PREDICTORS OF ENVIRONMENTAL MODIFICATION AND SPECIAL
EQUIPMENT USE IN FAMILY CAREGIVING

By

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A THESIS

Presented to the Department of Public Health and Preventive Medicine

and the Oregon Health Sciences University

School of Medicine

in partial fulfillment of

the requirements for the degree of

Masters of Public Health

May 1999

School of Medicine
Oregon Health Sciences University

CERTIFICATE OF APPROVAL

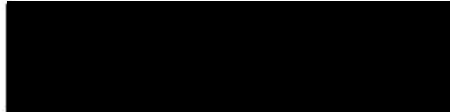This is to certify that the MPH thesis of

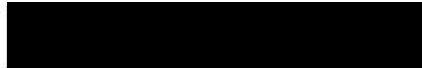Deborah C. Messecar

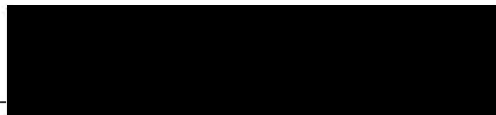Has been approved

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Acknowledgments

knowledge and expertise to the project in a way that respected their other various commitments and deadlines.

The committee members, Dr. Thomas Becker, Dr. David Phillips, and Dr. Kent Anger, gave thoughtful feedback and critique to the investigator at both the proposal and written report stages of the project. Dr. Becker's help was especially appreciated given that he fit this into his multiple commitments to other students in the Public Health and Preventive Medicine department. Dr. Phillips has been a great advisor and mentor and a very supportive faculty member. Dr. Anger provided very detailed and expert scientific critique of the project, which improved both the proposal and written report substantially. Thank you all for your commitment to students.

Abstract

Evidence suggests that families do not adequately modify the environment of the older person's home to optimize independent functioning. The reasons that families do not make these adaptive changes are not well understood. The overall purpose of this study was to identify the family caregiving characteristics associated with use of special equipment and environmental modifications in a cognitively or physically impaired older person's home. This study also evaluated the psychometric properties of a home environment observation scale used in a previous family caregiving study. The environmental data collected using this instrument had not been analyzed prior to this time.

To gather data on the psychometric characteristics of the Interviewer Observation of the Environment Scale (IOES), secondary analysis of data from 108 of 122 dyads who participated in the Caregiver Relief Study (Archbold & Stewart, 1988) was conducted. Cross tabulations were used to examine how well the rater evaluations were correlated using Pearson r. Rater reliability Pearson r coefficients for the six items ranged from .31 to .92 among the two graduate research assistants who conducted the majority of the interviews, and from .29 to .68 among all raters combined. Cronbach's alpha for the raters who interviewed the caregiver and the care receiver in the same home was .85. Interrater reliability between raters' averaged scores who viewed the same home situation at the same time was .80 (p< .001). A random effects ANOVA demonstrated that there were no significant differences between raters on the rating of the overall quality of the environment. To assess validity of the measure, bivariate correlations between the IOES and socioeconomic variables such as the care receivers' education, income and income

adequacy were examined to establish construct validity. Construct validity was further tested by examining the relationship of higher environmental quality to caregiver role strain. The theoretical correlations were all in the expected directions, although most were low in magnitude and some were not significant.

Data from 106 of the 108 dyads care receiver and caregiver dyads were used for the second analysis. Two cases were excluded due to missing data on predictor variables. Using logistic regression to control for care receiver poor health status and impairment, caregiver psychosocial variables were identified that were able to explain the use of special equipment. Use of special equipment in the home where a caregiver is present was mainly predicted by the caregiver's access to formal and informal supports (friends, family, and someone whose job it is) and resources (such as having enough time, energy, and money). Having resources and available help increased the odds of using special equipment in the home by 3 (95% confidence interval [CI] = 1.4, 6.2) to 4.2 (95% CI = 1.3, 13.5) times respectively. Surprisingly, having a good relationship with the care receiver, decreased the likelihood of use of special equipment by 75% (odds ratio = .26, 95% CI = .08, .80). The results indicate that family caregiver characteristics influence the use of special equipment in the home.

Introduction

This thesis is composed of two papers for publication. Paper 1: Psychometric Properties of the Interviewer Observation of the Environment Scale (IOES), provides a report of the psychometric evaluation of a scale that measures quality of the home environment. Data from 108 of the 122 dyads that participated in the Caregiver Relief Study conducted by Archbold and Stewart in 1986-1987 were used to assess the reliability and validity of this observation measure. Paper 2: Family Caregiving Characteristics: Predictors of Environmental Modification and Special Equipment Use, provides an overview of the primary thesis findings. For this analysis, data from 106 of the 108 dyads used in the psychometric evaluation of the IOES were used to explore what family caregiving characteristics predict the use of special equipment and environmental modifications. Both papers were prepared using the guidelines from the American Psychological Associations 4th edition. Tables, figures, and references were created for each paper, so the reader will notice some redundancy between the two reports. This was done to improve the readability of each of the separate papers.

Running Head: IOES PSYCHOMETRIC PROPERTIES

Psychometric Properties of the Interviewer Observation of the Environment Scale

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Abstract

To gather data on the psychometric characteristics of the Interviewer Observation of the Environment Scale (IOES), secondary analysis of data from 108 of 122 dyads who participated in the Caregiver Relief Study (Archbold & Stewart, 1988) was conducted. The Caregiver Relief Study examined the impact of providing in-home services on caregiver role strain among subscribers of a large Northwest Health Maintenance Organization. Interrater reliability for two graduate research assistant interviewers who conducted 76% of the interviews, and for all interviews in which interviewers in the original study evaluated the same home setting on the same day and time was computed. Crosstabulations were used to examine how well the rater evaluations were correlated using Pearson r. Rater reliability Pearson r coefficients for the six items ranged from .31 to .92 among the two graduate research assistants, and from .29 to .68 among all raters combined. Cronbach's alpha was computed separately for the raters who interviewed the caregiver and the care receiver in the same home by computing a scale for them individually. The two raters' scales were then correlated to examine the similarity between raters viewing the same home situation at the same time. Interrater reliability between raters averaged scores who viewed the same home situation at the same time was .80 (p< .001). A random effects ANOVA demonstrated that there were no significant differences between raters on the rating of the overall quality of the environment. To assess validity of the measure, the conceptual model for the Caregiver Relief Study was used to identify hypothesized theoretical relationships between quality of the environment and certain caregiving outcomes related to strain. In addition, bivariate correlations between the IOES and socioeconomic variables such as the care receivers'

education, income and income adequacy were examined to establish construct validity. Construct validity was further tested by examining the relationship of higher environmental quality to caregiver role strain. The theoretical correlations were all in the expected directions, although most were low in magnitude and some were not significant.

Psychometric Properties of the Interviewer Observation of the Environment Scale

About 85 to 88% of all older people live in ordinary homes that are unlikely to have been constructed with features designed to enhance the functioning of frail or chronically ill persons. Approximately 75% of this group own their own homes (Lawton & Hoover, 1981). For the majority of older people who are not physically impaired, such housing clearly affords the maximal range of autonomy and security. However, problems can arise for older people when reduced physical or mental competence makes it difficult to perform their everyday activities.

Evidence suggests that families do not adequately modify the environment of the older person's home to optimize independent functioning. Struyk (1987), using data from the 1978 Annual Housing Survey, estimated that of households headed by an individual 65 years of age and older and in which at least one elderly member had health or mobility limitations, only about 10% had been modified in some way. Handrails and grab bars were the most common additions; less frequent adaptations were made to accommodate wheelchair access and sensory deficits. However the modal number of adaptations was only one, and 865,00 households that could have benefited from such modifications had none. If nurses understood better the impact that the environment has on the older person and their caregiver, then nursing strategies could be designed to assist families in making their homes more supportive.

To systematically assess the home environment, nurses will require information about the quality of the home in which family caregiving takes place. Few instruments are available to assess the potential of the home environment to provide optimal support for the physical and mental well being of the older person. The purpose of this study was

to evaluate the reliability and validity of the Interviewer Observations of Environment Scale (IOES) of the Family Caregiving Inventory (Archbold & Stewart, 1986). In addition to items that assess the overall quality of the home environment, the scale includes an environmental modifications item that the observer uses to document the presence or absence of home modifications. The scale is an observation instrument developed for the Caregiver Relief Study (Archbold, Stewart, Greenlick, & Harvath, 1990). The environmental data collected using this instrument have not been analyzed prior to this time. The purpose of this paper is to (a) describe the development of the IOES, and (b) to report on the psychometric properties of the IOES. The evaluation of the psychometric properties of the IOES will provide evidence about its utility for further home care research and clinical purposes.

<u>Assessing Environments for Older People with Chronic Illness</u>

Environment is a key variable in the care of chronically ill older people. Lawton's environmental docility hypothesis states that "the less competent the individual, the greater the impact of environmental factors on that individual" (Lawton, 1986, p. 14). Chronic illness and disability increase with age (Aging in America 1991) and adversely affect competence of older people in home environments. Person-environment fit has been defined by Kahana (1982) as congruence between environmental characteristics and individual needs. The centrality of the person-environment fit in managing geriatric syndromes in acute and long-term care settings is apparent in the recommendations of the nursing literature related to falls (Hogue, 1992; Hollinger & Patterson, 1992), incontinence (Pearson & Larson, 1992; Wyman, 1992; Smith, Newman, McDowell, & Burgio, 1992), and cognitive impairment (Foreman, 1992; Beck, Heacock, Mercer, &

Walton, 1992). The lack of valid and reliable measures of the quality of the home caregiving environment may have seriously limited nurses' understanding of the actual impact of this important variable on the older person's well-being. In addition, not understanding what factors are associated with the propensity to make adaptations in the older person's home precludes nurses from intervening effectively.

Most tools used by clinicians in the home setting to assess the physical environment are limited in focus and lack evidence of reliability and validity. For example, a number of tools to evaluate home safety have been developed. Most of these measures either do not have demonstrated reliability and validity information available, or have serious construct validity flaws that make their use problematic. For example, the Safety Assessment of Function and the Environment for Rehabilitation (SAFER Tool) was designed to evaluate seniors' ability to manage safely within their home environments (Oliver, Blathwayt, Brackley, & Tamaki, 1993). The tool is a 97-item checklist that identifies problems with an elder's ability to function safely in a given environment. Construct validity was evaluated by testing hypotheses about the SAFER Tool, which were not supported (Letts & Marshall, 1995). Another category of environment assessment tools tries to assess architectural barriers to activity. The Enabler (Iwarsson & Isacsson, 1996) is a tool that tries to quantify the amount of environmental demand by juxtaposing a list of activity limitations with a list of barriers in the environment. An individual's total score is computed by summing rankings of barrier problems given that person's activity limitations. Although the tool's reliability has been demonstrated (Iwarsson & Isacsson, 1996), no studies have addressed its construct validity.

