# Factor Analysis and Construct Validity of the SAFER-HOME

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**Key words: safety, outcome assessment, occupational therapy, home care**

**ABSTRACT**

*This article describes the development, factor analysis, reliability, and validity of the Safety Assessment of Function and the Environment for Rehabilitation–Health Outcome Measurement and Evaluation (SAFER-HOME). A pilot test of 104 pretest–posttest observations showed that occupational therapists perceived the SAFER-HOME as clinically useful, practical to administer, and sensitive in detecting changes. Using a factor analysis of 1,173 observations, a 10-factor structure SAFER-HOME v.2 was developed. The 93-item SAFER-HOME had an internal consistency coefficient alpha value of 0.86. The low correlations between the SAFER-HOME v.2 and the Functional Autonomy Measuring System (*r = -0.206; p = *.018) supported the presumption that home safety was related but not limited to functioning. There is some evidence supporting the SAFER-HOME v.2 as a valid and reliable instrument. The SAFER-HOME v.2 represents a carefully constructed, theoretically driven, and clinically sound outcome measure for use by occupational therapists to assess home safety.*

This article describes the development, factor analysis, reliability, and construct validity of the Safety Assessment of Function and the Environment for Rehabilitation–Health Outcome Measurement and Evaluation (SAFER-HOME). Occupational therapy promotes independence in the lives of people who are restricted in their ability to participate in daily activities and aims to help them retain meaningful occupations (Baum, 2003). One possible restriction in the environment is the safety of the home, which can affect the full participation of many older adults. Occupational therapists have the knowledge and skills not only to assess safety levels, but also to improve on home safety and enable individuals to enhance their independence, safety, and quality of life.

However, there is a lack of outcome measures that can evaluate the effectiveness of home safety assessment and intervention for use by occupational therapists. Consequently, the authors have initiated the development of a new outcome measure, the SAFER-HOME, to address this gap (Oliver, Chiu, Marshall, & Goldsilver, 2003). This article is the first of a series of publications that report on the psychometric properties of the SAFER-HOME. Future research will study additional reliability and validity properties, as well as sensitivity to change, of the SAFER-HOME.

## Background

### Study Site

This study was conducted at COTA Health, Toronto, Ontario, Canada. COTA Health is a not-for-profit, accredited community health organization that is a leader in providing comprehensive rehabilitation, mental health, and support services to people of all ages. Established in 1973, COTA Health delivers quality services through a multidisciplinary team, including 165 full-time equivalent occupational therapists. At COTA Health, occupational therapists provide home visiting services to children, adults, and older adults. Approximately half of the occupational therapists provide geriatric services to clients who have physical problems, mental health problems, or both.

At COTA Health, home safety assessment and intervention are major services provided by occupational therapists. The services are offered mainly to

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*Table 1*
**Home Safety Assessments Review Results**

| Measure | Review Results |
|---|---|
| The Westmead Home Safety Assessment (Clemson, 1997) | It focuses on risks of falls and less on safety concerns related to cognitive impairments. |
| The Falls and Mobility Efficacy Scale (Peterson et al., 1999) | It is a self-completed questionnaire that focuses on falls and mobility and less on safety concerns related to cognitive impairments. |
| The SAFE AT HOME (Robnett, Hopkins, & Kimball, 2003) | It covers unsafe situations in a kitchen area and is designed for administration in an institutional setting. |
| The Physical Housing Environment (Fange & Iwarsson, 1999). | It is a self-completed questionnaire with more focus on physical environment and less on safety concerns related to cognitive impairments. |
| The Safety Scale for People with Dementia Living in the Community (Isabelle et al., 2001) | It is designed primarily for use by physicians rather than occupational therapists. |
| The SAFER Tool (Chiu et al., 2001; Oliver et al., 1993) | It is a comprehensive safety assessment designed as a clinical tool, not as an outcome measure. |

geriatric clients who have physical health problems, cognitive impairments, or both. They may live at home alone or with family members. The home safety assessment services are also available to younger adults with a disability. Typical interventions involve prescribing equipment and assistive devices, educating clients and caregivers, linking to community resources, and recommending environmental modifications (Oliver et al., 2003).

### Need for a New Home Safety Outcome Measure

In 1999, a need to use outcome measures to evaluate the effectiveness of occupational therapy home safety assessment and intervention was identified at COTA Health. A literature search and discussion with experts in the field identified six potential measures. The six measures were reviewed to evaluate whether they were (1) able to measure outcomes of home safety assessments and intervention, (2) suitable for the COTA Health client population, (3) practical to use, and (4) psychometrically sound. The review results showed that each tool had its unique purposes and addressed important safety aspects.

