trained in the administration methods of the Housing Enabler. The professions represented amongst the raters were: occupational therapist (n=15), psychologist (n=6), social worker (n=3), sociologist (n=1), and neuroscientist (n=1). The study completed 64 pair-wise assessments with a minimum six from each country. Iwarsson et al. reported significantly lower inter-rater reliability than in the 1996 study where only Swedish occupational therapists were used. The level of inter-rater reliability in the areas of functional limitations and environmental barriers reflected only moderate agreement. Iwarsson et al. maintained that the Housing Enabler was still a useful instrument, even for cross-national research. The findings of the second study were attributed to the complex difficulties of conducting cross-national research; perhaps larger samples in each country would have provided results supporting the previous study's findings.

Considering the results of these studies, the research question was raised whether American rehabilitation professionals would be able to obtain an acceptable inter-rater reliability using the Housing Enabler. It is the purpose of this study to determine the inter-rater reliability of the Housing Enabler as it would be practically administered as a home safety evaluation in the United States.

Method

Participants

Participants for this study were recruited from a sub-acute rehabilitation facility in Northwest Ohio according to the following criteria: a) They were to be discharged from the facility within three months and had a home safety evaluation already scheduled; b) they were at least 65 years of age; and c) they obtained a score of at least 22 on the Mini-Mental Status Examination (MMSE). These criteria were chosen to reflect approximately the same criteria used in the Iwarsson studies of 1996 and 2005. The patients received both a standard home safety evaluation as well as the Housing Enabler. Once it was determined that a patient was going to receive an occupational therapy home safety evaluation, an occupational therapist working at the facility offered an explanation of the current study and asked to patient to sign an informed consent form. The patient was then screened using the MMSE and was scheduled to receive the home visit if obtaining an MMSE score of at least 22.

Thirteen participants were recruited for this study. It was decided in advance that two of these were going to be pilot participants for the raters to refine the administration of the instrument. One participant signed an informed consent but later refused participation, and ten patients completed the main study. The mean age of the ten participants who completed the main study was 73.6 ($SD = 7.5$) years. The mean MMSE score of the participants was 26.6 ($SD = 1.5$). The participants lived in the following housing structures: one-story home ($n=4$), two-story home where

only floor was used (n=2), two-story home (n=1), a split level home (n=1), apartment (n=1), assisted living dwelling (n=1). Four participants had garages that were typically used.

The Instrument

The Housing Enabler is a home evaluation instrument currently being studied and used in Sweden. This instrument measures both the functional limitations in the person as well as the environmental barriers found in the home. The environment barriers are divided into four sections; (a) outdoor environment, (b) entrances, (c) indoor environment, and (d) communication. The two factors are measured separately and matched by being coded into a matrix. At the point where an identified functional limitation and an identified environmental barrier intersect, there may a numerical value indicating a problem for that person. This problem is judged for severity by using the following pre-existing scale: (1) potential problem, (2) problem, (3) severe problem, or (4) impossibility. A total score is summed and labeled “predictive physical environmental demand” (Iwarsson, 1996). The Housing Enabler is currently available for the use of clinical practice, research and development, and education (Iwarsson & Slaug, 2001).

In order to achieve an ecologically valid estimate of inter-rater reliability, the raters of the current study did not complete any formal or official training course on the methodology of the Housing Enabler (which is currently only available in Europe). They were self-taught in the instrument’s methods through study of the Housing Enabler Manual that is provided with commercial purchase of the instrument.

Procedure

The Enabler was administered once by the registered occupational therapist who worked at the sub-acute rehabilitation facility and who recruited the subjects. The first evaluation was scheduled to be conducted at the same time that the patient was to receive his or her standard home safety evaluation. Following the first evaluation, a second evaluation was scheduled within three

weeks of the first evaluation. The second home evaluation was completed by an occupational therapy doctoral student attending The University of Toledo. The raters scored their evaluations separately and did not communicate any information concerning the home to one another.

Results

In processing the data collected from this study, two levels of statistical analysis were used. An intra-class correlation coefficient (ICC) was used to determine the overall inter-rater reliability of the summation of the scores of the instrument. This analysis was the primary focus of this study. In addition to the primary research question, each separate item of the instrument was tested for inter-rater reliability using a) Cohen's *kappa* (k) statistic and b) calculation of percentage agreement.

With $N = 10$, the mean overall Enabler score (summing sections A, B, and C) was 194.5 ($SD = 139.5$). Overall inter-rater reliability was computed via a random effects model for generalization to future raters and resulted in an ICC value of .91. According to Eliasziw, Young, Woodbury, and Fryday (1994), an ICC value of .91 reflects almost perfect agreement among raters. Section D of the instrument was not analyzed for an ICC value since no environmental barriers were identified in this section by either rater throughout the study, yielding a score of 0 for the section throughout.