The only objective measure of the home environment developed from the perspective of the family caregiving environment for an older person is the environmental subscale of the QUALCARE Scale (Phillips, Morrison, & Chae, 1990). Originally the QUALCARE Scale was developed to operationalize the dependent variable in a study of elder abuse. According to the authors of the scale, previous research (Ferguson & Beck, 1983; Sengstock & Hwalek, 1986; Tomita, 1982) had failed to produce instruments with adequate reliability and validity and relied on the classification of qualitative data. The QUALCARE Scale was designed to overcome these theoretical and methodological problems by attempting to quantify the construct 'quality of elder caring.' The items were organized around Block and Sinnot's (1979) six dimensions of elder abuse: environmental, physical, medical care maintenance, psychological, human rights violations and financial. The methodological model for the QUALCARE Scale was the QUALPACS Scale of Wandelt and Ager (1974). A Likert-type format (Likert, 1932) was employed using five response alternatives scored from 1 to 5: best possible care, between, average care, between, and worst possible care. Items are averaged within the subscales to determine a subscale and total scale mean. The nurse completes the scale retrospectively after making an assessment of how well the caregiver meets the needs of the elder in the six subscale areas. The nurse uses observations, questioning of the caregiver, care receiver and other medical staff involved in the care and chart audit to form the basis of her assessment. Because of the use of time sampling (Bakeman & Gottman, 1986) raters are not limited to data obtained from direct observation. The standard of measurement selected was optimal care or the care that a knowledgeable professional nurse would provide in the same situation. Cronbach's alpha for the total and

the subscale portions of the scale exceeded .80. Inter-rater reliability was assessed using percentage of agreement between raters observing the same situation at the same time (highest bound of reliability) and through the calculation of k/kmax (the lower bound of reliability). Inter-rater reliability checks were recorded for three periods during the study. k/kmax did not fall below .64, however, the reliability of this observational measure is not unequivocal. To obtain adequate inter-rater reliability, the raters had to be extensively trained and retrained throughout the study period. Training consisted of viewing videotapes of home situations and then comparing ratings with those obtained by more experienced interviewers. Consequently, it is unclear if this level of reliability could be reproduced in a practice setting.

The environmental subscale of the QUALCARE scale is also limited in two important ways. One, the standard of measurement of optimal care is probably not a realistic or appropriate standard to judge the adequacy of the home environment for family caregiving. Two, the measure fails to incorporate or address the family's use of environmental modifications, an important aspect of providing care in the home. In describing the hardships of living with chronic illness, Strauss et al. (1984) identified multiple problems of daily living that are particularly pertinent for family caregivers trying to incorporate care regimens into their caregiving situations. Examples include prevention and management of medical crises, dealing with social isolation, adjustments to changes in the trajectory of the disease, and attempts at normalizing lifestyle. The key problems facing family caregivers involve them in a variety of different kinds of work and tasks. Working out basic strategies to handle these key problems is critical. One basic

strategy the family must devise is the environmental modifications required to facilitate caregiving work.

The IOES addresses both of these limitations. First, the items are written in language designed to capture a conception of the environment that lies outside the individual and is capable of being counted or rated consensually by observers (see Table 1. for a copy of the instrument). Second, an additional item was created that addresses the presence of environmental modifications and asks the observer to qualitatively describe this on the data collection form. As stated previously, the data collected using this observation instrument were not analyzed in the Caregiver Relief Study.

Conceptual Basis for the IOES

The IOES was developed to quantify interviewer's observation of the quality of the home environment. It was assumed that unsupportive residential environments for those experiencing disability might adversely affect outcomes for caregiving. Subsequent research has documented that many chronically-ill frail elders do not live in environments responsive to their needs. A study that sought to determine the types and frequencies of environmental problems in the homes of at-risk elders found a surprising average of four serious problems per home (Mann, Hurren, Tomita, Bengali, & Steinfeld, 1994). In addition, even though most elders in the study had a social support system, significant numbers of environmental problems were not addressed. A subsequent study (Mann, Hurren, Tomita, & Charvat, 1995) found that most stroke survivors had a very large number of environmental problems such as bathroom and kitchen accessibility problems, stairs and other changes in levels in the home that were problematic, insufficient space or cluttered space that made ambulating difficult. Gitlin, Levine and Geiger (1993) have

found that inadequate knowledge of the physical dimensions and properties of an elder's home leads to inappropriate prescription of technology which increases the likelihood of an elder's misuse or nonuse of devices. In the investigator's own work (Messecar, 1999), undesirable physical features in the home were identified by families as problematic for caregiving.

The IOES is designed to quantify the construct 'quality of the home environment' which is defined as the salient positive aspects of the physical home setting that impact upon the well-being of the elder and the family caregiver. Quality of the home environment is conceptualized as a continuum that ranges from excellent to poor or delapidated. A poor or dilapdated home environment is one in which the home has fallen into a state of disrepair. There may be structural damage or other potentially dangerous hazards present such as broken windows or doors off their hinges. The furniture may be broken or torn. The home may be dirty and far too small or crowded or may have a problematic layout, too many stairs, or other safety obstacles. An excellent home environment would be clean and tidy with more than enough space for all the occupants. An excellent home is well-maintained, secure, and furnished with new materials or materials that are in good shape. Problematic features such as too many stairs, inadequate lighting or other safety hazards are minimal. This definition focuses on objective housing indicators of safety, security, cleanliness, size, and maintenance of the residence.

Instrument Development and Item Generation

Items for the scale were generated by advanced practice home care nurses with extensive experience in making home visits to chronically ill frail older people. Hence the instrument was is particularly well suited to evaluation of the home environments of the

types of patients that most home care nurses are likely to serve. The Family Caregiver Inventory (FCI) instrument, of which the IOES was a part, was developed based on Archbold and Stewart's (1986) conceptual framework that depicts family care for elders in a home setting. Burr, Leigh, Day and Constantine's (1979) synthesis of role theory was the conceptual framework used for the development of the scales relevant to family caregiving in the FCI. The emphasis of this particular view of family caregiving relies heavily upon a symbolic interactionist world view.

Preliminary support for the content validity of the IOES was provided by the involvement of experts in its development. Previous inductive research of this investigator (Messecar, 1999) was used to provide further evidence of content validity. Features of the home environment that impact caregiving were identified by interviewing 24 family caregivers. Caregivers reported that the security, safety, ease of maintenance, and adequacy of the size of the home made caregiving difficult or easy. Caregivers indicated that poor accessibility features in the home such as a poor layout, or too many stairs, were particularly problematic and difficult to amend.

The qualitative data collected by the Caregiver Relief Study interviewers and reported in Table 1 further supports that the IOES items represent or tap the domain of important qualities of the home environment. In addition, a review of the limited individual residential environment assessment literature indicated that security, safety, and the level of clutter and comfort have been prominent features of home environment assessment tools developed by geriatric home service providers and occupational therapists (Lawton, Weisman, Sloanne, & Calkins, 1997). The main concern about the adequacy of the operational definition of the IOES relates to its possible lack of

comprehensiveness. As the qualitative data indicate, the safety item of the IOES and the single environmental modification item may be too inclusive to capture all of the possible response options that should be included.

<u>Details of Administration and Method of Scoring</u>

The instrument data collection is based upon the nurses' observation of the home environment during the course of a home visit interview. The IOES is retrospectively completed by the professional nurse after the home visit. The nurse bases her assessment on the observations she has made during the course of a 1 to 2 hour interview. The method of scoring is based on the nurses' perceptions of their direct observations which are rated on either a 4 or 5-point scoring system where higher scores equate with higher environmental quality. Items cover the adequacy of the size, cleanliness, safety, and state of repair of the care receiver's dwelling.

The five response alternatives for the general condition of the furnishings and residence items, 'dilapidated', 'poor', 'fair', 'good', and 'excellent', are scored from 1 to 5. The four response alternatives for the security and safety items 'poor', 'fair', 'good', and 'excellent', are scored from 1 to 4. The cleanliness of the environment response alternatives 'filthy', 'unclean', 'untidy but clean', and 'clean and tidy' are scored from 1 to 4. The size of the dwelling response alternatives 'far too small and/or very crowded', 'pretty small and/or somewhat crowded', 'a little small and/or slightly crowded', 'adequate size, not crowded', and ' larger than needed; more than enough space' are scored from 1 to 5. To calculate the total scale score, four response items are recoded so that their range is 1 to 5. Then the six items are summed and divided by the total number of items.

Training of Interviewers in the Caregiver Relief Study

With only one exception, all of the interviewers in the Caregiver Relief Study were registered nurses. However, none of the items in the IOES require nursing specific expertise to complete. The training for the interviewers began with an orientation to the theoretical perspective used in the study. Interviewers were then familiarized with the instrument during initial training sessions that occurred first in the classroom and were followed by making home visits with the primary investigators. Interviewers were paired with more experienced raters until they were comfortable with the use of the tool and the scoring procedures. Instructions for handling possible coding problems were discussed in weekly meetings held with the primary investigators.

Method

A descriptive correlational design was used to evaluate the pyschometric properties of the IOES. The data from 108 of the 122 dyads participating in the Caregiver Relief Study (Archbold & Stewart, 1988) were used to address the aims of the study. Only data that were collected on the same day and time in the older person's home were used for the pyschometric study. Interviews of the caregiver and the care receiver were completed in separate parts of the home. Each interviewer separately rated the home environment after the home visit. Out of 122 dyads that participated in the Caregiver Relief Study, 108 (or 89%) were interviewed in the older person's home.

Sample

The sample of 122 dyads from the Caregiver Relief Study included interview and service utilization data from 103 caregiver/care receiver units collected 6 weeks post-hospitalization and data from 19 subjects that were part of the original study's expanded

care sample. These additional 19 dyads were not measured post hospitalization, but were recruited based on their use of the Social Health Maintenance Organization (SHMO) services. All care receivers were 65 years or older and had been receiving services from a large health maintenance organization (HMO) in the Pacific Northwest. To qualify for the study, the care receiver had to require assistance in one or more of the following areas: (a) medications or injections; (b) bathing, shampooing or dressing; (c) walking, shopping or errands; or (d) household chores such as cleaning. Caregivers had to be 18 years of age or older and able to speak English. The 122 caregiver-care receiver dyads were recruited from a pool of 243 subjects potential subject families whose eligibility for the study was confirmed during a telephone call.