Table 1 summarizes the review results, which showed that an appropriate comprehensive home safety outcome measure suitable for use at COTA Health was not available. Hence, a need to develop a new home safety outcome measure was identified. Consequently, a series of studies have been undertaken to develop the new outcome measure. The purpose of this article is to report on the development of the SAFER-HOME and the three studies that examined its acceptance of use by occupational therapists, factor structure, internal consistency, and construct validity.

## Development of the SAFER-HOME

A sound outcome measure should be sensitive enough to detect changes, be suitable for routine use in clinical settings, and have demonstrated psychometric properties including reliability and validity (McDowell & Newell, 1996; Slade, Thornicroft, & Glover, 1999; Turner & Dudek, 1997). Instead of developing a new outcome measure from raw items, the authors considered the feasibility of continuing on the work of an existing clinical assessment, the Safety Assessment of Function and the Environment for Rehabilitation Tool (SAFER Tool). The SAFER Tool has been used at COTA Health for more than 10 years. Previous studies of the SAFER Tool confirmed that its content is comprehensive in its coverage of items used to examine a person's ability to function safely in the home environment (Letts & Marshall, 1994, 1995; Oliver, Blathwayt, Brackley, & Tamaki, 1993).

The SAFER Tool had demonstrated its suitability for routine use to assess home safety and guide intervention. However, an outcome measure often requires a minimum of two time points: pre-intervention and post-intervention measurements. Because the SAFER Tool was not designed to measure changes post-intervention, its rating scale was not sensitive enough to detect changes. Therefore, we decided to keep the SAFER Tool's items and structure, modify its rating scale, and study its psychometric properties.

### Construction of the SAFER Tool

The construction of the SAFER Tool, the precursor of the SAFER-HOME, was initiated by a literature review of existing home safety assessments (Chiu, Oli-

ver, Marshall, & Letts, 2001). Theoretically, the SAFER Tool is grounded in the assumption that people's occupational performance is a function of their skills and abilities interacting with their physical and social environments (Lawton & Nahemow, 1973). Therefore, the SAFER Tool is not designed to assess only a person's abilities or home environment. Instead, its evaluation focus is on the interaction between the person and the environment or environments in which he or she functions (Letts, Marshall, & Cawley, 1995).

Initially, 128 items were generated based on published home safety assessments and suggestions from experienced occupational therapists (Oliver et al., 1993). The 128 items were subjected to a content review using an expert panel of occupational therapists and older adults. Following the panel review, 9 items were deleted, resulting in a total of 119 items to be included for the reliability and validity testing (Letts & Marshall, 1995; Letts et al., 1995). The content validity testing results supported the deletion of another 22 items, leaving a total of 97 items in the final version of the SAFER Tool (Letts & Marshall, 1995; Letts et al., 1995).

Further studies revealed that the SAFER Tool has good interrater and test–retest reliabilities (Letts & Marshall, 1995). A 100-page manual of the SAFER Tool was written, providing assessment guidelines and recommendations for each item (Chiu et al., 2001). The 97 items are grouped into 14 areas of concern: living situation, mobility, kitchen, fire hazards, eating, household, dressing, grooming, bathroom, medication, communication, wandering, memory aids, and general issues. Occupational therapists use a combination of observation, interviews, and task performance to rate each item.

### Development of the SAFER-HOME v.1

The 97 items of the SAFER-HOME v.1 were the same as the SAFER Tool items, grouped into the same 14 domains. The original rating of the SAFER Tool was a binary scale (presence or absence of a safety problem). The rating scale of the SAFER-HOME v.1 was expanded into a 4-point rating scale to increase its sensitivity to detect change. The definitions of the rating options, expressed using both qualitative and quantitative descriptors, are listed below.

1. No identified concern–following observation, interview, and/or task performance, no safety concern was identified at time of assessment.
2. Mild problem–low safety risk to client's function and/or environment (with 1% to 33% chance of negative consequences).
3. Moderate problem–medium safety risk to client's function and/or environment (with 34% to 66% chance of negative consequences).
4. Severe problem–high safety risk to client's function and/or environment (with 67% to 100% chance of negative consequences).

Occupational therapists at COTA Health use the 100-page SAFER Tool manual to ask questions, make observations, and assess the client's task performance in each item. For example, occupational therapists would assess the item "Carrying drinks or meals" by answering the question: "Are there any safety concerns for the client when carrying drinks or meals from the kitchen counter to the table?" They can also observe the client's performance to address the following question: "Can the client bring drinks or meals from the preparation area to the table or chair safely?" (Chiu et al., 2001). In addition to the manual, occupational therapists use an addendum of the SAFER-HOME to learn the revised rating scale (Chiu, Oliver, Faibish, & Cawley, 2002). They were also provided with training to administer the SAFER-HOME v.1.

The time taken to complete the SAFER-HOME varies and is affected by the administration method, the client's functioning level, and the home environment. Home safety assessments are typically completed in one visit in an average of 1 to 1½ hours (Chiu et al., 2001).

