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Research Article

Impact of Online Instructions about Home for Life Design on Occupational Therapy Students: Suggesting a Standardized Home Assessment Tool

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Abstract

Background: The number of older adults that choose to age in place is rapidly growing creating a need for efficient and standardized home assessment measures. The Home for Life Design (HfLD), Home Assessment was created on a technology platform to enhance occupational therapy (OT) home assessment practice. This inter-rater agreement study includes the enhanced training including a Scoring Decision Guide that were developed during the inter-rater agreement analysis to improve the inter-rater agreement. This is a preliminary study for the tool's standardization for reliable use by occupational therapists.

Method: The study composed of 52 occupational therapy student raters' home accessibility scores against the author's scores using a Rater Test. Prior to taking the Rater Test, the students viewed the on-line training that included instructions on how to use the newly developed Scoring Decision Guide. Each of the student raters' scores were compared to the test author's using descriptive stats and an intraclass correlation with absolute agreement, two way mixed effects model and 95% confidence interval.

Results: The average intraclass correlation for the 52 raters was .93, with a standard error of 0.011 and a 95% confidence level of 0.022. This indicates good/excellent inter-rater agreement between the 52 raters and the author of the tool.

Conclusion: Practitioners who choose to measure accessibility of a client's home and follow the on-line training of the HfLD Home Assessment, can use this tool as a reliable OT home assessment.

Keywords: *Home for Life Design (HfLD); Occupational Therapy (OT); Home Assessment*

Introduction and Background

The growing number of older adults in the United States is set to reach an unprecedented number of over 70 million in the year 2030 (US Census Bureau) [1]. The majority of people over the age of 65 currently live in traditional private housing and face unmet needs in the areas of self-care, functional mobility and home maintenance [2]. In addition, of the 38.1 million people enrolled in Medicare, only 31% were able to perform daily activities without assistance [3]. Moreover, housing stock significantly lacks accessibility features that support long-term function in the home [4]. Research inside and outside occupational therapy literature describes the home environment as a critical objective factor linking to a person's function and disability [5-7], whereby an intervention focus on modifying environmental fac-

tors can be a supportive and enabling change agent of a person's functional behavior [8]. An older adult population at risk for encountering occupational deprivation, propels and facilitates targeted occupational therapy intervention and requires accurate and time effective assessment of physical environmental aspects in the role they play in creating disabilities that may not otherwise exist [9].

The American Occupational Therapy Association [9] identified two standardized home assessments that are commonly used by occupational therapy practitioners to facilitate aging in place in the community. These home assessments help guide occupational therapists providing home modification services: the In-Home Occupational Performance Evaluation [6] and the Safety Assessment of Function and the Environment for Rehabilitation-Health Outcome Measurement and Evaluation [10]. The I-HOPE is a multi-step assessment involving an activity card sort of 42 activities that are prioritized and rated according to the client's satisfaction with level of performance. These activities are then performed and measured by the practitioner, reflective of a Functional Independence Measure (FIM) score against the severity of the barrier present during the activity performed. This assessment requires person-environment interaction and results in an Activity Score, a Performance and Satisfaction Score, and a Total Barrier Severity Score. While this home assessment involves carefully prioritizing performance barriers based on findings, the outcomes may not consistently require home modification interventions specifically. For example, activities such as "Responding to an Emergency" or "Paying the bills" often involve deficits in areas outside of the physical environment and thus point to interventions within the occupations or activities themselves versus home modifications. Similarly, the SAFER-HOME v3, rates the severity of safety concerns identified within 12 categories. The number of safety problems are tallied and weighted to determine an overall SAFER-HOME score and can be completed with or without the client present. The SAFER-HOME v3 includes example items such as "Feeding and swallowing," and "Addictive behavior," all of which elicit safety concerns that do need to be measured, but are not likely influenced by the physical environmental factors of the home. Both of these assessments are paper-based, scored manually, and have an average completion time of 45-60 minutes. To assess this comprehensively, they take longer to administer (higher cost) and some of the items are not relevant to some people who have purely physical limitations that threaten their ability to stay in their homes safely. Both of these assessments have an important role to play in assisting older adults to safely live in their homes as long as they can, but these two assessments, by being more comprehensive, are not necessarily needed for everyone who is experiencing physical barriers in staying in their own homes. A more focused assessment on physical barriers in a person's home that limit their safety for independently completing their activities of daily living in their home could be helpful at a significantly lower cost (30 min. vs. 60 min. of the therapist's time for the assessment).