The characteristics of the 108 dyads that met the secondary data analysis sample criteria of being interviewed on the same day and time in the older person's home are outlined in Table 2. The caregiver sample was primarily female (67.6%), white (96.3%), married (81.5%), well-educated (72% had high school or more education), with more than adequate income for meeting their needs (76%). The median income category for caregivers was $15,000 to $24,999. A little more than half of the caregivers were spouses. Approximately one half of the caregivers were new to the role, and had been caring for their care receivers for 2 years or less. Care receivers were primarily female (58.3%), white (97.2%), and less likely to be married or well-educated than caregivers. Only 13% of the care receivers lived alone. Income adequacy was not completely reported for the care receivers making it difficult to judge what would be the average response among care receivers in the sample. Two-thirds of the care receivers reported that their health was worse than a year ago. Nearly 80% of the care receivers had

problems with mobility, and 27% were cognitively impaired according to the report of the caregiver. The median number of caregiving tasks performed by the caregiver was 22.

Analysis Procedures and Results

Several aspects of reliability were considered in initially assessing the psychometric properties of the IOES including inter-rater reliability and internal consistency. Nunnally and Bernstein's (1994) and Winer's (1977) criteria for evaluation of reliability estimates were used.

Interrater reliability is of critical importance for the IOES because the evaluation of the environment depends on the use of different raters. Statistical estimates for interrater reliability for the two graduate research assistant interviewers who conducted the majority of the interviews for the study was computed for all interviews in which both evaluated the same home setting on the same day and time. These interviewers completed over 76% of the observed ratings of the environment. Cross tabulations were used to examine how well the two raters evaluations were correlated. The Pearson r was used to evaluate this correlation (Table 3). Cronbach's alpha was computed separately for the two raters by computing a scale for them individually. The two raters' scales were then correlated to examine the similarity between raters viewing the same home situation at the same time (see Table 3).

In addition, interrater reliability for observations of the home environment completed by caregiver and care receiver interviewers who visited the same home setting on the same day and time was computed. Cross tabs were used to examine how well the caregiver and care receiver's ratings by the separate interviewers were correlated. The Pearson r correlation coefficient was used to evaluate this correlation (Table 3). All of

these correlations were significant, and for most, the magnitude was greater than .40. The caregivers and care receivers' scales were then correlated to examine the similarity between raters viewing the same home situation at the same time. This correlation was .68 and was significant at the .0001 level.

Because the Pearson correlation coefficients for interrater reliability were lower than 0.80, the reliability for the average of the scores of the raters that viewed the same home situation on the same day and time was computed. Streiner and Norman (1995) have indicated that when each clinical situation is assessed by multiple raters, the average of these observations should have a higher reliability than any single item. The reliability coefficient for the averaged IOES scores was 0.80. In addition, average measure intraclass correlation coefficients were also computed for home environment ratings of the caregiver (ICC = .84; 95% CI = (.77, .88)) and care receiver interviewers (ICC = .85; 95% CI = (78, .89)). The intraclass correlation coefficient indicates that the averaged raters scores are reliable, suggesting that despite their differences in scoring, the raters are able to separate different levels of environmental quality.

A random effects ANOVA was used to look at rater differences in rating of environmental quality of the caregiver and the care receiver. Table 4 contains the results of the four random effects ANOVAs computed for data collected on both caregiver and care receiver quality of the environment and observation of environmental modifications. For the ratings of the quality of environment rated by the caregiver interviewers, the variance due to differences in raters was not significant. This was not true for ratings of the environment observed by the care receiver interviewers, nor for the ratings of observations of environmental modifications by either the caregiver or care receiver

interviewers. This indicates that a considerable amount of the variation in observed modifications was due to differences in how the raters scored this item.

Other possible means of assessing interrater reliability such as the tetrachoric correlation coefficient, the D-L test of agreement and Cohen's Kappa were not used for the following reasons. First, by using ANOVA to assess reliability, three sources of variance from the subject, the observers, and from error will be accounted for in a technical estimate of a true score (Streiner & Norman, 1995). Defining the observers as random factors, specifically accounts for the variance due to the observer (Winer, 1971). Conventional treatments of reliability consistently omit the main effect associated with observations. Examining the Pearson r correlations between the two raters on each item of the IOES will facilitate identification of patterns of agreement among the raters on individual items.

Internal consistency. The reliability of the IOES was further assessed by computing Cronbach's alpha coefficient and by inspecting the inter-item correlations by subscale and total, subscale to total correlations. Rater reliability for each of six items and for a total score including 6 of the 8 items expected to reflect quality of home environment was computed to assess the reliability of the observation measure and to identify items that may be problematic. Cronbach's alpha was computed separately for the caregiver and care receiver's environments by computing a scale for them individually. Cronbach's alpha was equal to .85 for both the caregiver and the care receiver scales which exceeds Nunally and Bernstein's (1994) criteria for a mature scale. Nunnally and Bernstein suggests that at least 50% of inter-item correlations within scales should range between $r \geq 0.30$ and ≤ 0.70 and that item-to-total correlations range

between $r \geq 0.50$ and ≤ 0.70. In the computed caregiver and care receiver scales, only one item failed to meet the inter-item criteria for the caregiver scale ($r = .29$; size of the dwelling). Items in scales that had item-to-total correlations greater than .7 were in the caregiver scale ($r = .81$, condition of furnishings; $r = .8$, condition of residence), and the care receiver scale ($r = .83$, condition of residence). Only one item-to-total correlation was less than .5 in the care receiver scale ($r = .49$, size of dwelling).

The total range of means for the caregiver and care receiver quality of environment scales and the observed modification item appears in Table 4. The average scores for the quality of the environment for both the caregiver and the care receiver exceeded 4 or a rating of good, with more than 50% of the scores between good and excellent indicating that the raters perceived that the quality of the environment for most of the caregiving situations was very high.

Construct Validity

Construct validity was assessed in the following way. The bivariate relationship of four socioeconomic variables and the IOES were inspected (Table 5). The five variables were: (a) high care receiver annual income; (b) perception of having enough income to meet one's needs; (c) higher educational level; and (d) being married. The marital status variable is coded in the reverse direction, so that not married is coded with a score = 1, and married is coded with a score = 0. All of the correlations were in the correct direction and were statistically significant.

Construct validity is established through evaluating the performance of the measure in relation to theoretical predictions regarding its performance. For the IOES, construct validity was assessed through the inspection of the patterns of the predicted

bivariate correlations between the IOES and five other variables. Four of these variables (a) strain from direct care; (b) strain from lack of resources; (c) strain from economic burden; and (d) global strain from caregiving were deduced from the conceptual model of family caregiving developed by Archbold et al. (1990). The other variable, care receiver mobility impairment, was deduced from Verbrugge and Jette's model of disability. For the IOES, all of the correlations were in the direction predicted and three were significantly different from zero at the $p \leq 0.05$ level (see Table 6). The magnitude of the correlations for the testing of the construct validity of the IOES was not expected to be high because of the difference in method of measurement used for the IOES, which was an observation instrument versus the measures of care receiver impairment and caregiver role strain which were self-report.

To examine the likelihood that the single item measure of the presence of environmental modifications captures the construct of using the environment to support the older person, a bivariate correlation between this item and another item in the Family Caregiving Inventory, the use of special equipment was examined. The correlation between these two items was .33 which was significant at the $p < 0.0001$ level.

Discussion

According to Lawton et al. (1997), the person and the environment are inseparable in their relationship to well-being. The need to have instruments available to assess home environments used by elders is great since private residences accommodate an estimated 85% to 87% of all people over the age of 65. Even though a large percentage of people over the age of 65 are capable of maintaining their everyday activities, many healthy people will eventually encounter a state of compromised ability

during which their previously well-matched home environments will become less and less functional. The purpose of the development of the IOES was to quantify data relevant to the assessment of the quality of the elder's home environment. Initial testing of the IOES suggests that it has promise as a valid and reliable research instrument and may have utility as an evaluation instrument for practice. To help nurses in home health make expert decisions about the quality of the home environment and its ability to support caregiving, it is critical that instruments be developed that assist nurses to standardize their observations. The IOES needs further development before it can be used for this purpose.

The random effects ANOVA that was conducted to test the contribution of observer differences to the scales variance indicates that under circumstances where a wide number of raters are used, the error due to variation in rater scoring increases. This could be corrected by adding more items to operationally define safety, by creating more detailed definitions for each of the 6 IOES items, and by improving training for the observers. The qualitative data collected by the interviewers in the Caregiver Relief Study Based could be used to generate additional items for the IOES. Based on the results of the correlations calculated to assess interrater reliability, the security and safety items seem the most in likely to benefit from more precise definitions. Observer training could be improved by familiarizing the raters with the revised items and definitions. In addition, observers may need a checklist of the minimum features in the home that need to be observed. For example, observers should be instructed to view the rooms of the house that the care receiver uses for activities of daily living and for leisure time. Several

home tour videotapes could be created so that new inexperienced raters can improve their skills prior to making home visits.

Caution regarding the use of the environmental modification item should also be applied. For this item, variance in observer ratings seems particularly problematic. The most common error when using categorical questions is that they are employed when the response is not categorical (Streiner & Norman, 1995). The use of a dichotomous response option for the wide variety of environmental modifications that are possible leads to three difficulties. First, since different people will have different ideas about what constitutes a positive response to a question, there will be error introduced into the response. Second, even if all the raters have a similar conception of category boundaries, there will still be error introduced into the measurement because of the limited choice of response levels which results in a potential loss of information and a corresponding reduction in reliability. Third, dichotomizing a continuous variable leads to a loss of efficiency of the instrument and a reduction in its correlation with other measures.

In spite of this limitation, the magnitude of the calculated interrater reliability coefficient between the two graduate research assistants and among the other interviewer raters who observed the same home setting, ranged from .0.69 to 0.43. In addition, the item was also moderately correlated with the care receivers' use of special equipment, which is according to many home adaptation experts (Regnier & Pynoos, 1987), another form of environmental modification. If the use of environmental modifications could be graded with a continuous measure, the reliability and validity could be improved.