## Study One: Acceptance of the SAFER-HOME by Occupational Therapists

Study One aimed to evaluate COTA Health occupational therapists' perception of the clinical utility, practicability, and ability to detect change of the SAFER-HOME v.1. Because the SAFER-HOME was designed for occupational therapists to use in daily practice, their acceptance of the tool and perceived usability are important. COTA's Research Ethics Committee approved this study and Studies Two and Three.

### Measurement Instruments

The occupational therapists used the Outcome Measure Evaluation Questionnaire (OMEQ) to record the experience of using the SAFER-HOME v.1 with each client. The OMEQ was developed by the first author to evaluate outcome measures for clinical practice. The OMEQ has been used in several evaluative studies to assess the suitability of an outcome measure for use in community practice (Chiu & Neufeld, 2003; Chiu & Marshall, 2004). A factor analysis of the OMEQ studies data with varimax rotation revealed a three-factor solution. The 14 items were grouped into the following domains: clinical

utility, practicability, and ability to detect changes. The Cronbach alpha coefficients of the internal consistency were 0.91, 0.83, and 0.86, respectively.

### Data Collection Procedures

The study was conducted in 2001 and 2002. We recruited 25 occupational therapists at COTA Health. They administered the SAFER-HOME v.1 twice, once before and once after interventions with the clients in their caseload. Each occupational therapist completed the OMEQ after the reassessments of the SAFER-HOME were completed. We conducted a focus group and invited the participating occupational therapists. Seven participants volunteered to take part in the focus group. We validated the OMEQ findings with the focus group participants. The audiotaped focus group discussion was transcribed and analyzed, and salient themes were identified.

### Results

A total of 104 COTA clients who received occupational therapy home safety assessment participated in the study. The participant characteristics are presented in Table 2. The occupational therapists completed 70 OMEQ questionnaires. The results showed that occupational therapists generally accepted the tool; 96% rated the SAFER-HOME v.1 as practical to administer, 74% indicated that it measured changes of the client, and 76% indicated that the SAFER-HOME v.1 information helped them make clinical decisions.

Seven focus group participants validated the above findings. The focus group participants had an average of 10 years of home safety assessment and intervention experience. They indicated that they liked the SAFER-HOME v.1 because it enabled them to rate the severity of safety risks and organize the assessment. They found the SAFER-HOME v.1 useful for formulating treatment goals, setting priorities, and tracking the progress of intervention. Communications with clients, family caregivers, and referrers were enhanced with the checklist of problems, written comments, and recommendations. There was a high acceptance of using the SAFER-HOME v.1 as an outcome measure. A suggestion for improvement was to develop more guidelines to ensure consistency of ratings. The focus group participants recommended that the SAFER-HOME v.1 be used as an outcome measure in all geriatric mental health and home safety assessments at COTA Health.

*Table 2*
**Participant Characteristics**

| Characteristic | Study One | Study Two | Study Three |
|---|---|---|---|
| Age, y | | | |
| No. | 104 | 1,173 | 133 |
| Mean (*SD*) | 79.21 (10.62) | 77.61 (12.18) | 76.80 (11.77) |
| Range | 25 to 97 | 21 to 103 | 23 to 98 |
| Gender | | | |
| Male | 29 (28%) | 451 (38%) | 61 (46%) |
| Female | 75 (72%) | 722 (62%) | 72 (54%) |
| Total | 104 (100%) | 1,173 (100%) | 133 (100%) |
| Primary diagnosis | | | |
| Dementia | 25 (24%) | 189 (16%) | 4 (3%) |
| Orthopedic | 22 (21%) | 168 (14%) | 22 (16%) |
| Neurological | 11 (11%) | 174 (15%) | 25 (19%) |
| Other | 46 (44%) | 642 (55%) | 82 (62%) |
| Total | 104 (100%) | 1,173 (100%) | 133 (100%) |
| Living situation | | | |
| House | 62 (60%) | 663 (56%) | 61 (46%) |
| Apartment | 40 (38%) | 491 (42%) | 71 (53%) |
| Other | 2 (2%) | 19 (2%) | 1 (1%) |
| Total | 104 (100%) | 1,173 (100%) | 133 (100%) |

## Study Two: Factor Analysis and Reliability

Study Two was conducted in 2004 to evaluate the factor structure of the SAFER-HOME v.1 and refine its items. The SAFER-HOME v.1 was introduced as an outcome measure in daily practice in 2002 at COTA Health. The cumulative assessment data collected in 2002 and 2003 were used in this study.

### Participants

A total of 1,173 SAFER-HOME assessments, completed by 75 occupational therapists, were available in COTA Health's outcome database for a factor analysis. The participant characteristics are presented in Table 2.

