Prediction of Objective Everyday Competence and Self-Reported IADL Functioning: Cognitive Status and Health Measures

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Functioning in such instrumental activities of daily living (IADLs; Fillenbaum, 1985; Lawton & Brody, 1969), such as housekeeping, medication use, managing finances, shopping, preparing nutritious meals, negotiating transportation, or using the telephone are critical to the maintenance of an independent lifestyle. The vast majority of research on instrumental tasks has arisen from an epidemiological, survey-based approach to functional competence in the elderly. The focus of these studies has been on global, self-report assessments of difficulties in instrumental domains, rather than on an examination of the specific components or cognitive demands of these daily tasks. Little is known about how performance on everyday cognitive tasks relate to such instruments.

To date, most studies have focused on the association of functional ability to measures of global cognitive status, such as the Mini-Mental State Exam (MMSE), reporting moderate correlations between them (Fillenbaum, 1985; Folstein, Folstein, & McHugh, 1975; Galasko, Fillenbaum, Cohen, & Burchett, 1991; Lawton & Brody, 1969). While these examinations may further our understanding of the impact of cognitive deficits on functional ability, such studies typically employ clinical measures that may not be sensitive to very mild cognitive impairments in everyday activities (Ashford, Hsu, Becker, Kuman, & Bekian, 1986) and may not provide information relevant to nondemented, community-dwelling older adults.

Similarly, although many studies have attempted to better understand the relationship of health status to impairments in instrumental activities of daily living, this research has focused on traditional self-report measures of competence (e.g., Crimmins & Saito, 1993; Furner, Rudberg, & Cassel, 1995; Idler & Kasl, 1995; Myers, 1992). As yet, the nature of associations with health factors have not yet been established with objective measures of everyday *cognitive* competence.

While functional competence certainly encompasses physical, social, and cognitive components, the earliest losses are likely to occur in cognitive domains. Thus, it is important to examine the sensitivity of objective performance on everyday competence tasks to potential correlates, such as demographic, cognitive status, functional health, health status, and service utilization factors.

Multidimensionality of Instrumental Activities of Daily Living

Recently, research has suggested multidimensionality among instrumental task domains. As Farmer et al. (1995) suggest, specific IADL items may vary widely in their required tasks and abilities. Wolinsky and colleagues (Fitzgerald, Smith, Martin, Freedman, & Wolinsky, 1993; Wolinsky et al., 1992; Wolinsky & Johnson, 1991) suggest a hierarchical relationship among categories of instrumental activities, with household ADLs (i.e., light and heavy housework, shopping, etc.) representing difficulties with daily chores that likely stem from physical impairment, while advanced ADLs (i.e., managing money, using telephone, meal preparation, etc.) rely less on physical activity and represent cognitively directed everyday tasks. Advanced activities of daily living are thought to capture the underlying mental functioning and cognitive capacity of older adults. Studies have indicated that advanced cognitive ADLs are predictive of disability days, hospital visits, and mortality (Wolinsky & Johnson, 1991). In addition, cognitively demanding advanced ADLs (as opposed to household or basic ADLs) have been found to be more closely related to Alzheimer's disease and cerebrovascular disease, and to predict scores on a mental status questionnaire (Fitzgerald et al., 1993; Johnson & Wolinsky, 1993).

Self-Report and Performance Based Strategies

Recent research has attempted to validate self-report measures against more objective, performance based assessments. In an early comparison, Kuriansky, Gurland, Fleiss, and Cowan (1976) found the Performance Test of Activities of Daily Living (PADL) to be predictive of outcomes such as institutionalization at a 3-month interval, while self-reports were not correlated

with health or outcome status. In general, participants' own ratings of functional competence were not representative of their actual level of ability, with only 41% of the sample accurately evaluating their performance.

The emphasis on basic physical ability inherent in these measures may explain their minimal association with indicators of cognitive functioning. These instruments may be best suited to early identification of chronic disease conditions that could be exerting influence before disability is evident (Rozzini, Frisoni, Bianchetti, Zanetti, & Trabucchi, 1993). However, other instruments have been developed to capture the complex cognitive processes that are necessary for successful completion of advanced instrumental tasks. The Direct Assessment of Functional Status (DAFS; Loewenstein et al., 1989) focuses on discrete behaviors necessary for independent living, such as counting coins, writing a check, making telephone calls, and remembering items on a grocery list. Utilizing this instrument, the researchers differentiated the performance levels of Alzheimer's patients from those of normal and depressed participants. Unfortunately, measures such as this one are suitable primarily for low functioning elderly and are not adequate evaluation tools for estimating status in nondemented, at-risk older adults.

Several researchers have hypothesized that self-report and performance measures of functional abilities may posit unique information regarding functional ability (Hoeymans, Feskens, van den Bos, & Kromhout, 1996; Rozzini et al., 1993). Rozzini et al. (1993) reported that an objective measure of functioning in everyday tasks, the Physical Performance Test (PPT) exhibited greater sensitivity to the detection of early or mild functional limitations than did self-report measures. These results may support the differentiation between functional limitations and disability, as outlined in the disablement process model (Verbrugge & Jette, 1994). Participant performance on objective measures may represent functional limitations (i.e., restrictions or

impairments in the basic physical and mental processes necessary to perform activities), whereas their self-report ratings may reflect actual disability in performing everyday tasks.