The weakest case for the validity of the instrument was made by the theoretical correlations of the IOES with measures of caregiving role strain. The magnitude of the

correlations was low, and some of the correlations were not significant. It may be that the externally perceptible physical aspects of the home environment play only a small role in the perceived quality of life of a home's occupants. In terms of managing the work of caregiving, the social emotional context of the home environment may be the main critical factor affecting caregiving outcomes.

The IOES was designed to assess the quality of the home environment in a population of chronically-ill elders. The instrument is simple, easy to complete, and because it is an observation-based tool, it could be readily incorporated into a nurses' home visit assessment. An important next step in the development of the instrument will be to further develop the safety and environmental modification domains. Further examination of the reliability and validity of the IOES with other populations is needed.

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Table 1. Caregiver Relief Study: Interviewer Observations of Environment Scale (IOES) items along with qualitative data noted by observers rating those items.

Items from IOES	Notes on problems or positive features observed associated with specific items

2. What was the general physical condition of the furnishings?
  • Dilapidated
  • Poor
  • Fair
  • Good
  • Excellent
	• currently redoing living room so house looks as if construction is in progress

3. How would you rate the general security of the residence?
  • Poor
  • Fair
  • Good
  • Excellent
	• excellent, Doberman
	• excellent, fence, security system
	• has security system
	• neighbor watch sign in window
	• recent installation of iron screen doors with deadbolt locks.
	• robbed two weeks ago

4. How would you rate the safety of the environment? (consider: problematic layout, stairs, adequacy of lighting, obstacles such as throw rugs)
  • Poor
  • Fair
  • Good
  • Excellent
	• thick carpet
	• too many levels (i.e. stairs) to house. Difficult to manage after stroke
	• care receiver's room crowded. Little walking room. Difficult to walk along side and support.
	• open stairs to basement
	• open stairway to basement
	• oxygen line long and tangled; may trip on
	• stairs
	• stairs down front porch
	• stairs make it difficult to bring care receiver downstairs
	• stairs to bathroom's and throw rugs (mother tripped on)
	• steep stairs to basement
	• step down to family room. Care receiver blind
	• tall concrete steps at back door
	• throw rugs
	• mother is unable to leave bedroom except on rare occasions because of fatigue

5. How would you rate the cleanliness of the environment? • Filthy • Unclean • Untidy but clean • Clean and tidy	• but had bad smell – dog urine • clean and tidy except for urine smell which caregiver does much to combat • odiferous also • because of construction
6. How would you rate the size of the dwelling in terms of whether it is large enough to accommodate both the number of persons who live there and the belongings of those persons? • Far too small and/or very crowded • Pretty small and/or somewhat crowded • A little small and/or slightly crowded • Adequate size, not crowded • Larger than needed; more than enough space	
8. What was the overall general physical condition of the residence? • Dilapidated • Poor • Fair • Good • Excellent	• older residence in need of some maintenance repairs

Table 1 (continued)

Environmental Modification Item	Recorded observations by interviewers

Did you notice any environmental modifications that would help the care receiver? (e.g. rails put on outside porch, ramps, bed placed in living room)
  • Yes
  • No
If yes, what were they:
	• Air conditioner
	• Bar in bath tub
	• Bar in bath tub
	• Bars in bathroom. Commode at chair side in living room
	• Bed in living room
	• Bright yellow handrail alongside stairs in front of house. Bright yellow stripes painted on cement stairs in front of house
	• cg stated he put rails up by stairs
	• Chair with booster. Furniture cleared so wheel chair can get through
	• Commode in her sitting area
	• Doors taken off entrance to hallway and kitchen to allow easy passage of walker
	• Elevated seat in bathroom
	• Equipment: hospital bed, commode, wheelchair, walker, etc.
	• Hand rails on walls for care receiver to grab for support while walking in home
	• Hospital bed and commode in care receiver's bedroom
	• Hospital bed in bedroom
	• Hospital bed in care receiver's room with other equipment i.e., commode IV stand, etc.
	• Hospital bed in care receiver's room, raised seat in living room
	• Hospital bed in dining room
	• Hospital bed in living room with trapeze
	• Hospital bed, commode, trapeze on bed in care receiver's room
	• Hospital bed, scooter
	• Hoyer lift in bedroom. Labels on personal objects of care receiver in bedroom, i.e., name of objects printed on labels. Has aphasia
	• In SAFE project; hand railings for outside being installed
	• Lift chair for care receiver; special table

Environmental Modification Item	Recorded observations by interviewers
	for care receiver
	• Lift chair in living room, grab bars
	• Lock on gate and doors also to keep care receiver from wandering
	• O2 tank and line for CARE RECEIVER in living room
	• O2 tank in living room
	• Only in kitchen
	• Railing on stairway
	• Rails in bathtub
	• Rails in bathtub
	• Rails outside
	• Raised chairs
	• Raised toilet seat, bars in tub area. Special chair
	• Ramp leading up to front door
	• Two teenage children having to share same bedroom because one taken over
	• Walker in living room; bars on bath tub
	• Wheel chair ramp leading to front door

Table 2. Demographic characteristics of dyads from Caregiver Relief Study Sample

	Care Receiver		Caregiver	
	N=108	%	N=108	%
Age (years)				
14-44			11	10.2
45-64			32	29.6
65-74	32	(29.6%)	37	34.3
75-84	50	(46.3%)	28	25.9
85 and over	26	(24.5%)		
Caregiver is a spouse			58	53.7
Gender				
Female	63	(58.3%)	73	67.6
Male	45	(41.7%)	35	32.4
Ethnicity				
White	105	(97.2%)	104	96.3
Black	3	(2.8%)	3	2.7
Native American			1	.9
Marital Status				
Married	63	(58.3%)	88	81.5
Widowed	36	(33.3%)	9	8.3
Divorced	8	(7.4%)	5	4.6
Separated	1	(0.9%)	1	.9
Never Married			5	4.6
Education				
Attended grade school	14	(13.0%)	1	.9
Completed grade school	19	(17.6%)	14	13.0
Attended high school	28	(25.9%)	15	13.9
Completed high school	21	(19.4%)	28	25.9
Post high school vocational	6	(5.6%)	11	10.2
Attended college	9	(8.3%)	23	21.3
Completed college	9	(8.3%)	16	14.8
Don't know	2	(1.9%)		
Income per year				
Under $3,000	2	(1.9%)		
3,000 5,999	13	(12.0%)	6	5.6
6,000 9,999	14	(13.0%)	14	13.0
10,000 14,999	20	(18.5%)	25	23.1
15,000 24,999	17	(15.7%)	29	26.9
25,000 34,999	13	(12.0%)	17	15.7
35,000 44,999	6	(5.6%)	9	8.3
45,000 and over	1	(0.9%)	2	1.9

	Care Receiver		Caregiver	
	N=108	%	N=108	%
Income adequacy				
Can't make ends meet	8	(7.4%)	2	1.9
Have just enough; no more	12	(11.1%)	24	22.2
Have enough with a little extra	36	(33.3%)	53	49.1
Always have money left over	18	(16.7%)	29	26.9
Lives with caregiver	89	(82.4%)		
Living arrangements				
Lives alone	14	(13.0%)		
Lives with spouse	67	(62.0%)		
Lives with children	26	(24.1%)		
Lives with other relatives	22	(20.4%)		
Lives with non relatives	4	(3.7%)		

Table 3, Pearson r correlations to assess interrater reliability

IOES items and total	Pearson r correlation coefficient for the two graduate research assistants		Pearson r correlation coefficient for all of the ratings that occurred in the same home on the same day.	
Physical condition of furnishings	.46	n = 11	.56***	n = 86
Security of residence	.52	n = 11	.29**	n = 86
Safety of environment	.45	n = 11	.24*	n = 79
Cleanliness of environment	.92***	n = 11	.68***	n = 86
Size of dwelling	.31	n = 11	.40***	n = 86
Condition of residence	.63*	n = 11	.56***	n = 86
Total score			.68***	n= 79
Reliability of the average of two raters			.80	
Environmental modification item	.69**	n = 11	.43***	n = 77
			.43*** phi coefficient	n = 77

*Statistically significant at the p < .05

**Statistically significant at the p < .01

*** Statistically significant at the p < .0001 level

Table 4. Random effects ANOVA to examine variance due to observers

Scale	M(SD)	95% CI	df/df	F ratio	P value
CG Quality of Environment	4.01(.63)	3.90 to 4.13	4/103	.46	.76
CR Quality of Environment*	4.15(.62)	4.02 to 4.30	7/71	2.90	.01
Item	M(SD)	95% CI	df/df	F ratio	P value
CG Environmental Modifications*	.38(.49)	.28 to .47	4/101	3.41	.01
CR Environmental Modifications*	.24(.43)	.14 to .34	7/71	2.32	.03

*Random effects ANOVAs were significant indicating that a substantial amount of

variance was due to observer effects.

Table 5. Bivariate correlations for the IOES with socioeconomic variables as evidence of construct validity.

	N	Correlation with IOES
Higher care receiver annual income	86	.27***
Care receiver perception of having enough income to meet one's needs	74	.44****
Higher educational level	106	.22**
Not married (coded so that not married is scored as 1)	108	-.27***

**Statistically significant at the p < .01

***Statistically significant at the p < .005

**** Statistically significant at the p < .0001 level

Table 6. Prediction of relationships between IOES and theoretically related variables as evidence of construct validity.

Variable	Predicted relationship	Correlation with IOES
Strain from direct care	-	-.14
Strain from lack of resources	-	-.16*
Strain from economic burden	-	-.21*
Global strain from caregiving	-	-.05
Care receiver mobility impairment	-	-.18*

*Statistically significant at the $p \leq .05$ level.

RUNNING HEAD: Predictors of Environmental Modifications and Special Equipment Use

Family Caregiving Characteristics: Predictors of Environmental Modification and Special Equipment Use

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Abstract

The family caregiver characteristics that predict use of environmental modifications and special equipment use were studied in 106 care receiver and caregiver dyads. Using logistic regression to control for care receiver poor health status and impairment, caregiver psychosocial variables were identified that are able to explain the use of special equipment. Use of special equipment in the home where a caregiver is present is mainly predicted by the caregiver's access to formal and informal supports (friends, family, and someone whose job it is) and resources (such as having enough time, energy, and money). Having resources and available help increase the odds of using special equipment in the home by 3 (95% confidence interval [CI] = 1.4, 6.2) to 4.2 (95% CI = 1.3, 13.5) times respectively. Surprisingly, having a good relationship with the care receiver, decreased the likelihood of use of special equipment by 75% (odds ratio = .26, 95% CI = .08, .80). The results indicate that family caregiver characteristics influence the use of special equipment in the home.