### Item Analysis and Scale Refinement

The number of factors to be extracted in the SAFER-HOME was explored using two procedures: cumulative variance and interpretability (Hatcher & Stepanski, 1994). Hatcher and Stepanski (1994) recommended four sequential procedures in determining how many components to be extracted: eigenvalue greater than one, scree plot test, cumulative variance explained, and interpretability. In this study, the eigenvalue-greater-than-one method was not used because its use is recommended when few-

*Table 3*
**SAFER-HOME v.1 Items Considered for Modifications**

| | SAFER-HOME v.1 Items | Inter-item Correlation > 0.8 | "No Concern" > 98% | Factor Loading < 0.15 in All Factors | Modification Decision |
|---|---|---|---|---|---|
| 1 | Access, entrance, security | | | Yes | Keep |
| 6 | Elevator | | 99.3% | Yes | Remove, merge into "Access, entrance, security" |
| 13 | Wheelchair/scooter | | | Yes | Keep |
| 32 | Wiring, plugs | | 98.4% | | Keep |
| 33 | Electric blanket, pad, heater | | 98.4% | Yes | Keep |
| 34 | Furnace, thermostat, fireplace | | 99.1% | | Keep |
| 36 | Liquids/food | | | Yes | Keep |
| 48 | Iron - manual, auto shut-off | | 98.0% | | Keep |
| 50 | Undress | 0.82 alpha with "Dress" | | | Remove, merge into "Dress" |
| 66 | Door lock | | 98.7% | | Keep |
| 67 | Safe water temperature | | 98.2% | | Keep |
| 68 | Taps | | 99.2% | | Keep |
| 70 | Safe storage of family drugs | | 98.5% | | Keep |
| 71 | Ordering, delivery | | 98.5% | | Keep |
| 82 | TV/radio | | 98.9% | | Remove |
| 87 | Windows/doors | | 98.7% | | Remove, merge into "Enclosed yard" |
| 88 | Enclosed yard | | 99.2% | | Keep |
| 92 | Intercom | | 98.4% | | Keep |
| 94 | Bulbs, fuses, snow, grass | | 99.1% | | Keep |
| 95 | Storage of dangerous substance | | 98.4% | | Keep |
| 97 | Abuse | | 98.8% | | Keep |

er than 30 items are analyzed. The scree plot test was explored but not selected because the results supported a two- or three-component solution but the two or three components extracted explained only approximately 20% cumulative variance.

The principal component analysis of the 97 items generated four possible solutions: 8-, 14-, 21-, and 29-component solutions that explained 29.7%, 40.1%, 50.1%, and 59.4% cumulative variance, respectively. Although the 21- and 29-component solutions yielded greater variance explained values, these solutions consisted of a large number of components, making it difficult to interpret the meaning of each component. On the other hand, the 8- and 14-component solutions generated factors that could be meaningfully interpreted. Subsequently, each solution between the 8- and 14-component solutions was individually analyzed using a varimax rotation and generalized least square procedure. The analysis results supported a 10-factor solution that yielded the most clinically meaningful solution and explained 33% of cumulative variance.

The SAFER-HOME items were examined to determine how they best fit in one of the 10 factors. A factor loading of .15 or greater was used to select an item for inclusion (Norman & Streiner, 1994). Items that had factor loading of less than 0.15 in all 10 solutions were identified for analysis in the next step of scale refinement. Two additional criteria were used for the scale refinement analysis: (1) inter-item correlations that were greater than 0.8, which indicated a multi-collinearity problem, and (2) greater than 98% of "no concern" responses, which indicated a lack of variation of item response (Table 3).

## Results

The inter-item correlations analysis showed that there was one pair of highly correlated items, "Dress" and "Undress." Also, the "no concern" re-

sponses analysis showed that among the 97 items, 17 had greater than 98% "no concern" responses. In addition, five items were identified to have a factor loading lower than 0.15 in all factors. These three results in combination identified 21 items that were considered for refinements. The content review of each item based on clinical judgment supported that the pair of "Dress" and "Undress" items be collapsed, the item "TV/radio" be removed, the item "Elevator" be merged with "Access, entrance and security," and the item "Windows/doors" be merged with "Enclosed yard." The remaining 17 items were kept because of their clinical significance.

Although few clients presented safety problems in these items, the unsafe conditions can lead to severe harm to the clients or others. For example, a small proportion of clients were identified to have safety problems in the item "Wheelchair/scooter." The clients' wheelchair/scooter might be poorly maintained, or the clients might have impairments such as visual perceptual problems that affected their safe use of the equipment. If not identified and addressed, the safety problems may lead to accidents that harm the clients or others. Another example is the item "abuse." Although infrequently identified, the problem could cause physical, mental, or financial harm to the clients if not addressed. Consequently, the 97-item SAFER-HOME v.1 was reduced to a 93-item SAFER-HOME v.2.