Overview of the HfLD, home assessment

The Home for Life Design (HfLD), Home Assessment App and Solution was developed to advance OT home assessment practice with technology and provide a home assessment measure of physical environmental factors to assist home modification implementation. The solution allows home assessment completion though a web-based application and is accessible on any mobile device. The home assessment is built by the practitioner and can include one or multiple rooms per home. Quantitative measures in this assessment include the client's perceived level of safety and the physical environment's accessibility during occupational performance in each of the rooms selected. In addition, the solution allows the selection of products and design suggestions to promote increased accessibility and safety, embeds pictures of the room being assessed and generates a report of findings for third party viewers.

'Safety' was selected as a targeted outcome measure for improvement based on its influence on decision making in aging in place [11-13] and its impact on activity performance [14]. The safety rating is a Likert scale from 1 (I do not feel safe) up to 10 (I feel very safe) and is provided by the client. This self-perception measure facilitates an intervention implementation with the client versus on the client and helps to enhance autonomy [15]. In addition, and in support of Christiansen and Baum's Person-Environment-Occupation-Performance model of practice, within the environment component, the assessor determines the accessibility of the built environmental context as it enables or disables occupational performance [16].

Accessibility ratings are scored by the practitioner as a performance-based measure, 0 (not accessible), 5 (partially accessible), or 10 (fully accessible). The practitioner uses clinical reasoning skills during the client's performance to help determine the person-environment fit. Each of these accessibility scores reflect the severity of the environmental barrier during the client's occupational performance. If the person is unable to complete the occupational task, a practitioner would rate the environment (0)-- that the environment is not accessible. If the person is able to complete the occupational activity in the home environment safely and independently, the environment is rated as accessible (10). If the person can complete the task but factors in the environment (or lack of supports in the environment) limit the person's ability to complete the task safely, the environment is rated as partially safe (5). When practitioners score a '5' or '0', they have made a clinical decision that there is a better environmental modification that is needed for the client's safety since their ability to perform that task was not totally safe in their current environment.

After a practitioner digitally enters all of the safety and accessibility scores, a mean score is calculated in each room assessed to give an overall safety (provided by the client) and accessibility score (provided by the assessor) (See figure 1). These scores enable practitioners to manage each of their client's data for simple tracking over time and how the person completes the task after physical modifications have been implemented.