Family Caregiving Characteristics: Predictors of Environmental Modification and Special

Equipment Use

Evidence suggests that families do not adequately modify the environment of the older person's home to optimize independent functioning. Struyk (1987), using data from the 1978 Annual Housing Survey, estimated that of households headed by an individual 65 years of age and older and in which at least one elderly member had health or mobility limitations, only about 10% had been modified in some way. Handrails and grab bars were the most common additions; less frequent adaptations were made to accommodate wheelchair access and sensory deficits. However, the modal number of adaptations was only one, and about 865,00 households that could have benefited from such modifications had none. If the family caregiving characteristics associated with the likelihood of developing environmental modifications could be identified, then nursing strategies could be designed to facilitate this type of adaptation among elder's families. The specific aim of this study was to test whether specific family caregiving characteristics such as the degree of mutuality, amount of resources and help, and preparedness for caregiving are associated with making observable environmental modifications in the older person's home.

About 85 to 88% of all older people live in ordinary homes that are unlikely to have been constructed with features designed to enhance the functioning of frail or chronically ill persons. Approximately 75% of this group own their own homes (Lawton & Hoover, 1981). For the majority of older people who are not physically impaired, such housing clearly affords the maximal range of autonomy and security. However, problems can arise for older people when reduced physical or mental competence makes it difficult

to perform their everyday activities.. Consequently the field of environmental modifications is split with those advocating housing adaptations and those providing special equipment working in isolation from one another. The only place that the two are integrated is at the level of the individual care receiver and their family caregivers. Environmental modifications, which include changes in, reorganization of, or additions to the home environment, could make things easier for either the care receiver, caregiver or both. Changes like additions of ramps, moving the bed into the living room, or use of assistive technology such as walkers and canes are examples of possible environmental modifications. Many changes are the joint result of the older person and the family caregiver. Given the critical role that families play in the use of environmental modifications and special equipment, what accounts for differences in the likelihood of their use?

Figure 1 depicts a model developed through previous research to guide social science research on the use of environmental modifications and special equipment. Constructs and their relationships are displayed in boxes and black arrows. Some of these constructs were identified both in the principal investigator's dissertation research (Messecar, 1999) and from a review of the assistive technology literature (Gitlin, 1998). The aspects of the model that have not been previously studied are the caregiving psychosocial and demographic characteristics that influence the likelihood of making environmental modifications.

Home Environment Factors

A study that sought to determine the types and frequencies of environmental problems in the homes of at-risk elders found a surprising high average of four serious

problems per home (Mann, Hurren, Tomita, Bengali, & Steinfeld, 1994). In addition,

even though most elders in the study had a social support system, significant numbers of

environmental problems were not addressed. A subsequent study (Mann, Hurren, Tomita,

& Charvat, 1995) found that most stroke survivors had a large number of environmental

problems in their homes. Bathroom and kitchen accessibility problems were common, in

several homes stairs and other changes in levels in the house were problematic, and many

homes had insufficient or cluttered space that made ambulating difficult. Gitlin, Levine

and Geiger (1993) have found that inadequate knowledge of the physical dimensions and

properties of an elder's home leads to inappropriate prescription of technology which

increases the likelihood of an elder's misuse or nonuse of devices. In the investigator's

own work (Messecar, 1999), undesirable physical features in the home were identified by

families as targets of the attempts to modify the environment. A shared living

arrangement is correlated with being more disabled (Stone, Cafferata, & Sangl, 1987).

Care Receiver's Capabilities

In previous research on assistive technology, frail elders reported using devices

most frequently for physical, then visual, and cognitive, and hearing impairments (Mann,

Tomita, Packard, Hurren, Creswell, 1994; Mann, Hurren, Tomita, & Charvat, 1995).

Mixed impairments such as difficulty with mobility and low vision made many devices

ineffective (Mann, Hurren, Karuza, & Bentley, 1993). Patterns of ongoing device use

vary depending on the types of impairment. For example, one study showed that stroke

patients followed over one year increased device ownership and also increased the

number of devices used (Mann, Hurren, Tomita, & Charvat, 1995). However, a similar

follow up study of cognitively impaired elders found that 42% of the devices

recommended by the therapist were no longer used (Yang, Mann, Nochajski, Tomita, 1997). Mann, Hurren, & Tomita (1993) found that generally elders owned the most devices that related closely to the major type of impairment they suffered from. At higher levels of impairment, neither personal assistance only, nor use of equipment only, appears sufficient to support individuals in the community (Manton, Corder, & Stallard, 1993). This is consistent with the findings in the investigator's previous research (Messecar, 1997) that in many cases, equipment is necessary to supplement active personal assistance.

Not only the type, but the degree of activity limitations may be predictive of environmental modification use. Some researchers have suggested that the decision to undertake home modifications might be motivated by increasing restrictions in activities (Struyk, 1987; Wister, 1989), particularly problems related to mobility (Struyk, 1987). In a secondary analysis of the Assistive Devices Supplement sample from the National Health Interview Survey (NHIS), use of a higher total number of devices correlated with a poorer health status and greater activity limitations (Watts, Erickson, Houde, Wilson, Maynard, 1996).

Elders with cognitive impairments tend to use the least number of assistive devices among all elders with impairment (Mann, Karuza, Hurren, & Tomita, 1992). In addition, cognitively impaired elders had higher levels of dissatisfaction with the devices that they owned. Devices for physical disabilities tend to be more readily accepted and used than devices for cognitive impairments by older persons with cognitive impairment (Nochajski, Tomita, & Mann, 1996). Elders with higher MMSE scores (15 to 23) and their caregivers were more likely to accept both physical and cognitive devices more than

did participants with lower MMSE scores (10 to 14) (Nochajski, Tomita, & Mann, 1996).

The primary reason for dissatisfaction with assistive technology was the limited cognitive

abilities of the individual. The finding that the cognitively impaired elders have the

greatest degree of functional disability but also own the fewest numbers of assistive

devices suggests that many devices may be too difficult for them to use (Mann, Hurren,

& Tomita, 1993). The total number of assistive devices used by 31 elders with cognitive

impairment was best predicted by the degree of physical disability and by the severity of

impact of disease on their daily activities (Mann, Karuza, Hurren, & Tomita, 1992). A

follow-up study of elders with cognitive impairment and assistive device use found that

two thirds of the devices for physical impairment were still being used at the follow up,

while only one third of the cognitive devices were still being used (Yang, Mann,

Nochajski, & Tomita, 1997). These results suggest that progressive deterioration of

cognitive functioning over time changes modification needs which may vary according to

the stage of disease.

Care Receover's Demographic & Psychosocial Factors

Demographic variables related to poor health. In previous caregiving research,

five demographic variables have been consistently related to poor health: older age,

female gender, minority race, lower education, and not being currently married. Chronic

illness and disability, which increase with age (Hobbs & Damon, 1996), adversely affect

the competence of elders in both institutional and home environments. In Geiger's (1990)

study of assistive device use after discharge from an acute rehabilitation setting, subjects

who were older were more likely to continue using their prescribed assistive devices.

Women are more likely than men to be disabled according to data in 65+ (Hobbs &

Damon, 1996). In a national data-based study of assistive device use, not only did women report a higher rate of limitation, they also represented a higher percentage among the most disabled limitations (Watts, Erickson, Houde, Wilson, Maynard, 1996). Not surprisingly, they also reported a higher percentage of device use. It is expected that a higher proportion of women compared to men will use environmental modifications. Minority race is considered a risk factor for higher levels of disability (Hobbs & Damon, 1996). Higher education protects one against developing disability in later life (Hobbs & Damon, 1996). Married stroke survivors were more likely to remain in the community and avoid institutionalization (Fiedler, Melvin & Geiger, 1994). Married care receivers in the investigator's prior work tended to allow their spouses to do more activities for them than care receiver's who were cared for by sons and daughters. This is consistent with a finding from analysis of NHIS data that indicated that a higher percentage of persons not living with a spouse reported more total devices (Watts, Erickson, Houde, Wilson, & Maynard, 1996).

Depression. Patrick (1997) found that depressive symptoms are negatively related to treatment outcome in geriatric rehabilitation. It is expected that depressed care receivers will be less interested in trying new things and consequently will use fewer environmental modifications. Unfortunately, this variable was not measured in the Caregiver Relief Study, so its impact cannot be explored.

Attributes of Modifications

Technology has been classified according to a low, medium and high level of mechanical complexity (Gitlin, 1998). However, in the principal investigator's previous research (Messecar, 1999), and in the assistive technology literature, the most salient

aspects of the modifications likelihood of implementation of technology related to its cost (LaPlant, Hendershot, Moss, 1992;. Karpman, 1992; Mann, Hurren, & Tomita, 1993; Miller, Hornbrook, Archbold, & Stewart, 1996), availability (Karpman, 1992; Mann, Hurren, Tomita, & Charvat, 1995; Yang, Mann, Nochajski, & Tomita, 1997), ease of use (Eblen 1992; Karpman, 1992; Mann, Granger, Hurren, Tomita, & Charvat, 1995; Mann, Hurren, Tomita, & Charvat, 1995; Messecar, 1999; Thompson & Medley, 1995; Waters, Torburn, & Mulroy, 1992) and ease of installation (Messecar, 1999). Unfortunately, measures of the environmental modification attributes are not part of the existing data set. This variable is depicted in the model however, because the absence of data for this variable may be very important.

Task Demands

As noted in the discussion on the physical characteristics of the care receiver, the total number of assistive devices used by 31 elders with cognitive impairment was best predicted by the degree of physical disability and by the severity of impact of disease on their daily activities (Mann, Karuza, Hurren, & Tomita, 1992). In a follow-up study of these community dwelling cognitively impaired elders, those with declining mental function stopped using cognitive devices such as reminder calendars and talking clocks, and used more devices that assisted the caregiver in assisting with activities of daily living (ADLs) (Mann, Hurren, Charvat, & Tomita, 1996). In addition, more home modifications were made to restrict the elder's behaviors such as wandering or rummaging. In a home adaptation program offered free of charge to elders in the Montreal area, modifications related to self care activities were the most popular (Trickey, Maltais, Gosselin, & Robitaille, 1993). Half of all modifications were made in

the bathroom, bedroom, and the kitchen were the next most popular area for changes. It has been demonstrated that successful bath device use is related to individuals having a bath device appropriate for their level of disability (Mann, Hurren, Tomita, & Charvat, 1996). In a program of home modifications offered in Canada (Gosselin, Robitaille, Trickey, & Maltais, 1993), elders who perceived that modifications might improve performance of daily activities were four times more likely to have modifications made to their home.