The present research will explore the relation of an objective, behavioral measure of everyday competence in complex cognitive tasks of daily living to self-reported IADLs, clinical measures of cognitive status, functional health, and health service utilization. The Everyday Problems Test for Cognitively Challenged Elderly (i.e., EPCCE; Willis et al., 1998) will serve as the objective measure. This study has two main objectives: (1) To determine whether group membership on health service utilization or functional health indicators are associated with lower scores on objective everyday cognitive competence, and (2) To determine if objective everyday cognitive competence (i.e., EPCCE) exhibits differential relationships with demographic, cognitive status, health, and service use factors as compared to the association of such factors to self-reported competence in instrumental tasks (i.e., self-report IADL).

Method

Design

The present study is part of a program of research that is currently being conducted in collaboration with the Monongahela Valley Independent Elders Survey (MoVIES), an ongoing, prospective epidemiological study of cognitive impairment and dementia begun in 1987 to establish a population-based dementia registry. The survey sample includes adults aged 65 years and older selected by age-stratified random sampling from voter registration lists of a group of communities in the Monongahela Valley of southwestern Pennsylvania. This is a rural blue-collar population of relatively low socioeconomic status and education. To be eligible for participation in the study, persons had to be living in the community, be fluent in English, and have at least 6 years of education.

Participants

The first occasion sample for this study included 596 (F = 392, M = 204) low SES, community-dwelling older adults from rural southwest Pennsylvania. Participants were predominantly Caucasian (98%), with a mean age of 78 years (SD = 4.64; Range = 70-94). Thirty-one percent of participants (n = 185) were young-old (70-75 years), while 69% (n = 411) could be classified as old-old (75 years and older). Approximately one-third of the sample had less than a high school education (6-9 years, 19%; 10-11 years, 13%); 36% completed high school; and 29% had post secondary education (trade or technical school, 13%; some college, 8%; college graduate, 5%; graduate or professional training, 4%).

The vast majority of participants were either married (49%) or widowed (43%). Single or divorced participants each comprised four percent of the overall sample, respectively. Approximately 67% of participants reported living with a spouse or other relative, while 33% lived alone. A minority of older participants (n = 12; 2%) reported that they were unable to accomplish some activities of daily living independently and thus required assistance in the home. However, information is not available on the specific difficulties or domains that made assistance or supervision necessary for these individuals.

Representativeness of the Penn State Sample

Of the 869 MoVIES subjects available for participation at the first occasion of the Penn State study, approximately seventy percent (n = 596, 68.6%) are included in this study. Of the remaining 273 cases (31.4%) that did not participate in the Penn State study, 33 cases (12.1%) were excluded by the interviewer based on their judgment of the subject's cognitive impairment, ill health, or sensory impairment. In 50 cases (18.3%) the subject was rated as 0.5 or higher on the Clinical Dementia Rating Scale (CDR; Hughes, Berg, Danziger, Coher., & Martin, 1982), indicating possible dementia and thus excluded. In the remaining 190 cases (69.6%) the subject chose not to

respond to the EPCCE, indicating the following reasons: desired no more involvement or disliked cognitive testing (46.3%) time constraints (16.8%), sensory impairment (14.2%), illness (6.8%), fatigue (4.2%), or an unknown or other reason (11.6%).

Procedure

Subjects were assessed in their homes. Subjects were first administered the MoVIES protocol, involving an extensive interview and a battery of clinical and neuropsychological measures. The semi-structured interview focused on demographic information, sensory impairments, functioning in daily self-care and instrumental activities, health, nutrition, number and types of medications, and the use of formal and informal health and social services. Following the MoVIES battery, subjects were told that they had the opportunity to take part in a new phase of the study (i.e., EPCCE). Subjects were paid $10 for their participation in the MoVIES project and an additional $10 for testing on the EPCCE measure.

Measures

Everyday Cognitive Competence.

The test of Everyday Problems for Cognitively Challenged Elderly (EPCCE) measures older adults' cognitive ability to solve tasks associated with everyday activities. This 32-item measure assesses complex cognitive functioning in each of the seven IADL domains (Fillenbaum, 1985; Lawton & Brody, 1969). Participants are shown 16 printed stimulus materials that represent real-world stimuli encountered in tasks of daily living, such as an itemized phone bill, directions for over-the-counter medication, or a nutrition label. Upon viewing each stimuli, subjects are asked to solve two problems related to the information presented (e.g., 'What is the maximum number of teaspoons you would take in a 24-hour period?'). For the present sample of older adults ($N = 596$), the internal consistency was .90 and split-half reliability was .91.

Clinical and Neuropsychological Battery

The MoVIES clinical and neuropsychological test battery (Ganguli et al., 1991) is an expansion of the protocol defined by the Consortium to Establish a Registry for Alzheimer's Disease (CERAD; Morris et al., 1989). Prior research analyzing the structure of the CERAD (Morris et al., 1989) has suggested a three-factor structure encompassing the areas of memory, verbal ability, and praxis/executive functioning. An exploratory factor analysis of the present data indicated that three latent constructs may underlie the tests comprising the expanded CERAD battery. For the purposes of this study, the following factors were tested and composite variables created: (1) Verbal Ability (Verbal Fluency and the Boston Naming Test), (2) Memory (Story Recall and Word List Recall), and (3) Executive Functioning (Clock Drawing, Constructional Praxis, and Trail Making Parts A and B). The Mini-Mental State Exam was considered separately due to prior work indicating the complex nature of this measure and its predicted association with each construct (Morris et al., 1989).