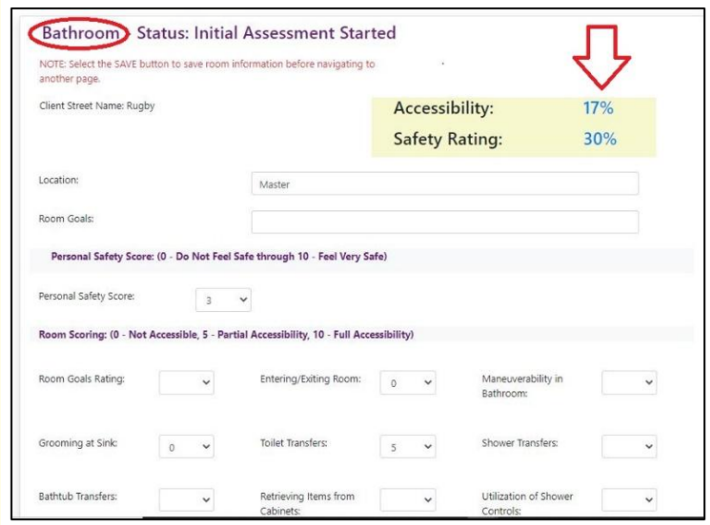

Figure 1

After completion of the home assessment's safety and accessibility scoring, the "solution" part of the app offers the practitioner the opportunity to recommend appropriate home modification solutions. To enhance the practitioner/client in the moment experience, pictures of these various home recommendations are available on the app for the specific problems encountered, and if the therapist recommends different options, they are embedded into the assessment report for easy reference. This feature provides opportunities for students and new therapists to learn what options are currently available for the barrier the person is experiencing and learn how to recommend the best person-environment fit so the person can complete the task safely (Figure 2). As the practitioner suggests and educates the client and thereby determine the recommendation is appropriate, they select the recommendation via checkboxes. To further make the assessment comprehensive related to physical barriers, a section for practitioner notes and the opportunity to upload photos of the environment is provided in each room being assessed. All data, notes and relevant photos are synthesized and transferred for review, sharing and download via weblinks (Sample Home Assessment).

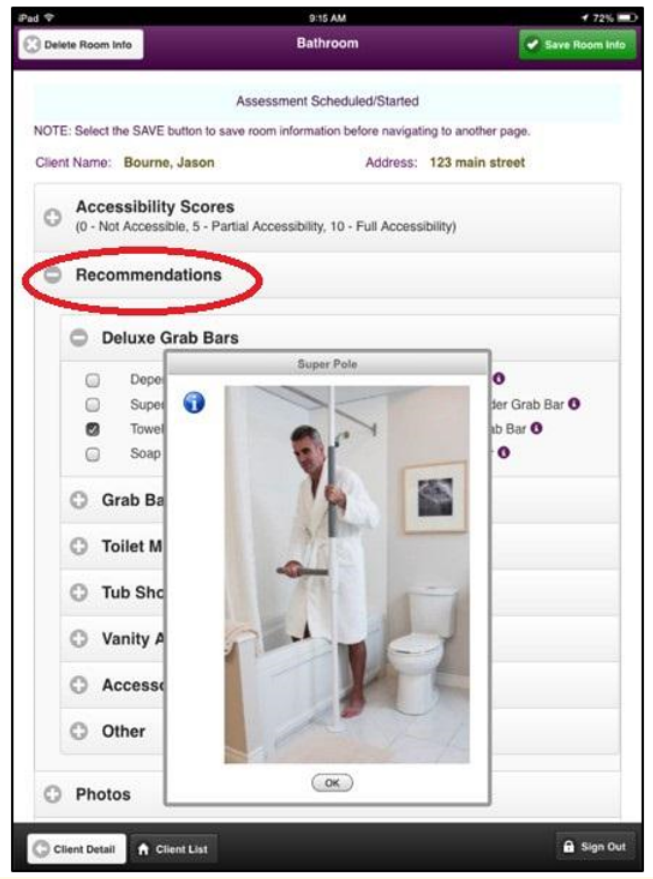

Figure 2

The solution also facilitates an opportunity for collecting follow up-assessment data after the recommended modifications are implemented, allowing an effortless comparison between initial and follow up assessments (Figure 3).

Five preliminary studies (unpublished) for the HfLD, Home Assessment were conducted. On-line training modules were made available by the second author, and inter-rater agreement tests (Rater Test) were created for each of the studies. initially, The first study was conducted with 10 expert therapists, however for the last five studies, OT students were exclusively invited as raters. This decision was made to make it more efficient to test multiple convenience samples with larger sample sizes. Students have been used in multiple published studies for inter-rater agreement/reliability after they were trained and tested as being reliable raters [17-19]. Edwards [17] found that well trained students could be trained to be reliable raters with standardized administration guidelines and scoring criteria whether or not they had previous health care training.

Raters in each of the preliminary studies independently completed the same HfLD, Home Assessment online training provided to OT practitioners who use the tool professionally. After completing the online training, each rater completed a Rater Test. Improvements in, and additions to the on-line training and Rater Test content were completed during earlier phases of this study to work towards stan-