Although ADLs have a clear link to the use of environmental modifications, the investigator's prior work suggests that families also like to use these strategies to support IADL functioning. This in turn promoted a sense of independence and dignity in the care receiver who with the aid of modifications, could still perform important functions such as banking, writing checks, and managing cooking. The Direct Care Scale used in the Caregiver Relief Study includes items in this category. Leisure activities are often not the focus of therapist interventions, yet in a study of stroke survivors, leisure activities were the activities they missed the most (Mann, Hurren, Tomita, & Charvat, 1995). Several of the families in the dissertation study conducted by the investigator reported that supporting leisure activities was often a goal of their use of environmental modifications. Task demands are seen as an important and critical predictor of the use of environmental modifications, with higher task demands resulting in greater use of environmental modifications.

Caregiver Demographic Factors

The five demographic variables consistently related to poor health -- older age, female gender, minority race, lower education, and not being currently married -- were

included for caregivers as well as care receivers. The length of time caregiving accounted

for variance in the outcomes from technological side effects in Smith's study (1994).

More time as a caregiver should lead to more use of environmental modifications.

Positive caregiving outcomes are associated with adequate income (Given, Given,

Stomel, Collins, King& Franklin, 1992). Financial difficulties due to the expense of

caregiving and the loss of income from employment due to caregiving responsibilities are

all associated with poor caregiving outcomes (Biegel, Sales, & Schultz, 1991). Smith

(1994) found that income adequacy was one of several variables associated with being

able to manage the technological care of tube feeding dependent frail elders.

Caregiver Psychosocial Factors

Caregiver psychosocial factors such as mutuality, availability of resources,

informal and formal supports and caregiver skills, have been previously identified in

caregiving research as factors that affect caregiving outcomes generically. However, it is

not clear from other prior caregiving research how these factors impact the caregiver's

ability to use the environment as a caregiving strategy. For example, other researchers

have identified the importance of a good quality relationship with the care receiver and

having adequate resources as being important factors that support caregiving (Nkongho

& Archbold, 1996). This study will test how these factors contribute to our understanding

of what supports a caregiver's ability to make and use environmental modifications.

Quality of relationship with elder. Prior research has demonstrated that the quality

of the relationship between the elder and the caregiver is related to caregiving outcomes

(Archbold, Stewart, Greenlick, & Harvath, 1990). Smith (1996) found that both mutuality

and preparedness were associated with caregiving effectiveness outcomes. The

investigator's prior research suggested that a poor quality relationship make it difficult for the caregiver and the care receiver to communicate on a number of issues. Since good communication was identified as a necessary element in making environmental changes by several caregivers, this variable may predict more modification use.

Caregiver's personal resources. The caregiver's personal resources include his/her access to financial supports, having time available, and his/her general emotional and physical health and well being. In situations where caregivers have limited personal resources, they have difficulty mounting the effort needed to make substantial changes for the care receiver. Smith (1994) concluded from her path analysis of a model of caregiving effectiveness that inadequate resources such as low income or poor health make it hard to give effective care. Several caregivers in the investigator's prior research reported that the reason that they had not made modifications even though they thought they would be helpful was that they lacked the resources to do so. An analysis that examined the ability of older frail households to make adaptations for independent living via making room use alterations, adding special features to the dwelling such as ramps or grab bars, by making residential moves within the last 12 months, and by obtaining help with personal assistance or household operation activities like cleaning found that those lacking financial resources and informal support and who live alone are less likely to be able to make housing adaptations (Reschovsky & Newman, 1990). Low income is associated with an observed pattern of lower home upkeep in old age (Stuyk, 1987), and less probability of having a home modified (Fox, 1995; Gosselin, Robitaille, Trickey, & Maltais, 1993).

Informal and formal supports. Informal and formal supports include the social resources that caregivers use to receive tangible aid and emotional support. As Archbold (1983) noted in her study of caregiving daughters, personal services were not only difficult to locate, but costly. The amount of family help available was a strong predictor of future institutionalization among stroke rehabilitation patients (Johnson, Zorowitz, & Nash, 1994). Some research findings suggest that the use of outside services to help in the carrying out of daily activities could favor home modifications (Wister, 1989). Supports in the investigator's prior work were important sources of aid in installing modifications, in getting ideas for possible modifications, and help for learning how to use modifications.

Caregiver's skills. Recent studies have identified the development of caregivers' management abilities as a meaningful approach for addressing diverse caregiver needs encountered over time (Clark & Rakowski, 1983; Corbin & Strauss, 1988; Corcoran & Gitlin, 1991; Crossman, London, & Barry, 1981; Gallagher, 1985; Pinkson & Linsk, 1986; Smith, Smith & Toseland, 1991; Toseland, Rossiter, & Lebrecque, 1989). Another qualitative study that explored the experience of caregiving in the home for elders after stroke identified that being able to monitor and evaluate the survivor's functional status and environment were critical skills that families developed (Davis & Grant, 1994). In Archbold's study of parent caring daughters, she noted that caregivers that managed care for their parents had to have skills in the assessment of the elder's functional capacity (1983).

When caregivers feel that they are well prepared for caregiving, they experience less strain from their role (Archbold, Stewart, Greenlick, & Harvath, 1990). Maximizing

caregiver skill development to modify the environment has been advocated by

occupational therapists Corcoran & Gitlin (1992). These therapists proposed a model

therapist intervention using the competent-environmental press model (Lawton &

Nahemow, 1973) to enhance the caregiver's ability to modify environmental press to

minimize difficult behaviors manifested by the elder with dementia.

Method

Design

A descriptive, cross-sectional, secondary-data-analysis design was used to answer

the research questions. In secondary data analysis, the researcher tests new hypotheses by

using raw data that have been collected by someone else (Jacobsen, Hamilton, &

Galloway, 1993). Advantages of secondary analysis, compared to primary data

collection, have been well-documented and include maximizing the use of previously

collected data, saving time, and reducing expenses associated with data collection

(Aaronson, 1990; Bowering, 1984; David, 1991; Jacob, 1984; Kiecolt & Nathan, 1985;

Miller, 1982; Sieber, 1991). The study used data collected from interviews in the

Caregiver Relief Study (Archbold & Stewart, 1988) which examined the impact of

providing in-home services on caregiver role strain among subscribers of a large

Northwest Health Maintenance Organization. The Caregiver Relief Study focused on

caregiving situations in which a family member or friend provided extensive levels of

care in the home to an elderly care receiver who was moderately to severely impaired,

either physically or cognitively. The following criteria were used to evaluate the potential

of the data set to answer this study's research question. The data were available in SPSS

file format. Scrutiny of the conceptual and operational definitions of the study variables

demonstrated that the data set's variables adequately reflected the secondary analyst's concepts of interest. The study design and data collection methods including the sampling method, characteristics of respondents, validity and reliability of instruments, qualifications and training of research team members and the procedures for handling missing data were evaluated for consistency with the purpose of the data reanalysis. In addition, documentation of the data set's instruments, data editing and coding procedures were obtained.

Although this data set may have limited generalizability to other elder populations who are not part of a managed care health care system, the findings from this secondary data analysis are useful for clinicians who need a better understanding of how the environment impacts family caregiving and what factors are associated with the use of environmental modifications. A potential problem is that the data set is relatively old, having been collected in 1986 and 1987. A substantive review of the literature suggests that there may be several historical threats to validity regarding changes in older person's typical home setting or the use of environmental modifications due to the age of the data set. First, since the original study was completed, changes in the US health care system include the development of caregiver assistance programs in more than 35 states. Second, changes in the Medicare and Medicaid reimbursement system in 1994 to 1996 have made home visits to assist families in becoming home care providers for elders reimbursable. However, in spite of these changes, researchers indicate that many elders who could benefit from devices either do not receive or use them (Mann et al., 1997). Consequently, the analysis of these data may provide important insights into what factors are associated with use of environmental modifications.

Sample

The data from 106 of the 122 dyads participating in the Caregiver Relief Study (Archbold & Stewart, 1988) were used to address the aims of the study. The original sample of 122 dyads from the Caregiver Relief Study included interview and service utilization data from 103 caregiver/care receiver units collected 6 weeks, post-hospitalization and data from 19 subjects that were part of the original study's expanded care sample. These additional 19 dyads were not measured post hospitalization, but were recruited based on their use of the Social Health Maintenance Organization (SHMO) services. These additional 19 dyads differ from the main study sample in two ways. First, they were not measured post hospitalization, but were recruited based on their use of the Social Health Maintenance Organization (SHMO) services. Second, many of the care receivers in this group were very frail and appear to use environmental modifications more frequently than their original sample counterparts.

Interviews of the caregiver and the care receiver were completed in separate parts of the home. Each interviewer separately rated the home environment after the home visit. Out of 122 dyads that participated in the CRS, 108 (or 89%) were interviewed in the older person's home. Only data from dyads that had complete data on all of the salient predictor variables were used for the study.

Demographic Characteristics of Dyads in the Caregiver Relief Study. Subjects for the original longitudinal, quasi-experimental study were recruited from a large Northwest Health Maintenance Organization (HMO). The purpose of the study was to analyze the effects of an organized system of long term care services on the strain and health of family caregivers of recently hospitalized older persons. Subjects had to meet the

following criteria. Care receivers required assistance in one or more of the following, medications or injections, bathing, shampooing or dressing; walking, shopping or errands; and household chores. Caregivers had to speak English and be 18 years old or older. For purposes of the secondary data analysis, there had to be data on the observation of the care receiver's home environment (n=108). Demographic data collected on care receivers included age, gender, ethnicity, marital status, education, income, income adequacy, health compared to others, and living arrangements. Demographic data collected on caregivers included age, gender, ethnicity, marital status, education, income, income adequacy, health compared to others, health compared to one year ago, and living arrangements. Characteristics of the caregiving relationship, the caregiving situation and environment were also measured. Data collected from the sample for the described demographic and caregiving variables for the 108 dyads with complete data on the home environment are presented in Table 1. Two of these cases did not have sufficient data to be included in the final analysis.

One potential problem of combining the expanded care sample and the hospitalized sample could be the introduction of information bias if interviewers were aware of the differential status of the two groups and this had somehow altered the type of information gathered from the two groups of subjects. Interviewers in the original study used the identical interview procedure for both groups of subjects. Since the study recruitment staff asked the questions about recent hospitalization and this was not a part of the interview guide in the home, interviewers were not aware or were blinded as to the status of whether or not subjects were part of the social HMO project.