Story Recall: Immediate and Delayed. In order to assess immediate and delayed memory recall, a short story was read to participants and they were asked to report everything they could remember about the story (Becker, Boller, Saxton, & McGonigle-Gibson, 1987).

Verbal Fluency. To assess verbal ability, participants were asked to name as many items as they could within 60 seconds in a given category (i.e., letters P and S, fruits, animals) (Borkowski, Benton, & Spreen, 1967; Benton & Hamsher, 1976).

Modified Boston Naming Test: CERAD subset. On a modified version of the Boston Naming Test (Morris et al., 1989), participants were asked to name 15 objects when presented with drawings of those objects (i.e., tree, flower, dominoes). Participants are allowed 10 seconds per picture.

Mini-Mental State Exam. The Mini-Mental State Exam (MMSE: Folstein et al., 1975) was used as a cognitive screening test to assess participants' level of orientation to time and place, short-term and delayed memory recall, ability to follow simple directions, spatial ability, set-shifting, and language. In this study, the Serial 7's test was used to assess attention.

Word List Memory Task Recall: Immediate and Delayed. In the Word List memory task (Morris et al., 1989), participants were presented with a list of 10 words and then asked to recall as many words as they could in 90 seconds. Over the next two trials, the tester read the words in a new random order and asked participants to recall as many words as possible on each trial. Later in the battery, delayed recall for the original list of words was assessed.

Constructional Praxis. Constructional praxis was employed to assess constructional ability, planning, and executive functions (Rosen, Mohs, & Davis, 1984). Participants were given four drawings: a circle, diamond, double rectangle, and cube and asked to copy the drawings.

Clock Drawing. The Clock Drawing test (Kaplan, 1990) requires participants to draw the face of a clock so that the hands are set for 11:10. This task assesses abilities similar to those of constructional praxis.

Trail Making Part A and Part B. Trail Making Part A (Reitan, 1955; Reitan & Tarshes, 1959) assesses reaction time, visual scanning, working memory, and set shifting and sequencing. Participants were asked to draw lines connecting numbers from 1-25. The total score indicates the amount of time to finish the task, the total number of errors, and the total number of points connected. Part B is more cognitively complex than Part A. In this test, participants must connect both numbers and letters in subsequent order. For example, 1-A-2-B, etc.

Health Service Utilization and Perceived Health

Hospitalization and Emergency Room Use. Participants were asked whether or not they had been hospitalized or had used the emergency room since the last visit (i.e., approximately 2 years).

For hospitalization, two dichotomous variables (i.e., yes/no) were created, representing whether or not the participant had been: a) Hospitalized since last visit, and b) Hospitalized within the past 6-months.

Home Health and Social Service Use. Participants were also asked (yes/no) about their use of home health care and/or social services since the last interview. Responses indicated whether or not they had utilized any professional home health service (e.g., visiting nurses, home health aides, physical therapy, etc.), and/or any type of social service (e.g., adult day care, meal delivery, social workers, etc.) since the previous interview.

Self-Rated Health. A single item indicator of general health, "In general, how good do you feel your health is for a person your age" was utilized. Participants indicated a rating of self-perceived general health on a scale ranging from "1" for excellent, to "4" for poor.

Prescription Medications. Participants were asked to indicate the total number of prescription medications taken on a daily basis on an open-ended item. A categorical variable was created that ranged from 0-6, with the maximum category indicating the daily use of 6 or more prescription medications.

Cumulative Index for Service Utilization. A global index of health service utilization was created, including hospitalization since the last visit, hospitalization in the past 6 months, emergency room use, home health care utilization, and social services utilization. The inclusion of these indicators to represent global health service utilization is well documented in the health services literature (e.g., Wolinsky et al., 1992; Wolinsky & Johnson, 1991). A composite variable was created by summing the five dichotomous items (i.e., presence of use; absence of use) for each of the indices, with the total score ranging from "0" indicating no health service utilization to "5" representing the use of all forms of health care. Summative scales of dichotomous variables have

typically been used by researchers to approximate the extent of health services use in an older population (e.g., Penning, 1995; Strain 1991).

Functional Health

Instrumental Activities of Daily Living. Difficulty or disability in instrumental activities of daily living (IADLs) were assessed via the OARS (Duke University 1978; Fillenbaum, 1985; 1988). Participants rated themselves in seven IADL domains on a Likert scale ranging from "0" to "3". The scale for each item was collapsed into a dichotomous indicator of "0" representing independent functioning, and "1" indicating self-reported difficulty in a particular domain.

Sensory/Physical Impairment. Potential seasory or physical limitations were judged during the testing session via 3-dichotomous items (i.e., yes/no). The interviewer rated whether or not vision impairment, hearing impairment, or physical disability significantly interfered with the participant's performance during the session. To assess mobility, one item assessing getting around outside the home was employed (0 = no mobility limitation; 1 = mobility limitation).

Home Assistance. A dichotomous item was created indicating whether or not the participant reported the presence of assistance in the home due to an inability to prepare meals, take medications, attend to basic self-care needs, etc. (0 = did not have assistance; 1 = did have assistance).

Cumulative Index for Functional Health Variables. Functional health risks encompassed five indicators: vision impairment, hearing impairment, physical disability, home assistance, and mobility limitations. Composite scales of functional limitations or functional status have been employed in many studies and have typically included measures of physical functioning such as mobility, ADL disability, sensory difficulty, etc. (e.g., Johnson & Wolinsky 1993 1994; Morris, Sherwood, & Morris, 1996; Penning 1995). In studies of health services use, these functional measures are often interpreted as the need characteristics component of the Andersen model

(Andersen & Newman, 1973). A composite variable was created by summing the five dichotomous items (i.e., presence of difficulty; absence of difficulty) for each of the indices, with the total score ranging from "0" indicating no difficulty in any of the five domains, to "5" representing difficulty in all areas.