### SAFER-HOME v.2

The 93 items of the SAFER-HOME v.2 were examined using an exploratory factor analysis. The number of factors was extracted using the cumulative variance and interpretability methods. Factors were rotated using the varimax method and analyzed using a generalized least square procedure. Similarly, a 10-factor solution was found to have the most clinically meaningful structure. The 10-factor solution (Table 4) had factor loadings in all items greater than 0.15 except for three items ("Liquids/food," "Electric blanket, pad and heater," and "Wheelchair/scooter"). Because the safety risks associated with these items can be severe, they were kept in the SAFER-HOME v.2.

The SAFER-HOME v.1 had 14 categories, including Living Situation (9 items), Mobility (7 items), Kitchen (13 items), Fire Hazards (6 items), Eating (2 items), Household (11 items), Dressing, (3 items), Grooming (4 items), Bathroom (13 items), Medication (3 items), Communication (11 items), Wandering (7 items), Memory Aids (2 items), and General Issues (6 items). These categories were formed to support a logical flow of assessment processes (e.g., from outdoors to indoors and from less intrusive items to more intrusive ones).

In the SAFER-HOME v.2, 10 domains were identified based on the factor analysis. The groupings of these items represented the underlying correlations of the items within each domain. The 10 domains of the SAFER-HOME v.2 were Meal Preparation (10 items), Awareness of Safety Hazards (19 items), Mobility and Toileting (17 items), Cognitive Impairment (8 items), Homemaking Support (7 items), Emergency Communication (6 items), Functional Communication (6 items), Personal Care (6 items), Family Assistance (8 items), and Medication (4 items) (Table 5).

The 14 categories of SAFER-HOME v.1 were not exactly the same as the 10 domains of SAFER-HOME v.2. The 14 categories and 10 domains differed because the 14 categories were designed to facilitate the administration of the assessment, whereas the 10 domains were identified based on the underlying correlations among the items. Due to different reasons of item groupings, the two ways of grouping were kept for different uses—the 14 categories to guide administration and the 10 dimensions to calculate subscale scores.

### Internal Consistency and Reliability

The internal consistency of the SAFER-HOME v.2 was obtained using Cronbach's alpha reliability coefficient. The SAFER-HOME v.2 possesses good internal consistency with a coefficient alpha value of 0.859. Table 5 provides estimates of the internal consistency of each subscale. The coefficient alpha values of the subscales ranged from 0.529 to 0.789, indicating moderate internal consistencies. Due to the moderate reliability of the subscales, it is recommended that the subscale scores be used only for description purposes to explain safety problems. The total SAFER-HOME v.2 score should be used when comparing the safety levels among different groups or time points.

## Study Three: Divergent Validity

The purpose of Study Three was to examine the construct of the SAFER-HOME by testing the hypothesis of home safety being weakly correlated with functional status. As shown in the factor analysis, the SAFER-HOME consists of constructs other than functional status that contribute to home safety, such as the availability of homemaking support, resources for emergency communication, and cognitive impairments. Hence, the SAFER-HOME v.2 was expected to weakly correlate with a functional assessment.

### Measurement Instrument

The système de mesure de l'autonomie fonctinnelle (Functional Autonomy Measuring System [SMAF]) (Hébert, Carrier, & Bilodeau, 1988) was

