Psychology and Aging
1995, Vol. 10, No. 3, 478-491

0882-7974/95/$3.00

Everyday Problem Solving in Older Adults: Observational Assessment and Cognitive Correlates

Manfred Diehl
Wayne State University

Sherry L. Willis and K. Warner Schaie
Pennsylvania State University

Older adults' ability to solve practical problems in 3 domains of daily living was assessed using a new measure of everyday problem solving, the Observed Tasks of Daily Living (OTDL). Findings showed that the OTDL formed internally consistent scales representing 3 distinct factors of everyday problem solving. Moreover, the OTDL showed convergent validity with related scales of a paper-and-pencil test. Older adults' performance on the OTDL was significantly correlated with their scores on measures of basic mental abilities. Path analysis showed that age affected older adults' performance on the OTDL directly and indirectly via cognitive abilities. Participants' education and health affected their everyday competence indirectly through cognitive abilities. The effects of perceptual speed and memory span were mediated by fluid and crystallized intelligence.

In recent years, adults' performance with regard to practical or everyday problems has become a major focus of cognitive research (Park, 1992; Poon, Rubin, & Wilson, 1989; Puckett & Reese, 1993; Sinnott, 1989; Sternberg & Wagner, 1986). Both theoretical propositions and empirical findings have fueled this development. From a theoretical perspective, advocates of contextual (Berg & Sternberg, 1985; Dixon, 1992) and life span theories of human intelligence (P. B. Baltes, Dittmann-Kohli, & Dixon, 1984) have argued that conceptions of adult intelligence need to consider adults' knowledge of the pragmatics of everyday life. In addition, empirical findings have made students of adult cognition increasingly aware that older adults' level of intellectual functioning, as assessed with laboratory-type measures, and their functioning in everyday situations may be quite discrepant (Salthouse, 1990). Thus, there has been an increasing concern about the external (Schaie, 1978) and ecological validity (Denney, 1989) of traditional laboratory measures of intelligence and problem solving when these measures are used with middle-aged and older adults (Labouvie-Vief, 1985). This concern has led researchers to examine older adults' intellectual performance with regard to tasks that are designed to simulate situations of everyday life (Camp, Doherty, Moody-Thomas, & Denney, 1989; Cornelius & Caspi, 1987; Denney & Pearce, 1989; Morrell, Park, & Poon, 1990).

Despite the growing body of research on older adults' competence in solving practical problems (Poon et al., 1989; Sinnott, 1989), little systematic attention has been paid to the substantive domains to be studied. As Willis and Schaie (1993) have pointed out, however, a taxonomy of valid criterion tasks is needed to guide the research on everyday cognition. In the absence of an established taxonomy, Willis and Schaie (1993) proposed focusing on classes of everyday activities that are essential for older adults in maintaining an independent lifestyle. Such instrumental activities of daily living (IADLs) have been described by Lawton and Brody (1969) and are frequently used in clinical gerontology and geriatrics to assess elderly people's everyday competence (Fillenbaum, 1985, 1988). Recently, Grisso (1986) has suggested that older adults' performance on IADLs is of primary interest in determining their functional competence in the context of legal guardianship cases.

Although IADLs have found great acceptance among practitioners and researchers alike (Branch & Jette, 1982; Wolinsky, Coe, Miller, & Prendergast, 1984), there are several limitations with regard to an objective assessment of everyday problem solving. First, participants' self-reported performance in different domains of daily living is usually assessed by a single item per domain. From a measurement perspective, however, reliance on a single item is considered inadequate for assessing a person's competence in a specific domain of functioning (see Nunnally, 1978; Pedhazur & Schmelkin, 1991). Second, several studies have shown that older adults tend to overestimate their level of everyday competence in comparison with their actual performance. Fillenbaum (1978), for example, has reported findings from validity studies associated with the Older Americans Resources and Services Procedures (OARS) leading her to conclude that "the questionnaire tends to give too rosy a picture, for clinicians, in personal contact with clients notice difficulties which are not so evident from questionnaire data alone" (p. 28). Similar findings have been reported by Ford et

Manfred Diehl, Department of Psychology, Wayne State University; Sherry L. Willis and K. Warner Schaie, Department of Human Development and Family Studies, Pennsylvania State University.

This research was supported by Grant R01 AG08082 from the National Institute on Aging. This article is, in part, based on the doctoral dissertation of Manfred Diehl, which was conducted under the direction of Sherry L. Willis in the Department of Human Development and Family Studies at Pennsylvania State University.

Thanks to Ranjana Dutta, Ann O'Hanlon, Carolyn Nesselroade, Scott Maitland, and Michael Marsiske for their collegial encouragement over the course of this research. Special thanks also to Michael Marsiske and Lise Youngblade for their thoughtful comments on an earlier version of this article.