Results

Objective EPCCE and Self-Reported IADL Performance

Objective EPCCE Performance

The average score on the EPCCE at the first occasion ($N = 596$) was approximately 21 ($SD = 6.87$, Range = 0-32), indicating that participants responded correctly to 66% of items on the measure. Education and age effects were noted for EPCCE scores. Young-old participants scored significantly higher on the EPCCE, as compared to old-old adults [$F(1,584) = 37.06$, $p < .001$; Young-old $M = 23.41$, Old-old $M = 19.83$]. Standardized to T-scores (i.e., $M = 50$, $SD = 10$), these means were 54.17 and 48.12, indicating a 6-point discrepancy between groups, or over one-half a standard deviation unit difference between young-old and old-old participants.

Education level exerted a significant effect on performance, with participants who failed to attain a high school education achieving lower scores than those with a high school education or beyond [$F(2,584) = 31.25$, $p < .001$; Below high school $M = 18.18$, High School $M = 22.91$, Above high school $M = 23.77$]. Standardized to T-scores, these means were 44.41, 52.12, and 53.45, indicating that the low education group scored over two-thirds of a standard deviation lower than those with a high school degree and nearly one standard deviation lower than older adults with educational attainment beyond high school.

A series of ANCOVA models were examined to assess mean differences on EPCCE scores across health and functional health variables. Age and education served as covariates for each analysis. Variables for which significant differences on the EPCCE were found will be discussed.

Home Health Care and Social Service Use. Those participants who reported using home health care since their last interview had significantly lower EPCCE scores ($\underline{M}$ = 17.05) than those who did not report such use ($\underline{M}$ = 20.17), $\underline{F}(1,590) = 5.39$, $\underline{p} < .05$. Similarly, participants reporting the use of social services exhibited lower EPCCE scores than those who did not use services. ($\underline{M}$ = 16.47 vs. $\underline{M}$ = 20.76), $\underline{F}(1,590) = 9.63$, $\underline{p} < .01$.

Sensory Impairment. Main effects for vision and hearing problems were found, but the interaction was not significant. Participants with visual difficulties scored significantly lower on the EPCCE ($\underline{M}$ = 11.09) than those without such limitations ($\underline{M}$ = 17.70), $\underline{F}(1,590) = 3.85$, $\underline{p} < .05$. Similarly, the mean score for hearing impaired individuals was significantly lower than those participants without noticeable hearing loss, $\underline{F}(1,590) = 13.96$, $\underline{p} < .001$ ($\underline{M}$ = 5.02 vs. $\underline{M}$ = 19.77).

Self-Rated Health. Self-rated health influenced mean level EPCCE scores, with those who perceived their health as "excellent" or "good" achieving higher scores ($\underline{M}$ = 22.55; $\underline{M}$ = 21.22) than groups reporting "fair" ($\underline{M}$ = 19.13) or "poor" ($\underline{M}$ = 15.15) health status. $\underline{F}(3,590) = 2.73$, $\underline{p} < .05$.

Self-Reported IADL Performance

The majority of participants ($\underline{n}$ = 482; 81%) reported independent functioning in the six domains of instrumental activities of daily living (i.e., telephone use omitted). Approximately twelve percent of individuals ($\underline{n}$ = 71) reported difficulty in one domain, 5% ($\underline{n}$ = 27) had limitations in 2 to 3 domains, and 3% ($\underline{n}$ = 15) endorsed impairment in 4 to 6 of the instrumental task areas. Functional ability differed across the IADL domains. Considering each domain separately, participants reported the greatest difficulty with housekeeping duties (17.9%) and shopping for necessities (6.5%). Negotiating transportation and preparing meals were rated as difficult by 4.2

and 3.2 percent of the sample, respectively. Participants reported the least difficulty with taking medications (1.0%) and dealing with finances (1.5%).

Rates of impairment in IADL also differed by age group and gender. Men reported greater levels of independence in each age group. For the young old, 96% of men and 89% of women reported independence in daily tasks. In the old-old age group, 87% of men and 72% of women reported having no IADL dependence. Old-old adults reported more impairments, with 3.5% of men and 8.6% of women indicating limitations in 3 or more domains. In general, the greatest levels of IADL impairment were observed for old-old women.

Association of Objective EPCCE and Self-Reported IADLs

The association between EPCCE and IADL scores was significant, but modest ($\underline{r}$ = -.25). While 81% of participants rated themselves as independent in IADL domains, only 44% of participants functioned at or above the 75th percentile of performance on the EPCCE (i.e., a score of 24 or above). Approximately 59% of participants identified as low functioning on the EPCCE, those at or below the 25th percentile, indicated that they were independent in all 6 IADL domains on the self-report scale. However, an examination of the subgroup of highly disabled individuals (i.e., those reporting 4 or more limitations in instrumental domains) revealed very low EPCCE scores for these participants, with a mean score of 12 out of 32 possible points (Range: 0 - 20).