*Table 4*

**Exploratory Factor Analysis of the SAFER-HOME v.2**

| | SAFER-HOME v.2 Items | Meal Preparation | Awareness of Safety Hazards | Mobility and Toileting | Cognitive Impairment | Homemaking Support | Emergency Communication | Functional Communication | Personal Care | Family Assistance | Medication |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Preparation - hot drinks | **0.71** | | | | 0.28 | | | | | |
| 2 | Preparation - meals | **0.62** | | | | 0.38 | | | | | |
| 3 | Knives, scissors - safe storage, use | **0.59** | | | | | | | | | |
| 4 | Kettle - manual, electric, shut off | **0.59** | | | | | | | | | |
| 5 | Stove - gas, electric | **0.59** | 0.21 | | | | 0.18 | | | | |
| 6 | Toaster, toaster oven | **0.46** | 0.29 | | | | | | | | |
| 7 | Stove - readable controls | **0.43** | 0.22 | | | | | 0.17 | | -0.16 | |
| 8 | Microwave | **0.42** | | | | 0.16 | | | | | |
| 9 | Meals on wheels | **0.40** | 0.23 | | | 0.16 | | | | | |
| 10 | Stove - removable dials, fuses | **0.24** | 0.16 | | | | | | | | |
| 11 | Stove - grease and clutter | 0.45 | **0.53** | | | | | | | | |
| 12 | Storage - accessible, safe | 0.20 | **0.53** | | | | | | | | |
| 13 | Food supply - fridge, cupboards | 0.22 | **0.52** | | | 0.15 | | | | | 0.23 |
| 14 | Garbage - storage, disposal | 0.28 | **0.48** | | | 0.17 | | | 0.16 | | |
| 15 | Wiring, plugs - electrical hazards | | **0.45** | | | | | | | 0.18 | |
| 16 | Evidence of alcohol | | **0.44** | | | | | | | | |
| 17 | Bulbs | | **0.41** | | | | | | 0.16 | 0.27 | |
| 18 | Nutrition/feeding | 0.15 | **0.33** | | 0.16 | | | | | 0.16 | |
| 19 | Environment cluttered | | **0.32** | | | 0.26 | | | | | |
| 20 | Evidence of burns or fires - fire hazards | 0.28 | **0.30** | | | | | | | | |
| 21 | Fire exit - fire hazards | | **0.25** | | | | | | | | |
| 22 | Scatter rugs, flooring - fall hazards | | **0.22** | 0.16 | | | | | | | |
| 23 | Furnace, thermostat, fireplace - fire hazards | | **0.22** | | | | | | | | |
| 24 | Wires, cords - fall hazards | | **0.21** | | | | | | | | |
| 25 | Smoke and carbon monoxide detector | | **0.21** | | | | | | | | |
| 26 | Abuse | | **0.20** | | | | | | | | |
| 27 | Continence - bowel | | **0.18** | 0.16 | | | | | | 0.16 | |
| 28 | Lighting, night light | | **0.15** | | | | | | | | |
| 29 | Electric blanket, pad, heater | | **0.13** | | | | | | | | |
| 30 | Bath - seating, transfer aid | | | **0.58** | | | | | | | |
| 31 | Bath - grab bar | | | **0.55** | | | | | | | |
| 32 | Sponge bath, shower, bath | 0.17 | | **0.53** | | | | | | | |
| 33 | Toileting | | | **0.53** | | | | | | | |
| 34 | Bath - shower extension | | | **0.52** | | | | | | | |
| 35 | Toileting - raised toilet seat | | | **0.46** | | | | | | | |
| 36 | Toileting - versaframe, grab bar | | | **0.44** | | | | | | | |
| 37 | Transfers | | | **0.38** | | | | | 0.20 | | |
| 38 | Bath - non-skid aid | | 0.22 | **0.37** | | | | | | | |
| 39 | Walking, devices | | | **0.26** | | 0.15 | | | | | |
| 40 | Stairs, ramps - railings | | 0.22 | **0.25** | | | | | | | |
| 41 | Stairs, ramps - condition | | 0.16 | **0.24** | | | | | | | |
| 42 | Position | | | **0.19** | | | | | | | |
| 43 | Venturing outside | | | **0.17** | | | | | | | |
| 44 | Continence - bladder | | | **0.16** | | | | | | 0.16 | |
| 45 | Access, entrance, security | | | **0.16** | | | | | | | |
| 46 | Wheelchair, scooter | | | **0.07** | | | | | | | |
| 47 | Wandering person's registry | | | | **0.80** | | | | | | |
| 48 | Night, day | | | | **0.67** | | | | | | |
| 49 | Medic alert, identification | | | | **0.65** | | | | | | 0.22 |
| 50 | Doors, windows, enclosed yard | | | | **0.58** | | | | | | 0.19 |
| 51 | Neighbors aware | | | | **0.36** | | | | | 0.19 | |
| 52 | Local traffic | | | | **0.30** | | | | | | |
| 53 | Leisure | | 0.21 | | **0.28** | 0.16 | | | | | |
| 54 | Smoking, candles, signs of burns | 0.23 | | | **0.25** | | | | | | |
| 55 | Cleaning - light, heavy | | 0.15 | 0.15 | | | **0.76** | | | | |
| 56 | Laundry | | | | | **0.67** | | | | | |
| 57 | Bed making | | | | | **0.54** | | | | | |
| 58 | Shopping | 0.19 | | | | **0.49** | | | | | 0.16 |
| 59 | Carrying drinks, meals | 0.30 | | 0.15 | | **0.34** | | | | 0.15 | |
| 60 | Support - family, friends | | | | 0.17 | **0.27** | | | | 0.17 | |
| 61 | Public, disabled transport | | 0.20 | | | **0.21** | | | 0.18 | | |