Measures

Each of the measures from the Caregiver Relief Study (Archbold & Stewart, 1988) that will be used to operationalize concepts in this study will be briefly described and the reliability for the scales at 6 weeks post-hospitalization will be reported.

Home environment factors. The average rating of the total of six items from the Interviewer Observations of the Environment Scale (IOES) were used to measure home environment factors. These items give a rating of the overall quality of the environment. Items cover the adequacy of the size, cleanliness, safety, and state of repair of the dwelling of the care receiver's dwelling. Cronbach's alpha for this scale was .85. Interrater reliability correlations between averaged ratings of observers who observed the same environment on the same day were .80.

Care receiver's demographic variables. The following demographic care receiver variables were used to measure poor health vulnerability. Health vulnerability was measured using a set of six variables in which higher vulnerability was reflected by older age, female gender, minority race, lower socioeconomic status reflected by fewer years of education, and currently not married. Social status variables related to poor health vulnerability have been combined into a summative index and used in other family caregiving regression models (Motzer & Stewart, 1996) to predict outcomes in the caregiving situation. It is expected that poor health vulnerability will predict an increased need for modifications in the environment to support care.

Care receiver's capabilities. A single item was used to measure care receiver mobility impairment. The item measures the degree of care receiver mobility impairment. Care receivers were rated on a scale of 0 to 5, with 0 being no difficulty with mobility to

5 being bedfast. A single item was used to measure cognitive impairment. This dichotomous item refers to whether or not the caregiver had to respond to the interview questions for the care receiver because the care receiver was cognitively impaired.

Tasks demands. The Direct Care Scale was used to measure task demands. Direct care refers to the number of caregiving activities performed by the caregiver for the care receiver. A total of 38 items are summed and caregivers that score high on the scale report that they do a high number of activities for the care receiver. The scale has eight subscales of caregiving tasks: personal care (10 items), housekeeping (3 items), protection (4 items), transportation (4 items), financial legal and health decision-making (6 items) handling behavior problems (6 items), medically related (2 items), and little extras (3 items). Coefficient alpha was.86.

Caregiver's demographic variables. The following demographic caregiver variables were used to measure poor health vulnerability. Caregiver vulnerability to poor health was measured using a set of six variables in which higher vulnerability was reflected by older age, female gender, minority race, lower socioeconomic status reflected by fewer years of education, and currently not married.

Caregiver's psychosocial factors. Mutuality was used to measure the quality of the relationship between the caregiver and the care receiver. Mutuality refers to the quality of the caregiver/care receiver relationship, based on reciprocity, love, shared pleasurable activities and shared values. The scale is composed of 15 items. Caregivers and care receivers receiving high scores on this scale report that their relationship with the other is characterized by a lot or a great deal of reciprocity, love, pleasurable activities and shared values. The scale has a potential range of 1 to 4. The scale was constructed by averaging

scores on the 15 items. Coefficient alpha for the caregivers was .91 and for the care receivers was .90. The scale is composed of six items and caregivers that score high on this scale have a big problem with lack of resources. The full scale had a coefficient alpha of .77. Three scales will be transformed to z scores and averaged to measure the amount of informal and formal support. Help from Relatives with Direct Care was used to measure informal support. This scale measures the amount of help with 38 direct caregiving tasks that the caregiver receives from relatives. The scale has a range of 0 - 38. Coefficient alpha was .92. The Help from Friends and Neighbors in Direct Care Scale contains 38 dichotomous items and 8 subscales corresponding to the subscales of direct care. The scale has a potential range of 0 - 38. Coefficient alpha was .79. Help from Someone Whose Job it is with Direct Care was used to measure formal support. The amount of help that the caregiver receives with caregiving activities from people whose job it is to give that help. Composed of 38 dichotomous items in eight subscales corresponding to the subscales of direct care. The range is 0 - 38. Coefficient alpha was .90. Preparedness was used to measure caregiver perception of skill. Preparedness refers to the caregiver's perception of their preparedness to manage the care receiver's problems.

Analysis Procedures

Descriptive statistics, correlations, logistic regressions and regression diagnostics were used in the analysis. Two logistic regression analyses were done, one using environmental modifications and the other using use of special equipment as the dichotomous outcomes. Order of entry of the variables in both logistic regressions was driven by the desire to test what family caregiver characteristics predict use of environmental modifications and special equipment while controlling for care receiver

variables that other researchers have found predict use. The quality of the home environment was considered an antecedent factor that exists prior to the development of functional limitations. Poor health vulnerability and the care receiver's impairment were entered as the second and third step to examine their separate contributions. Likewise, task demands was entered at the fourth step to be certain that its contribution would be detected. At the fifth step, the variables of interest, the caregivers demographic and psychosocial characteristics, were entered in order to examine their independent contribution to predicting use of environmental modifications and special equipment.

A level of significance of .05 was used for hypothesis testing. Correlations between all possible pairs of the predictor variables were examined. For the logistic regression that examined predictors of making environmental modifications, the range of absolute values of the rs was .002 to .45, with a median r of .12. Only 2 of the rs were over .40 and 89% of the rs were .19 or less. For the logistic regression that examined predictors of equipment use, the range of absolute values of the rs was .001 to .41, with a median r of .15. Only 1 correlation was over .40, and 78% of the rs were . 19 or less. No redundant variables were identified. Therefore, multicollinearity was not a problem. Another potential problem with logistic regression is missing data. Subjects were omitted from the analysis if they had missing data for the outcome variable or for more that 25% of the predictor variables. Only two cases of 108 were omitted from the analysis due to missing predictor variable data. The amount of missing data was less than 2%. Appropriate regression diagnostics were utilized to assess the final equation.

Potential problems that could have been encountered with logistic regression include too few cases relative to the number of predictor variables. Logistic regression

may produce extremely large parameter estimates and standard errors and failure to converge when combinations of discrete variables result in too many cells with no cases. This did not occur.

Outliers create a situation where the model has poor fit. Outlying cases were identified by creating a casewise-plot of residual outliers. The logistic regression that examined predictors of environmental modifications did not have any outliers. For the regression that examined use of special equipment, 6 cases (5.7%) were identified as outliers. According to Menard (1995), approximately 95% of the cases should have standardized residual values between –2 and +2. Therefore, the residual analysis did not indicate that outliers were exerting a disproportionate influence on the estimates of the coefficients in the regression equation. However, each case was examined to identify any unusual results that might justify removing the case from the analysis. Among all of the outlier cases, there were no observed environmental modifications and no reported use of special equipment. In the case with the largest standardized residual, the caregiver was performing many caregiving tasks in spite of having a poor relationship with the care receiver and living in a poor quality environment. For the case with the second largest standardized residual, the caregiver had poor health, which may have accounted for the lack of adaptive changes. In the third outlier case, the care receiver enjoyed relatively good health, had a good relationship with the caregiver, and the caregiver felt well-prepared to manage in the role. Consequently, modifications may not have been necessary. The caregiver and care receiver in the fourth case were living in a very poor quality environment, and may have lacked financial resources to change the home situation. The fifth case was very different from the other cases, the care receiver was

cognitively impaired, but relatively limitation free and required very little assistance from the caregiver. The caregiver in this case may not be using special equipment, because very little adaptive technology is available for cognitively impaired persons. The final outlier case had no unusual characteristics. For all of the outlying cases, the lack of special equipment use could be reasonably explained. Therefore, no cases were deleted from the analysis.

Because the sample size for this analysis was already determined, power analysis explored what effect size was necessary to detect a significant result given α set at .05 and minimal acceptable power set at .80. Desired power equal to .80 as a minimum is specified by Cohen, (1988). The statistical software power calculation package PASS 6.0 was used to calculate the power for a small, medium, and large change in the probability of modification and equipment use based on one standard deviation change in the predictor variables. The program options sepcify the parameter to be solved for from the other parameters. The paramters that were selected included p1=0.5 (the probability of making modifications or using equipment), N=106, alpha=0.05, 0.01, 0.10, and Beta=0.20. the change in probabilty that modfications or equipment would be used was specified so that power for an odds ratio of 1.5 could be calculated. The calculations indicated that for a small increase in the odds from 1 to 1.5, the sample size did not provide sufficient power to detect as statistically significant difference at the alpha=0.05 level. However, if the odds ratio change associated with a one standard deviation change in the predictors was greater than 1.8, or less than .6, then the sample size provided enough power to detect a statistically significant difference at the alpha=0.05 level. Power was also calculated for the changes in the odds ratio produced by the predictor

variables mutuality, access to resources, and receiving informal and formal support help. The power calculated for these predictors ranged from .80 to .96.

Results

Descriptive statistics for all scales used in the regression model are summarized in Table 2. As proposed in the conceptual model, the 10 variables were entered in 5 steps (see regression summary in Table 3). For the first logistic regression, using the presence of environmental modifications as the dependent dichotomous variable, none of the predictors was significant. For the second logistic regression, using the presence of special equipment as the dependent dichotomous variable, several important predictors of use emerged. On the first step, the home environment did not contribute significantly to explained variance. On the second step, the care receiver's poor health did significantly improve the fit of the model, albeit the explained variance was minimal. Surprisingly, neither cognitive impairment and mobility impairment, nor task demands added any explained variance above what was already explained by poor health. On the final step, with the addition of the caregiver variables, the fit of the model was improved. Notably, having adequate resources and more help was predictive of the use of special equipment. Mutuality was a significant predictor of not using special equipment.

Discussion

The objective of this study was to extend existing research on predictors of the use of environmental modifications and special equipment in the home caregiving environment. The findings of the study indicate that three of the four hypothesized psychosocial family caregiver characteristics explain the use of special equipment in the home setting. Care receivers who have family caregivers that have access to resources

and help from informal and formal social supports are 3 to 4 times more likely to use of special equipment. This is consistent with previous findings reported by de Klerk, Huijsman and McDonnell (1997) which demonstrated a strong relationship between receiving help and the volume of technical aids used. In the investigator's prior work (Messecar, 1999), providers of formal in-home services were important intermediaries in advising family caregivers in what special equipment would be useful to them.

The finding that mutuality was a significant predictor of not using special equipment was surprising, as it had been hypothesized that a good relationship with the care receiver would make the introduction of environmental modifications and special equipment easier. It was hypothesized that a good relationship between the caregiver and the care receiver, would make it easier to communicate and to more accurately anticipate needs for environmental supports. However, it may be that for some caregivers, doing tasks for the care receiver is a way of demonstrating and maintaining intimacy. Schumacher (1996) found that family caregivers often shift back and forth between doing more or less for their care receivers. The decision process family caregivers use to choose between providing more personal assistance versus encouraging more independence is not well understood and requires further study.