In fact, as the level of IADL disability increased, mean performance on the EPCCE decreased. Those reporting one IADL limitation had a mean of 20.5 on the EPCCE, while those with 2 domains of dysfunction earned an average of 14.7 points. Participants with 3 to 4 self-reported disabilities scored lower still, earning an average of 13.6 and 11.0 points, respectively. ANCOVA results (i.e., using age and education as covariates) indicated that individuals with 0 to 1 IADL impairment scored significantly higher than participants reporting 2 or more limitations in daily tasks, $\underline{F}(6,587) = 5.66$, $\underline{p} < .001$.

Prediction of IADL and EPCCE: Observed Health and Functional Health Indicators

Prediction of EPCCE

Hierarchical regression analyses were used to identify potential concurrent predictors of everyday cognitive performance on the EPCCE. In order to determine the influence of observed predictor variables on everyday cognitive competence apart from that of demographic indicators, regression analyses were conducted in two steps. In the first step, dichotomous and dummy coded categorical variables representing all health and functional health indicators were entered into the equation. Hearing impairment, social service use, home assistance, mobility limitations, and poor perceived health were significant concurrent predictors of EPCCE scores. This step accounted for 20% of the variance in everyday cognition, $F(14,581) = 10.44$, $p < .001$.

In the second step, the contribution of demographic factors to the equation was examined. The addition of age and education significantly increased the variance explained, $F(2,579) = 66.96$, $p < .01$, $R^2 = .35$, change in $R^2 = .15$. As a final step, all significant indicators from the second step were entered into a single equation. As Table 1 indicates, the most salient predictors of everyday competency scores were hearing deficits, home assistance, mobility limitations, age, and education level, accounting for 34% of the variance, $F(5,590) = 59.62$, $p < .001$.

Prediction of Self-Rated IADLs

Identical hierarchical regression analyses were used to identify potential concurrent predictors of self-reported limitations in IADL domains. The dependent variable in these analyses was the sum of the IADL limitations endorsed by the participant. In the first step, physical disability, home health care use, social services use, number of prescription medications, mobility limitations, and poor perceived health were significant concurrent predictors of IADL functioning. This step accounted for approximately 60% of the variance in IADL scores, $F(14,581) = 62.70$, $p < .001$.

In the second step, the contribution of demographic factors to the equation was examined. The addition of age and education significantly increased the variance explained, but only age was a significant predictor of IADLs, $F(2,579) = 15.38$, $p < .01$, $R^2 = .62$, change in $R^2 = .02$. As a final step, all significant indicators were entered into a single equation. As Table 2 indicates, the most salient predictors of self-reported IADL functioning were home health care use, social services use, prescription medications, home assistance, mobility limitations, poor perceived health, and age, accounting for 61% of the variance, $F(7,588) = 131.61$, $p < .001$.

Prediction of IADL and EPCCE: Clinical, Health Service, and Functional Health Indices

Associations among the EPCCE, clinical, and health variables are shown in Table 3. Everyday competency scores at both time points were strongly associated with the clinical factors and the Mini-Mental State Exam. The EPCCE was most highly related to the Executive Functioning component of the clinical battery, $r = .59$. Among the health and functional health scales, the EPCCE was most highly associated with Functional Health and IADLs ($r = -.38$ and $r = -.25$, respectively). The IADL scale was most strongly related to the functional health scale ($r = .59$), but was also associated with service utilization ($r = .35$). Functional health and service use scales were positively associated, $r = .26$. The CERAD factors were moderately correlated, ranging from $r = .45$ to .46.

Prediction of EPCCE

Prediction of objective everyday competency scores was accomplished with a three-step regression analysis. In the first step, the three CERAD composites, the MMSE, Health Services Use, Functional Health, perceived health, and prescription medications were entered. Verbal Ability, Memory, Executive Functioning, MMSE score, and Functional Health were significant predictors in this step, accounting for approximately 52% of the variance in EPCCE scores, $F(10,569) = 62.70$, $p < .001$. In the next step, age and education were added to the equation,

resulting in the addition of two significant predictors, and a significant change in R^2, $F(2,567) = 12.34$, $p < .01$, $R^2 = .54$. In the final model (see Table 4), Verbal Ability, Memory, Executive Functioning, MMSE score, Functional Health, age, and education were found to significantly predict scores on an objective measure of everyday competence, accounting for 54% of the variance. Consideration of only cognitive variables revealed that a model including the MMSE, Verbal Ability, Memory, and Executive Functioning accounted for approximately 50% of the variance in EPCCE scores.

Prediction of IADL

Identical hierarchical regression analyses were conducted using the sum of IADL limitations as the dependent variable. Executive Functioning, Functional Health, Health Services, and number of prescription medications significantly predicted subjective accounts of IADL competence. This step accounted for approximately 41% of the variance in IADL scores, $F(10,560) = 40.16$, $p < .001$. In the second step, demographic predictors were added. Neither age nor education were significantly associated with IADL scores, although the addition resulted in a significant increase in R^2, $F(2,567) = 5.0$, $p < .05$, $\Delta R^2 = .01$. Those variables that were significant in the second step of the analysis were entered simultaneously into a final model. As Table 5 illustrates, the most parsimonious model includes Executive Functioning, MMSE score, Functional Health, Health Services, and number of prescription medications, accounting for 41% of the variance in subjective IADL performance.

Discussion

Self-Report and Objective Functioning in IADL Domains

The association between subjective and objective functioning in instrumental domains, as assessed by the EPCCE and IADL scales was modest. While 81% of participants rated themselves as independent in IADL domains, only 44% of participants functioned at or above the 75th

percentile of performance on the EPCCE, a score chosen to represent a fairly high level of functioning on the measure. Clearly, participants are reporting higher levels of functioning in instrumental tasks of daily living than the objective performance-based measure would suggest. Some research has indicated that healthy, community-dwelling older adults may overestimate their actual level of functioning in task domains (Ford et al., 1988).