See Table 1 for summary statistics concerning the analysis of the secondary research question dealing with individual items. According to Landis and Koch (1977), a kappa value of .64 signifies substantial agreement while a kappa value of .5 signifies moderate agreement. For 102 items, kappa values could not be computed. In these cases, each rater agreed that there was no functional limitation or environmental barrier for any of the 10 subjects. When looking at the data in terms of percentage agreement, which does not correct for chance agreement, the raters agreed on about 92% of all items.

The mean number of functional limitations of the participants who participated in this study was 5.3 ($SD = 1.5$). Most of the functional limitations were orthopedic and stamina-related. Eight out of ten subjects had limitations in coordination or reliance on walking aides as rated by at least one of the raters. Nine of ten participants had poor balance or limitations of stamina as rated by at least one of the raters. The first rater found an average of 25.1 environmental barriers within the home ($SD = 11.8$) while the second rater found an average of 24.9 environmental barriers ($SD = 11.9$) out of a possible 188 barriers. The maximum number of barriers found was 46, and the minimum was 11.5 as averaged from the two raters.

Discussion

The purpose of this study was to conduct an ecologically valid assessment of the inter-rater reliability of the Swedish Housing Enabler. The raters in the study were not formally trained in the administration of the instrument, much as the typical American occupational therapist purchasing the manual would not be. The almost perfect ICC rating found in this study lends some support to the idea that American occupational therapists can use the Swedish Housing Enabler in an objective way. The assumption is that the individual's overall score is the best single indication of need for services. However, there was some disagreement as to the exact barriers faced by the individual, as can be seen by some of the low *kappas* pulling down the broadly acceptable mean *kappas*.

One reason that the overall levels of agreement are not even higher is that a disagreement about the functional limitations of a person leads automatically to several disagreements concerning environmental barriers. This chain reaction of disagreement is a result of the Housing Enabler's scoring structure, whereby items reflecting environmental barriers are relevant only for identified disabilities. For example, if no functional limitations are identified by the rater there is no possible way a score will be recorded in the matrix even though environmental barriers may be present.

It is important to clarify the apparent discrepancy between the very strong ICC value and the moderate *kappa* values indicated in the results. This is partly a result of the means by which *kappa* is calculated. In many cases, a low *kappa* value was accompanied by a high percentage of agreement. As noted in the results section, *kappa* cannot be calculated when raters agree for all subjects that a particular barrier is *not* present. In addition, a *kappa* value of 0 can occur when both raters agree in 9 of 10 cases that no barrier present but disagree on one subject. So *kappa* often equaled 0 despite 90% agreement.

Though the raters were each given the administration manual to research and review, one rater erred by rating only environmental barriers that had a direct effect on the functional limitations of the participant. That is, he only indicated barriers relevant to the functional limitations identified on the instrument. This deviation had little effect on the summative outcome of the instrument and the ICC but did affect the *kappas* reflecting inter-rater reliability of individual items.

There were other factors that might have affected the raters' ability to agree on individual items. The raters were unfamiliar with the language idiom and the measurement system used in the instrument; the Housing Enabler uses British English which varies in many respects to the American idiom. Also the instrument contained certain items prone to ambiguity; these were clarified only in Swedish. For these items, the raters were left to their own individual interpretations without set or standardized guidelines.

A significant limitation is the very small sample size. A sample of ten is inadequate to justify any strong conclusion as to the reliability of the Enabler. If the study had had more subjects, it is likely that other barriers could have been identified, thus bringing into play items not relevant to the homes of the ten people in the current study.

Given the limitations of this study, the researcher cannot confirm that this instrument should be used in the United States by untrained therapists for definitive research or clinical purposes.

However, this study's findings indicate that the Housing Enabler has great potential as a reliable instrument in this country. Further research with a larger sample size and refined methodology to eliminate human error is suggested in order to conclusively determine the reliability of this instrument.

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Table 1.

Inter-rater reliabilities expressed both as kappas and percentages of agreement for individual items of the two major Enabler sections: Functional Limitations and Environmental Barriers.

	<u>Type of</u> <u>Statistic</u>	<u>Number</u> <u>of Items</u>	<u>Mean</u>	<u>SD</u>
Functional	Kappa	12 ¹	.64	.36
Limitations	% Agreement	15	92%	9%
Environmental	Kappa	86 ¹	.50	.36
Barriers	% Agreement	182	92%	14%

¹ *Kappa* cannot be computed when there is perfect agreement that the event did not occur for any subjects (which happened frequently in this study) or when there is perfect agreement that the event occurred for all subjects (which did not occur in this study). Therefore mean *kappas* are based on only some of the items.