*Table 4 (cont'd)*
**Exploratory Factor Analysis of the SAFER-HOME v.2**

| | SAFER-HOME v.2 Items | Meal Preparation | Awareness of Safety Hazards | Mobility and Toileting | Cognitive Impairment | Homemaking Support | Emergency Communication | Functional Communication | Personal Care | Family Assistance | Medication |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 62 | Telephone - ability to dial 911, emergency # | | | | | | **0.91** | | | | |
| 63 | Telephone - emergency # posted, readable | 0.16 | | | | | **0.79** | | | | |
| 64 | Use of telephone | | | | | | **0.51** | 0.28 | | 0.17 | |
| 65 | Telephone - location | | | | | | **0.35** | | | | |
| 66 | Alert system | | | | | | **0.27** | | | | |
| 67 | Intercom | | | | 0.18 | | **0.23** | | | | 0.24 |
| 68 | Reading | | | | | | | **0.91** | | | |
| 69 | Writing | | | | | | 0.17 | **0.75** | | | |
| 70 | Vision | | | | | | | **0.60** | | | |
| 71 | Clocks, can tell time | 0.27 | | | 0.17 | | | **0.34** | 0.19 | | |
| 72 | Speech | | | | | | 0.22 | **0.30** | | | |
| 73 | Hearing | | | | | | | **0.15** | | | |
| 74 | Shaving | | | | | | | | **0.67** | | |
| 75 | Hair care | | | | | | | | **0.58** | | |
| 76 | Teeth - oral hygiene | | | | | | | | **0.53** | | |
| 77 | Dress/undress | | | 0.19 | | | | | **0.51** | | |
| 78 | Appropriate selection | | | | 0.16 | | | | **0.51** | | |
| 79 | Nail care | | | | | | | | **0.44** | | |
| 80 | Financial management, abuse | | | | 0.17 | | | | | **0.67** | 0.21 |
| 81 | Handling money, safekeeping | | | | 0.15 | | | | | **0.62** | 0.25 |
| 82 | Water taps | | 0.41 | 0.19 | | | | | | **0.42** | |
| 83 | Safe water temperature | | 0.21 | | | | | | | **0.39** | |
| 84 | Door locks in rooms and bathrooms | | 0.25 | 0.18 | | | | | | **0.33** | |
| 85 | Lives alone, with others | 0.17 | | | 0.24 | 0.18 | | | | **0.25** | |
| 86 | Storage of dangerous substance | | | | | | | | | **0.19** | |
| 87 | Iron - manual, auto shut-off | 0.17 | | | 0.18 | | | | | **0.18** | |
| 88 | Car, driving | | | | | | | | | **0.16** | |
| 89 | Liquids/food | | | | | | | | | **0.11** | |
| 90 | Safe storage of family drugs | | | | 0.16 | | | | | | **0.81** |
| 91 | Ordering, delivery | | | | | | | | | | **0.76** |
| 92 | In use as prescribed, dosette | 0.28 | | | 0.25 | | | | | | **0.33** |
| 93 | Calendar, date book, notes | 0.22 | | | 0.19 | | 0.19 | 0.21 | | | **0.26** |

Note. *The bolded factor loadings represent items selected for the subscale.*

designed based on the World Health Organization's *International Classification of Impairments, Disabilities and Handicaps* (World Health Organization, 1980). It consists of 29 items that assess an individual's level of disability and handicap in five domains: Activities of Daily Living (ADL), Mobility, Communication, Mental Functions, and Instrumental ADL. A reliability study showed that the intraclass correlation coefficient for total SMAF scores was 0.95 for test–retest and 0.96 for interrater reliability (Desrosiers, Bravo, Hébert, & Dubuc, 1995). The validity was supported by the correlation between SMAF scores and nursing time required for care ($r$ = 0.88) (Hébert et al., 1988) and its ability to distinguish disabilities among residents living in settings with different levels of care (Hébert & Bilodeau, 1986).

## Participants

In this study, a total of 133 clients who completed both the SAFER-HOME and the SMAF were identified from COTA Health's outcome database. The participant characteristics are presented in Table 2.

## Results

The results showed that the coefficient alpha value was -0.206 ($p$ = .018; the negative sign results from the inverse scoring of the scales), which supported the hypothesized correlation between the SAFER-HOME and the SMAF. The proven weak correlation between the SAFER-HOME v.2 and the SMAF verified the presumption that the SAFER-HOME v.2 did not simply measure functional status. The test provided information about the divergent validity of the SAFER-HOME v.2. Divergent validity, one type of construct validity,

*Table 5*
**Internal Consistencies of SAFER-HOME v.2 Subscales**

| | Subscale | No. of Items | Alpha |
|---|---|---|---|
| 1. | Meal Preparation | 10 | 0.789 |
| 2. | Awareness of Safety Hazards | 19 | 0.701 |
| 3. | Mobility and Toileting | 17 | 0.711 |
| 4. | Cognitive Impairment | 8 | 0.659 |
| 5. | Homemaking Support | 7 | 0.675 |
| 6. | Emergency Communication | 6 | 0.712 |
| 7. | Functional Communication | 6 | 0.672 |
| 8. | Personal Care | 6 | 0.679 |
| 9. | Family Assistance | 10 | 0.561 |
| 10. | Medication | 4 | 0.529 |

provided evidence of what a measure does not measure. Good validation studies should include hypothesis testing of divergent validity, instead of merely convergent validity (McDowell & Newell, 1996).