According to Hoeymans et al. (1996), individuals with no self-reported disability who exhibit poor objective performance may be confirming the differentiation between functional limitations and disability, as outlined in the disablement process model (Verbrugge & Jette, 1994). While functional limitations are defined as restrictions in the basic physical and mental processes necessary to perform activities, disability refers to actual difficulties performing activities of daily life. It could be that those participants who are reporting independence in daily tasks are basing their decision on the absence of full-blown disability in those activities. Conversely, performance on more objective measures may be tapping earlier occurring, but not necessarily outwardly obvious, impairments in thinking and judgment that could be characterized as functional limitations. Clearly, not all of these limitations will necessarily develop into disabilities for the older adult, but objective measures may be particularly advantageous in identifying early functional difficulties in instrumental domains (Karagiozis, Gray, Sacco, Shapiro, & Kawas, 1998; Rozzini et al., 1993). These measures may be particularly useful with populations that may be at-risk of developing impairment, as they may be able to capture early signs of decline before disability occurs. It would seem, then, that objective measures may be much more useful than self-report assessments in identifying areas for early intervention.

Predictors of EPCCE and IADL

Sociodemographic Variables

The sociodemographic characteristics of the present sample (i.e., rural community, low educated, low socioeconomic status) may create particular difficulties in the use of subjective measurement of functioning. Kovar and Lawton (1994) have warned that cognitive factors, such as low education or cognitive impairment, may limit older individual's ability to respond accurately on a self-report measure of IADL functioning, due to comprehension problems, memory for the occurrences of disability, etc. Populations at risk of disability or decline may require the use of other methods in order to gain an accurate portrayal of functioning (Kovar & Lawton, 1994; Myers, 1992). The use of an objective measure of cognitive competence in instrumental domains may be particularly beneficial for special populations such as the sample employed in the present study.

Health Service Use, Perceived Health, and Medication Use

In the present study, Health Services Utilization was related to self-reported functioning in IADL domains, but not to objective everyday competence as measured on the EPCCE. Need characteristics, particularly disability in IADL domains, have been identified as the driving force behind the use of health care services (Morris et al., 1996; Myers, 1992; Penning, 1995; Wolinsky & Johnson, 1991). Declines in the ability to perform tasks in instrumental domains have been linked to such negative outcomes as increased use of health services (Wolinsky & Johnson, 1991; Wolinsky et al., 1992), institutionalization (Branch & Jette, 1982), and mortality (Koyano et al., 1989; Maator, 1988).

Although groups who had used health services performed significantly worse on the EPCCE than those reporting no service use, the health services utilization index was not a significant predictor of EPCCE performance in the regression analyses. The fact that the use of health services was not significantly related to objective everyday competence may indicate that service utilization

is more closely related to the presence of disability and obvious need for assistance in the home due to impairment in specific IADL domains. It is likely that service utilization is closely tied to subjective and objective assessments of physical health and disability. Myers et al. (1993) found that self-report measures were more adept at distinguishing service users from non-service users than were performance-based assessments. It is possible that the link between everyday competence and service use is more distal, and that the length of this study was too short to capture this association. As data on service use at the second occasion was not available, the directionality of everyday competence to future service use could not be examined. Because competence in everyday tasks is thought to be an early indicator of decline, changes in this construct may be more likely to predict the use of services than vice versa. Further longitudinal investigations may elucidate the nature of this association.

Similarly, significant associations with perceived health and medications were observed for self-reported functioning, but not for objective everyday competence. A number of studies have indicated that greater self-reported impairment in IADL domains is related to poorer perceptions of health status, the number of health problems, and the use of medications (Boult et al., 1994; Crimmins & Saito, 1993; Idler & Kasl, 1995; Megaziner, Cadigan, Fedder, & Hebel, 1989; Myers, 1992; Penning, 1995). Perceptions of IADL limitations are most likely anchored in perceptions of health and disability.

Functional Health

While limitations in Functional Health were related to both self-reported and objective instrumental domains, it appears that subjective IADLs are more closely related to aspects of mobility limitations and the presence of home assistance, while objective EPCCE performance is more related to sensory impairment. The lack of a strong association among such physically based indicators of functioning, such as physical disability, mobility limitations, or the need for assistance

at home may serve to strengthen the assumption that the EPCCE is assessing cognitive demands of daily tasks. The need to separate physical performance from cognitive performance in objective measures has recently been recognized (Zanetti, Frisoni, Bianchetti, & Trabucchi, 1996). Recent investigations of the Physical Performance Test (PPT) (Rozzini et al., 1993) suggested that the presence of significant correlations with somatic health and the lack of significant associations with cognitive measures indicated that physical performance, rather than cognitive functioning, was being assessed. Similarly, the lack of strong associations among the EPCCE and physical ability measures could indicate validity for the assessment of cognitive capacity. Clearly, the distinction between physical capacity and cognitive capacity in the assessment of functional independence is an important consideration.

Clinical/Cognitive Status Measures

Measures of clinical or neuropsychological testing are often relevant in addressing everyday competency because older adults who perform poorly on mental status tests or other measures of cognitive functioning often exhibit problems in everyday tasks (La Rue & Markee, 1995). However, such tests cannot be used solely to make decisions regarding everyday competency (Loewenstein et al., 1995). At present, little research has been focused on examining the extent to which neuropsychological tests predict performance of tasks of daily living.