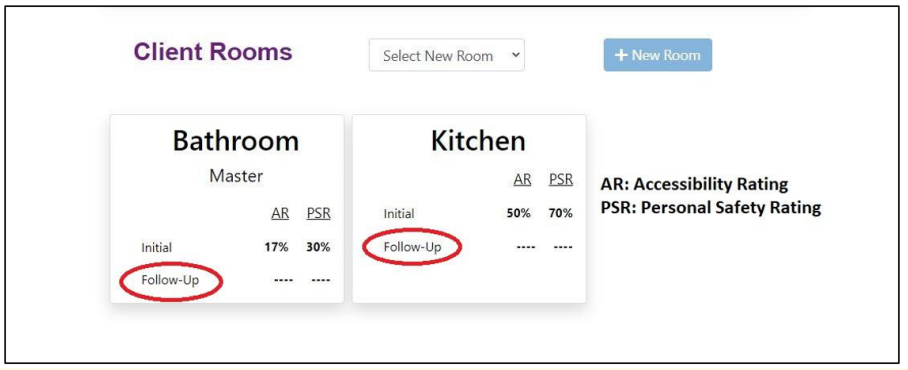

Figure 3

dardization and meet the authors' pre-set expectations of 80% intraclass correlation agreement. Enhancements to the on-line training included a section on the assessment's theoretical underpinnings, Baum's Person-Environment- Occupation-Performance Model [16], which is used to help frame how the assessor understands the environment and its role in shaping a person's independence during functional performance. The Rater Test content was refined three times based on participant feedback. The original test presented video clips provided by the second author, showcasing the person performing occupations in various rooms of the home. Raters reported that they could not clearly identify details needed to accurately score the environment's accessibility. Based on this feedback, the video clips were replaced with professional videos that highlighted those details providing clarification during scoring. The Rater Test was created intentionally to challenge raters and included person-environment fit scenarios that would be difficult to discern between a '5' (partially accessible) or '10' (fully accessible). One example was observing a person self-propelling independently through a bathroom door. The person was able to go through the door safely, without hitting their knuckles on the doorframe. In this example the accessibility rating would be a score of '10' (fully accessible), however raters could be tempted to score a '5' (partially accessible) since an environmental modification of widening the door frame would potentially be more accessible to accommodate the wheelchair (however, very difficult and expensive). Another example was a person using the vanity counter and bathtub as leverage to transfer off the toilet. While the transfer was completed and may initially suggest a '10' (fully accessible) score, the environmental factors here caused an unsafe performance whereby the awkward position of the arms and shoulders forced an unsafe transfer. Here the accessibility rating should be a '5' partially accessible, and an environmental modification is warranted. The authors, the first two of whom are both experts in the area of home modifications and aging in place, created the Scoring Decision Guide to help differentiate clearly between the two ratings in situations such as these described (Figure 4). Inter-Rater agreement results significantly improved on the Rater Test after the Scoring Decision Guide was provided and added to the on-line training and scoring process.

Data presented in this manuscript are from the 6th phase of a series of inter-rater agreement (IRA) studies conducted over the last six years. The purpose of this study was to determine if occupational therapy students could be reliable accessibility raters after completing on-line training modules and using the scoring decision guide when completing their ratings. The raters observed 10 professionally created video examples of people completing occupations in rooms of their own homes, and scored the person's safety completing that occupation (i.e. stepping into their shower) according to the scoring decision guide.