The insignificant contribution of task demand and home environment variables was not expected, based on their seeming importance in previous studies and the model of disablement proposed by Verbrugge and Jette (1994). The contribution of home environment may have been strengthened if the scale used to measure quality of the home environment had more items that addressed problematic features of ordinary dwellings such as too many stairs, or narrow doorways. It was also surprising that mobility

impairment did not predict the use of special equipment which would include ambulatory assistive devices such as walkers, canes, and wheelchairs. It may have been that a one-item measure was not sensitive enough to discriminate between different levels of impairment. It is less surprising that cognitive impairment did not predict either home modification or the use of special equipment. Previous research (Mann et al., 1992) has shown that cognitively impaired elders have difficulty learning how to use equipment and other new features in their environments. Caregiver skill as measured by preparedness was also not a significant predictor either of use of environmental modifications or special equipment. This particular measure was one that conceptually had a poor fit with the secondary data analysis concept it was being used to measure. Items on the preparedness scale do not capture either the ability to assess the care receiver's functional status or the ability to assess the environment. Rather the preparedness scale is intended as a measure of the caregivers perception of their readiness to assume their caregiving duties, and consequently, the measure may not be sensitive to measuring the kinds of skills caregivers need to use the environment as a therapeutic intervention.

A limitation of this study was the specification error introduced by not having data for all of the relevant variables identified in the conceptual model. Neither attributes of modifications nor depression in the care receiver were measured in the Caregiver Relief study. The misspecification caused by omitting relevant variables in the analysis, may have lead to biased or inefficient coefficients in the regressions. According to Menard (1995), bias of the coefficients is generally regarded as a more serious problem than inflated standard errors of the parameters. Any further research should include measures of these independent variables in order to improve prediction of the use of

environmental modifications and special equipment. The relationship between formal and informal supports and the use of equipment suggests the possibility that lack of access to information on modifications and special equipment is a barrier to obtaining and using them. Further research could try to clarify how these variables are related.

There are additional limitations of this study that should be mentioned. This study utilized a cross-sectional design, which is useful in identifying relationships between the predictors and the outcomes of interest, use of environmental modifications and special equipment. However, in order to determine if these variables can consistently predict modification and equipment use, longitudinal research will be needed. Most of the participants in the sample were Caucasian. The generalizability of these results may be limited, and studies evaluating cross-cultural use of the home modifications and special equipment to support caregiving would be useful. A significant limitation of this study was the use of a proxy single item measure to identify subjects who had cognitive impairment. In the Caregiver Relief Study, caregivers identified if the elders that they cared for were cognitively impaired. If they identified them as such, the care receiver was not interviewed. It is possible that some caregivers may have identified their care receivers as cognitively impaired to prevent the interviewers from discovering inadequacies in their care. However, because the all of the dyads included in this secondary analysis had observation data collected on the home, at least some of the use of environmental modification and special equipment would have been observed.

The data presented in this article have several important implications for clinical practice in the community. The association between better supports and resources and the use of special equipment suggest that these factors facilitate adaptation of the

environment to better suit the older person's needs. Supports in the community need to be created that assist caregivers with mustering the resources needed to make adaptive changes to their care receiver's homes. Improved information and referral services are needed to assist caregivers with searching for, selecting, and installing home modifications and technical aids. Further research should explore the environmental modification information needs of family caregivers.

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Table 1. Demographic characteristics of Caregiver Relief Study Sample

	Care Receiver Characteristics		Caregiver Characteristics	
	N=108	%	N=108	%
Age (years)				
14-44			11	(10.2%)
45-64			32	(29.6%)
65-74	32	(29.6%)	37	(34.3%)
75-84	50	(46.3%)	28	(25.9%)
85 and over	26	(24.5%)		
Caregiver is a spouse			58	(53.7%)
Gender				
Female	63	(58.3%)	73	(67.6%)
Male	45	(41.7%)	35	(32.4%)
Ethnicity				
White	105	(97.2%)	104	(96.3%)
Black	3	(2.8%)	3	(2.7%)
Native American			1	(.9%)
Marital Status				
Married	63	(58.3%)	88	(81.5%)
Widowed	36	(33.3%)	9	(8.3%)
Divorced	8	(7.4%)	5	(4.6%)
Separated	1	(0.9%)	1	(.9%)
Never Married			5	(4.6%)
Education				
Attended grade school	14	(13.0%)	1	(.9%)
Completed grade school	19	(17.6%)	14	(13.0%)
Attended high school	28	(25.9%)	15	(13.9%)
Completed high school	21	(19.4%)	28	(25.9%)
Post high school vocational	6	(5.6%)	11	(10.2%)
Attended college	9	(8.3%)	23	(21.3%)
Completed college	9	(8.3%)	16	(14.8%)
Don't know	2	(1.9%)		
Income per year				
Under $3,000	2	(1.9%)		
3,000 5,999	13	(12.0%)	6	(5.6%)
6,000 9,999	14	(13.0%)	14	(13.0%)
10,000 14,999	20	(18.5%)	25	(23.1%)
15,000 24,999	17	(15.7%)	29	(26.9%)
25,000 34,999	13	(12.0%)	17	(15.7%)
35,000 44,999	6	(5.6%)	9	(8.3%)
45,000 and over	1	(0.9%)	2	(1.9%)
Income adequacy				

Can't make ends meet	8	(7.4%)	2	(1.9%)
Have just enough; no more	12	(11.1%)	24	(22.2%)
Have enough with a little extra	36	(33.3%)	53	(49.1%)
Always have money left over	18	(16.7%)	29	(26.9%)
Lives with caregiver	89	(82.4%)		
Living arrangements				
Lives alone	14	(13.0%)		
Lives with spouse	67	(62.0%)		
Lives with children	26	(24.1%)		
Lives with other relatives	22	(20.4%)		
Lives with non relatives	4	(3.7%)		

Table 2. Reliability and descriptive statistics for dependent and predictor variables

Variable	No. of Items	α	No. of Cases	Potential Range	Actual Range	M	SD
Dependent Variables Used in Logistic Regressions							
ENVIRONMENTAL MODIFICATION	1	-	108	0 - 1	0 - 1	.41	.50
SPECIAL EQUIPMENT	1	-	108	0 - 1	0 - 1	.74	.44
Home Environment Factors							
HOME QUALITY	6	.86	108	1 - 5	1.6-4.9	4.07	.60
Social Status Variables Reflecting Poor Health Vulnerability of Care Receiver							
POOR HEALTH (composed of 5 indices)	1	-	108	0 - 4	0 - 4	1.83	1.2
AGE 85+	1	-	108	0 - 1	0 - 1	.24	.43
FEMALE GENDER	1	-	108	0 - 1	0 - 1	.58	.50
MINORITY RACE	1	-	108	0 - 1	0 - 1	.03	.17
LESS THAN HIGH SCHOOL	1	-	106	0 - 1	0 - 1	.58	.50
NOT MARRIED	1	-	108	0 - 1	0 - 1	.42	.50
Care Receiver's Capabilities							
MOBILITY IMPAIRMENT	1	-	108	0 - 5	0 - 5	2.11	1.4
COGNITIVE IMPAIRMENT	1	-	108	0 - 1	0 - 1	.27	.45
Task Demands							
DIRECT CARE TASKS	38	.86	108	0 - 38	3 - 32	21.2	6.9
Social Status Variables Reflecting Poor Health Vulnerability of Caregiver							
POOR HEALTH (composed of 5 indices)	1	-	108	0 - 4	0 - 4	1.44	.88
AGE 75+	1	-	108	0 - 1	0 - 1	.26	.44
FEMALE GENDER	1	-	108	0 - 1	0 - 1	.68	.47
MINORITY RACE	1	-	108	0 - 1	0 - 1	.04	.19
LESS THAN HIGH SCHOOL	1	-	108	0 - 1	0 - 1	.28	.45
NOT MARRIED	1	-	108	0 - 1	0 - 1	.19	.39
Family Caregiving Characteristics							
MUTUALITY	15	.91	106	1 - 4	1.7 - 4	3.12	.58
RESOURCES	6	.77	108	0 - 3	.5 - 3	2.13	.75
HELP (average z scores of 3 scales)	1		108	$-\infty$ - $+\infty$	-.8 - 2.5	-.01	.62
PREPAREDNESS	5	.71	107	1 - 4	2 - 4	2.97	.51

Table 3. Use of Special Equipment Summary (n=106)

Variable	β(SE)	(Exp) β @ Last Step	95% Confidence Interval	Chi-Square fit for step	P
Step 1: Home Environment Factors					
Home Environment	-.57(.46)	.56	(.23-1.39)	.72	.40
Step 2: Social Status Variables Reflecting Poor Health Vulnerability of Care Receiver					
Poor Health	.10(.25)	1.10	(.68-1.79)	4.72	.03
Step 3: Care Receiver's Capabilities					
Cognitive Impairment	.12(.68)	1.13	(.30-4.23)	.60	.74
Mobility Impairment	-.12(.22)	.89	(.58-1.4)		
Step 4: Task Demands					
Task Demands	.03(.05)	1.03	(.93-1.13)	.12	.73
Step 5: Family Caregiver Characteristics					
Caregiver Factors				17.85	.003
Poor Health	.08(.34)	1.09	(.56-2.00)		
Mutuality	**-1.37(.58)***	**.26**	**(.08-.80)**		
Resources	**1.09(.38)****	**2.97**	**(1.42-6.23)**		
Help	**1.45(.59)***	**4.26**	**(1.34-13.52)**		
Preparedness	.50(.57)	1.64	(.54-5.01)		

*p <.02, **p <.005

Conceptual Model

Attributes of Modifications
•cost
•availability
•ease of use
•ease of installation

Home Environment Factors
quality of environment

CR's Capabilities
Physical
Cognitive

Task Demands
•ADL
•IADL
•Leisure

Outcome
Presence or Absence of Environmental modifications
Use of special equipment

CR's Psychosocial Factors
•Depression

Caregiver Psychosocial Factors
•Quality of relationship with elder
•Caregiver's personal resources
•Informal and formal supports
•Caregiver's skills

CR's Demographic Factors
age
gender
race/ethnicity
education
marital status

Caregiver Demographic Factors
age
gender
race/ethnicity
education
marital status

Indicates concept that data set does not include