Although each of the cognitive functioning constructs from the clinical battery exhibited significant associations with EPCCE performance, everyday competence was particularly highly associated with Executive Functioning. This finding extends research indicating a link between everyday competence and executive functioning in a sample of older adults with Alzheimer's disease (Willis et al., 1998). From a neuropsychological perspective, executive functions are responsible for planning, purposive action, and effective performance of complex tasks. Executive functions are conceptualized as a global construct in that all of the components are necessary for

responsible and effective actions (Lezak, 1995). These skills are known to decline in both normal and pathological aging. Thus, without such capacities, an individual may not be able to complete complex behaviors, such as shopping or managing finances. Adequate capacity in these higher-order executive functions is closely related to the maintenance of independent living, and this particular aspect of cognitive functioning may have a salient association with the everyday cognitive competence, as assessed on the EPCCE scale.

The MMSE was significantly related to functioning on both subjective and objective tasks of daily living. This result was not surprising given the known link between IADL and mental status (Barberger-Gateau et al., 1992; Fillenbaum et al., 1990). However, mental status was more strongly associated with objective everyday competence, as assessed by the EPCCE, than with self-reported functioning (i.e., $r = .54$, $r = -.23$, respectively. It may be that individuals with mild cognitive impairment are underreporting their IADL limitations, thus lowering the association between self-report and mental status relative to that of performance and mental status (Rubenstein et al., 1984). However, the results might also indicate a more proximal relationship between cognitive status and objective status, influenced by difficulties in cognition appearing earlier, before the onset of disability (Hoeymans et al., 1996, Karagiozis et al., 1998; Rozzini et al., 1993).

Conclusions

Recent attention has been focused on moving toward the identification of community-dwelling older adults who may be at risk of loss of functional independence and/or dementia (Hobson & Meara, 1998). The inclusion of only nondemented, community-dwelling older adults is a methodological strength of the present study, decreasing the likelihood that observed associations with everyday competence are due to underlying disease conditions. An examination of cognitive competence among older adults who may already have limited cognitive resources (e.g., low socioeconomic status, low levels of education) is critical given the demonstrated losses in normal

cognitive aging, particularly in the domain of fluid intelligence (Horn, 1982; Schaie, 1983; 1996). When such at-risk older adults experience age-related changes in cognitive functioning, this further reduction in reserve could be extremely detrimental to their continued functional independence (Willis, 1996).

The focus on objective performance in cognitive domains present in this study is unique, as the vast majority of performance-based assessments have focused primarily on physical functioning of PADLs and IADLs. While this study explored differential associations among health and clinical variables to subjective and objective IADL performance, further research should attempt to explore the factors responsible for discrepancies between measurement strategies, specifically the role of cognitive functioning. As well, further investigations should focus on following at-risk individuals over greater time intervals, to help in the identification of a measure that is able to detect those at most risk of functional losses.

References

Andersen, R. M., & Newman, J. (1973). Societal and individual determinants of medical care utilization in the United States. Milbank Memorial Fund Quarterly, 51, 95-124.

Ashford, J., Hsu, L., Becker, M., Kumun, V., & Bekian, C. (1986). Mini-mental status and activities of daily living: Cross validation by scalogram and item analysis techniques. The Gerontologist, 26, 143A.

Barberger-Gateau, P., Commenges, D., Gagnon, M., Letenneur, L. Sauvel, C., & Dartigues, J. (1992). Instrumental activities of daily living as a screening tool for cognitive impairment and dementia in elderly community dwellers. Journal of the American Geriatrics Society, 40, 1129-1134.

Becker, J. T., Boller, F., Saxton, J., McGonigle-Gibson, K. L. (1987). Normal rates of forgetting verbal and nonverbal material in Alzheimer's disease. Cortex, 23(1), 59-72.

Benton, A. L. & Hamsher, K. D. (1976). Multilingual Aphasia Examination. Iowa City: University of Iowa.

Borkowski, J. G., Benton, A. L. & Spreen, O. (1967). Word fluency and brain damage. Neuropsychologia, 5, 135-140.

Boult, C., Kane, R. L., Louis, T. A., Boult, L., & McCaffrey, D. (1994). Chronic conditions that lead to functional limitation in the elderly. Journal of Gerontology: Medical Sciences, 49, M28-M36.

Branch, L., & Jette, A. M. (1982). A prospective study of long-term care institutionalization among the aged. American Journal of Public Health, 72, 1373-1379.

Crimmins, E. M., & Saito, Y. (1993). Getting better and getting worse. Journal of Aging and Health, 5(1), 3-36.

Duke University Center for the Study of Aging and Human Development. (1978). Multidimensional functional assessment: The OARS methodology. Durham, NC: Author.

Fillenbaum, G. G. (1985). Screening the elderly: A brief instrumental activities of daily living measure. Journal of the American Geriatrics Society, 33, 698-706.

Fillenbaum, G. G. (1988). Multidimensional functional assessment of older adults: The Duke Older Americans Resources and Services procedures. Hillsdale, NJ: Lawrence Erlbaum.

Fillenbaum, G. G., Hughes, D. C., Heyman, A., George, L. K. et al. (1988). Relationship of health and demographic characteristics to Mini-Mental State Examination score among community residents. Psychological Medicine, 18, 719-726.