## Discussion

The SAFER-HOME v.2 is a carefully constructed outcome measure. It is established on the theoretical model of Person–Environment–Occupation (Law et al., 1996) and on the belief that home safety must be interpreted in the context of one's natural environment (Letts et al., 1995). The theoretical framework of the SAFER-HOME is consistent with the World Health Organization's *International Classification of Functioning, Disability and Health* (ICF) (World Health Organization, 2001). The conceptual framework of the ICF asserts that a person's activity and participation are affected by not only his or her impairments, but also the environmental contexts.

Traditionally, clients are grouped using medical diagnoses or disabilities. Assessments are often developed under this framework. The safety problems of clients with physical health problems such as hip fractures or stroke are mainly about their risks of falls and environmental barriers. For clients with Alzheimer's disease and related dementias, the safety concerns are focused on their getting lost or being forgetful. The factor analysis results have shown that safety concerns form clusters around "Mobility and Transfer" and "Cognitive Impairments." However, there are eight other domains that are independent from diagnostic or disability groupings (e.g., the "Awareness of Safety Hazards," the availability and quality of "Homemaking Support," and the resources available for "Emergency Communication").

The 10 domains of the SAFER-HOME v.2 reflect the wide scope and complexity of home safety concerns that people with health problems encounter in their homes, demonstrating the interactive impacts of impairment, activity, participation, and environment on home safety. Therefore, the SAFER-HOME v.2 distinguishes itself from other safety assessments that focus on the home environment (without or with less emphasis on the person's ability), as well as those that evaluate an individual's performance in clinical settings (without considering the home condition).

The original intent for the development of the SAFER-HOME was to provide an instrument for occupational therapists to use in daily practice and to capture changes following home safety intervention. It should be a measure that is practical to use in daily practice and in repeated measurements before and after intervention. Study One results provided evidence that the SAFER-HOME v.2 was suitable for routine use in home visits. Occupational therapists accepted the measure and perceived it as practical to use, clinically useful, and sensitive to detecting change.

In addition to the suitability for routine use in clinical settings, a good outcome measure needs to demonstrate sound reliability and validity, coupled with the ability to detect changes (McDowell & Newell, 1996; Slade et al., 1999). Two studies reported in this article have begun the establishment of these psychometric properties. Study Two results yielded a high internal consistency of the SAFER-HOME v.2 (alpha = 0.859), indicating that the 97 items all contributed to the measurement of one dimension (home safety). Furthermore, the factor analysis showed that the 97 items formed 10 domains, reflecting different aspects of home safety.

The results have provided information about item groupings and scoring methods. First, the total score, instead of the subscale scores, should be used for comparison against another group or between time points due to the moderate internal consistencies of the subscales. Second, the subscale scores can be used descriptively to explain safety concerns in the 10 domains. Furthermore, in Study Three, the confirmation of the construct of the SAFER-HOME v.2 showed that an individual's functioning played a role in home safety but did not explain all unsafe concerns. This was supported by the weak correlation between the SAFER-HOME v.2 and the SMAF.

More work still needs to be done to examine the psychometric properties of the SAFER-HOME v.2. First, although a 100-page manual is available to guide the assessment, evaluation of the SAFER-HOME v.2's interrater reliability would provide evidence that different raters would score the measure in the same way. Second, further studies that examine the SAFER-HOME v.2's sensitivity to detect change are essential in making it a credible outcome measure. Because such studies should be conducted after the SAFER-HOME v.2 has established reliability and validity properties, its sensitivity to change was not studied in this stage but will be investigated in a later stage. Third, in-depth content review of similarities and differences among the 14 categories and the 10 domains may yield new understanding of how home safety should be conceptualized to guide assessment and practice.

Fourth, given the importance of environmental contexts on home safety and the limitation of the study samples drawn only from central Ontario, Canada, it is worthwhile to repeat the studies in other jurisdictions, healthcare systems, or countries. Whether the SAFER-HOME construct remains stable can be tested when there are differences in fire regulations, wandering registries, and barrier-free public facilities. Fifth, the construct validity of the SAFER-HOME can be further established by examining its correlations with other validated home safety assessment instruments to establish convergent validity.

The SAFER-HOME v.2 represents a carefully constructed, theoretically driven, and clinically sound outcome measure for assessing home safety of individuals with health or functional problems. The 93 items of the SAFER-HOME v.2 incorporate a wide scope of safety concerns essential for home-based occupational therapy practice that emphasizes the importance of person–environment–occupation interaction. The outcome measure is considered practical to administer and suitable for routine use. There is some evidence to support the presumption that the SAFER-HOME v.2 is a valid and reliable instrument. This article has documented the first three steps of a long-term tool development and refinement process, which is required for most established measurements. Further studies will be needed to establish the SAFER-HOME's psychometric properties, and further revisions will be undertaken to improve the instrument where applicable.

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