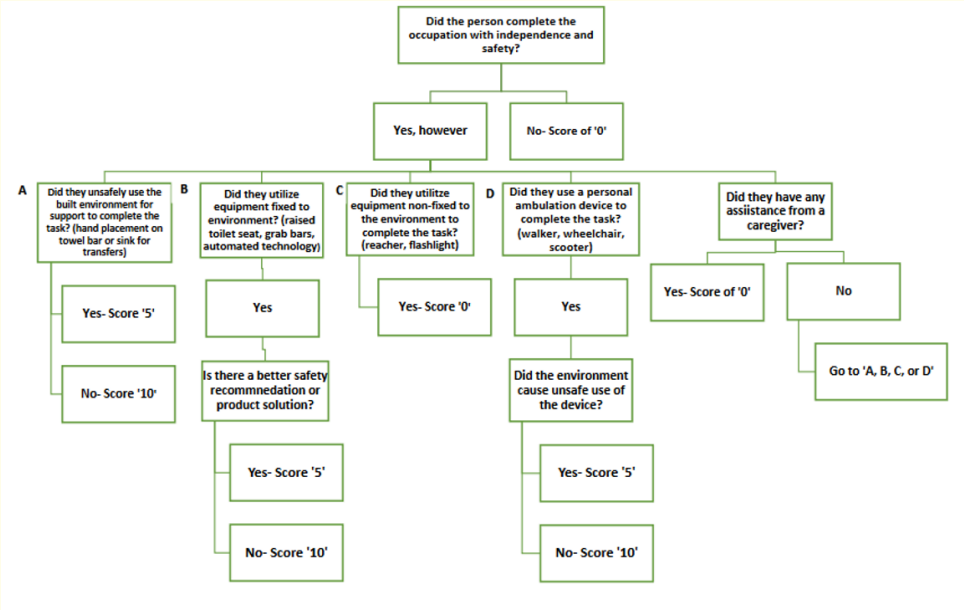

Figure 4

Method

Participants

Of the possible 64 second year MS graduate occupational therapy students, 52 (81%) provided permission through their informed consent to use their ratings from a class assignment as data in the study. Permission to conduct this study was granted by the Research Ethics Board of the university where the study took place.

Procedures

The final versions of the HfLD on-line training and scoring decision guide that had been developed based on the preliminary studies were used in this study. Study participants independently viewed the same 60-minute online training and included how to use the scoring decision guide. Upon completion of this training, the study participants independently completed the Rater Test on an eLearning platform and were instructed to use the scoring decision guide. The test involved viewing 10 video clips featuring simulated clients completing activities of daily living and instrumental activities of daily living within multiple rooms of a person's home environment. After each clip participants were prompted to rate the accessibility of the environment as the client performed the occupation. Participants individually rated the accessibility of the physical environment as either: 0- not accessible (person not able to complete the occupation in the environment), 5-partially accessible (person completed the occupation but either safety was a concern or there was a better environmental option available), or 10- fully accessible (person able to complete the occupation safely and independently using the environment in a safe way).

The independently rated test responses were scored and those scores were compared to the author's for each video clip. The author of the assessment is a registered and licensed OT practitioner and is considered an "expert OT rater" based on their credentials and is con-

sidered a leader in the field of OT for environmental modifications. The author followed the theoretical premise of the assessment to determine the correct accessibility ratings for how much the environment was supporting or limiting the person's ability to safely complete the occupation in the room observed. Participants' scores were exported from the eLearning platform into a spreadsheet to analyze the percent of raters' agreement with the author's scores. Data was then inputted into SPSS statistical package version 24 (SPSS, Inc, Chicago, IL) for an intraclass correlation (ICC) absolute agreement, 2-way mixed-effects model with a 95% confident interval. The ICC statistic was used due to its robust ability to compare raters' ordinal ratings using absolute agreement with the test authors' ratings [20,21].

Results

The agreement of the group of students' accessibility scores were analyzed for each item using descriptive statistics. For the combined group of raters, nine of the ten accessibility ratings had an agreement greater than .90 compared to the author's ratings, and 10 of the 10 ratings had an agreement greater than .85 for each occupation observed and rated. Table 1 lists each of the test items and the percent of agreement between the group of raters and the author.

	Test Item	Percent of Agreeance (%)
1.	Transfer out of Bed	95.11
2.	Exit from House to Garage	90.42
3.	Reach into Closet	100
4.	Transfer from Bathtub using Handrail	93.65
5.	Maneuver through Dining Room	95.32
6.	Up the Stairs	85.33
7.	Transfer from Toilet using Countertop	90.42
8.	Transfer from Furniture	92.09
9.	Utilize Appliance using Adaptive Equipment	98.34
10.	Maneuver through Hallway	91.98

Table 1: *IRA test items and percent of agreeability among ratings.*

Note: n = 52.

The ICC values for the mean of the 52 raters' individual absolute agreement scores ranged from a low of .69 to high of 1.0. The standard deviation was .08 and standard error 0.1. The mean of the 52 ICC individual scores was .93.