Fitzgerald, J. F., Smith, D. M., Martin, D. K., Freedman, J. A., & Wolinsky, F. D. (1993). Replication of the multidimensionality of activities of daily living. Journal of Gerontology: Social Sciences, 48(1), S28-S31.

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). Mini-Mental State: A practical method for grading the cognitive state of patients for the clinician. Journal of Psychiatric Research, 12, 189-198.

Ford, A. B., Bolmar, S. J., Salmon, R. B., Medalie, J. H., Roy, A. W., & Galazka, S. S. (1988). Health and function in the old and very old. Journal of the American Geriatrics Society, 36, 428-434.

Furner, S. E., Rudberg, M. A., & Cassel, C. K. (1995). Medical conditions differentially affect the development of IADL disability: Implications for medical care and research. The Gerontologist, 35(4), 444-450.

Galanos, A., Fillenbaum, G., Cohen, H., & Burchett, B. (1991). Limitations of functional health status in the comprehensive assessment of community-dwelling elderly. Unpublished manuscript, Duke University, Durham, NC.

Ganguli, M., Ratcliff, G., Huff, F. J., Belle, S., Kancel, M. J., Fischer, L., Seaberg, E. C., Kuller, L. H. (1991). Effects of age, gender, and education on cognitive tests in a rural elderly community sample: Norms from the Monongahela Valley Independent Elders Survey. Neuroepidemiology, 10, 42-52.

Hobson, P., & Meara, J. (1998). Screening for "cognitive impairment, no dementia" in older adults. Journal of the American Geriatrics Society, 46(5), 659.

Hoeymans, N., Feskens, E. J. M., van den Bos, G. A. M., & Kromhout, D. (1996). Measuring functional status: Cross-sectional and longitudinal associations between performance and self-report (Zutphen Elderly Study 1990-1993). Journal of Clinical Epidemiology, 49(10), 1103-1110.

Horn, J. L. (1982). The theory of fluid and crystallized intelligence in relation to concepts of cognitive psychology and aging in adulthood. In F. I. M. Craik & S. Trehub (Eds.), Aging and cognitive processes. New York: Plenum.

Hughes, C., Berg, L., Danziger, W., Coben, L., & Martin, R. (1982). A new clinical scale for the staging of dementia. British Journal of Psychiatry, 140, 566-572.

Idler, E. L., & Kasl, S. V. (1995). Self-ratings of health: Do they also predict change in functional ability? Journal of Gerontology: Social Sciences, 50B(6), S344-S353.

Johnson, R. J., & Wolinsky, F. D. (1993). The structure of health status among older adults: Disease, disability, functional limitation, and perceived health. Journal of Health and Social Behavior, 34(June), 105-121.

Johnson, R. J., & Wolinsky, F. D. (1994). Gender, race, and health: The structure of health status among older adults. The Gerontologist, 34(1), 24-35.

Kaplan E. (1990). The process approach to neuropsychological assessment of psychiatric patients. Journal of Neuropsychiatry and Clinical Neuroscience, 2, 72-87.

Karagiozis, H., Gray, S., Sacco, J., Shapiro, M., & Kawas, C. (1998). The Direct Assessment of Functional Abilities (DAFA): A comparison to an indirect measure of instrumental activities of daily living. The Gerontologist, 38(1), 113-121.

Kovar, M. G., & Lawton, M. P. (1994). Functional disability: Activities and instrumental activities of daily living. In M. P. Lawton & J. A. Teresi (Eds.), Annual review of gerontology and geriatrics: Focus on assessment techniques (Vol. 4, pp. 57-75). New York: Springer.

Koyano, W., Shibata, H., Nakazato, K., Haga, H., Suyama, Y., & Matsuzaki, T. (1989). Mortality in relation to instrumental activities of daily living: One-year follow up in a Japanese urban community. Journal of Gerontology: Social Sciences, 44(3), S107-S109.

Kuriansky, J. B., Gurland, B. J., Fleiss, J. L., & Cowan, D. (1976). The assessment of self-care capacity in geriatric psychiatric patients by objective and subjective methods. Journal of Clinical Psychology, 32, 95-102.

La Rue, A., & Markee, T. (1995). Clinical assessment research with older adults. Psychological Assessment, 7(3), 376-386.

Lawton, M. P. & Brody, E. (1969). Assessment of older people: Self maintaining and instrumental activities of daily living. The Gerontologist, 9, 179-185.

Lezak, M. D. (1995). Neuropsychological assessment (3rd ed). Oxford: Oxford University Press.

Loewenstein, D. A., Amigo, E., Duara, R., Guterman, A., Hurwitz, D., Berkowitz, N., Wilkie, F., Weinberg, G., Black, B., Gittelman, B., & Eisdorfer, C. (1989). A new scale for the assessment of functional status in Alzheimer's disease and related disorders. Journal of Gerontology: Psychological Sciences, 44(4), P114-121.

Loewenstein, D. A., Rubert, M. P., Arguelles, T., & Duara, R. (1995). Neuropsychological test performance and prediction of functional capacities among Spanish-speaking and English-speaking patients with dementia. Archives of Clinical Neuropsychology, 10, 75-88.

Magaziner, J., Cadigan, D. A., Fedder, D. O., & Hebel, J. R. (1989). Medication use and functional decline among community-dwelling older women. Journal of Aging and Health, 1(4), 470-484.

Manton, K. G. (1988). A longitudinal study of functional change and mortality in the United States. Journal of Gerontology: Social Sciences, 43, S153-S161.