Discussion

The data from this study suggests that the HfLD Home Assessment, can be considered a reliable home safety assessment when completing on-line training modules and using the scoring decision guide when viewing. It is assumed that since the raters in this study were occupational therapy students, their agreement with the author's can be generalized to other occupational therapy practitioners who have viewed the training and use the scoring decision guide for their ratings [17]. Overall, the majority of the 52 raters had a high agreeability with the author according to criteria by Koo and Li [21] and Adams and Lawrence [22]. The majority of ratings are within the excellent range for the ICC absolute agreement values described by Koo and Yi [21]. The lowest individual ICC absolute agreement score was .69, however that rater's score is close to the .70 criteria Stemler and Tasi [23] consider acceptable when demonstrating reliability. The .93 mean of the raters' individual ICC scores when compared to the author's scores was in the excellent range of reliability/agreement [20]. The ICC scores do not identify which items were scored consistently by raters, but the descriptive statistics demonstrated which of the video scenarios had subtle issues that may have challenged some raters.

The test item that had the lowest agreement (.85), presented a client going up a stairway to the second floor. In this scenario, the client touched/leaned on a piece of furniture and then later the wall as they progressed up the stairway (See figure 5). Here, the correct rating is a "5" (partially accessible) because the client used a piece of furniture and the wall for support as they transferred up the stairs. A client transferring up the stairs with independence would be rated a "10" (fully accessible) if they went up the stairs using securely installed handrails or not using handrails and maintaining safety. A '5' rating prompts the practitioner to make an environmental recommendation for the stairway to enhance safety and stability for the person, such as an additional handrail. Subtle performances such as these may initially challenge raters, however including unique performance situations in the Rater Test and scoring decision guide, allows new raters the opportunity to compare their scores to the author's feedback and determine why they scored incorrectly. It is recommended that new raters refer to the scoring decision guide in order to correctly score video clips showcasing various home contexts and during unique occupational performance situations. The scoring decision guide (Figure 4) does not suggest all contexts and scenarios that may occur in the home, but as practitioners become more familiar with the assessment and routinely begin to identify environmental factors as the barrier or facilitator of occupational performance, the need to reference the scoring decision guide will likely decrease.

Figure 5

Future Research

Future research could include inter-rater agreement studies involving trained practitioners conducting this home assessment simultaneously on the same client in the client's own home. Construct validity of this assessment, including semi-structured interviews with OT home assessment experts or through comparison with another gold standard home assessment could be helpful to establish the validity for standardization. In addition, comparing the clinical utility of paper-based home assessments versus a web-based assessment like the HfLD, Home Assessment is recommended to assist practitioners in choosing the most appropriate assessment for their needs.

Study Limitations

The study sample was a convenience sample geographically limited to one area of the United States. All of the study's participants were from the same university. They were, however, cohorts at two different campuses and each cohort had different teams of instruc-

tors, but the instructor at one of the campuses was an author in this study. All of the rater training was conducted on-line versus face to face, limiting the participants' opportunity to clarify any questions. This is however the very same training and format that is available to occupational therapy practitioners to learn how to score the assessment and use the tool in practice. The Rater Test included some actors and fictional video scenarios. Not all the scenarios were of actual people in their own homes actually doing their own daily activities.

Conclusion

Occupational therapy plays an important role in evaluating the person-environment fit during occupational performance. Modifying the physical environment of a person's home to increase accessibility necessitates using instruments that are effective in measuring this construct during the person's participation in functional tasks. Occupational therapy practitioners work to keep clients in their home and communities, meeting the demands of an aging population. These practitioners need standardized home assessment tools that enable real-time, effective intervention strategies that improve a client's quality of life and sustainability in the home. The HfLD, Home Assessment Web Application and Solution can be a reliable tool for targeting such outcomes during the occupational therapy process and helps to establish the distinct value that occupational therapy practitioners bring to home assessment practice.

Acknowledgements

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Conflict of Interest Disclosure

In full disclosure, the second contributing author, Carolyn Sithong is the developer of the Home for Life Design, Home Assessment. Her contribution in this study was assisting in the creation of the video clips and developing the scoring decision guide. Carolyn did not gather nor evaluate data and data findings in this study. In the manuscript she assisted in writing the background and overview of the tool.

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Volume 5 Issue 6 June 2023