Correspondence concerning this article should be addressed to Manfred Diehl, Department of Psychology, Wayne State University, 71 West Warren Avenue, Detroit, Michigan 48202. Electronic mail may be sent via Internet to mdiehl@gopher.science.wayne.edu.

al. (1988), who showed that healthy community-residing older adults tend to overestimate their actual level of functioning. Third, self-report assessment of everyday problem solving is also limited because it provides little information with regard to the real or perceived causes of an older adult's incapacity to perform certain tasks of daily living. For example, the inability to take medications according to instructions or to use the phone may be due to noncognitive factors such as sensory deficits or problems with manual dexterity, cognitive factors such as memory problems or difficulty understanding specific instructions, or an interaction of environmental factors with noncognitive or cognitive factors (e.g., small print on a medicine container and difficulty understanding the instructions).

Given this general background, the first objective of our study was to examine whether a set of tasks—the Observed Tasks of Daily Living (OTDL)—could be established to assess older adults' performance in three critical domains of daily living in an objective and naturalistic way. Development of the OTDL was guided by the assumption that everyday problem solving is a multidimensional rather than a unidimensional phenomenon (see Marsiske, 1992; Marsiske & Willis, 1995; Willis, 1991; Willis & Schaie, 1993). That is, it was assumed that tasks could be developed that represented distinct factors of practical problem solving in everyday life. Thus, multiple items and tasks were generated with the objective to observe older adults' performance in three IADL domains (see Lawton & Brody, 1969): food preparation, medication intake, and telephone use. Multiple tasks were developed for each of these domains to assess older adults' functional abilities with as much accuracy and reliability as possible (Willis, 1991, in press).

For theoretical and pragmatic reasons, the assessment of older adults' everyday problem-solving competence was limited to three IADL domains. In a previous study, tasks from these three domains had been rated most important for independent living both by different groups of practitioners and by community-residing older adults (Diehl, Willis, & Schaie, 1990). Similar results have been reported by Baird, Brines, and Stoor (1992), who found that adherence to medication, use of the telephone, and self-feeding and preparing hot foods were rated consistently as being among the most important tasks for successful independent living in elderly people. Moreover, several studies have shown that older adults' declining ability to perform tasks from these domains is associated with increased use of health services (Wolinsky et al., 1983), increased likelihood of becoming institutionalized (Branch & Jette, 1982), and increased mortality (Fillenbaum, 1985, 1988; Koyano et al., 1989; Manton, 1988; Wolinsky et al., 1983). Indirect evidence supporting the importance of these three domains has also been provided by a recent time budget study (M. M. Baltes, Wahl, & Schmid-Furstoss, 1990). Specifically, Baltes and her colleagues showed that community-residing older adults spend a considerable amount of time performing tasks from these three domains and other IADLs on a daily basis. From a pragmatic point of view, tasks were limited to the three most important domains to keep the testing time within a manageable limit.

The second objective of this study was to examine the convergent validity between the OTDL and a paper-and-pencil measure of everyday problem solving. Previous studies on older adults' everyday problem solving (e.g., Camp et al., 1989; Cornelius & Caspi, 1987; Denney & Pearce, 1989) have used single measures of everyday problem solving and have not addressed the issue of convergent validity (Campbell & Fiske, 1959). Convergent validity, however, needs to be demonstrated to ensure that measures that purport to assess the same latent construct or constructs are indeed correlated with each other. Moreover, because there is emerging evidence that everyday problem solving is a multidimensional rather than a unidimensional construct (Marsiske & Willis, 1995), the use of newly developed measures that focus on multiple dimensions of everyday problem solving can be justified only if convergence with other independent measures on the same underlying latent dimensions has been demonstrated. The present study addressed this issue by using confirmatory factor analysis to examine whether participants' observed performance in the three domains of everyday problem solving was related to their performance in the same three domains as assessed by a paper-and-pencil measure, the Everyday Problems Test (EPT; Willis & Marsiske, 1993).

The third objective of this study was to examine the relations between the observational assessment of everyday cognition and basic cognitive abilities. Previous studies have examined the association between basic abilities and everyday problem solving. The findings, however, have been mixed, and the debate about appropriate theoretical conceptualizations of the relations is ongoing (Sternberg, 1985; Sternberg & Wagner, 1986). Several investigators have reported significant yet moderate correlations between adults' performance on psychometric ability tests and their performance on everyday problem-solving tests (Camp et al., 1989; Cornelius, 1990; Cornelius & Caspi, 1987; Hayslip & Maloy, 1992). In concert, these studies support a conceptualization of everyday cognition as the phenotypic expression of underlying basic, genotypic intellectual abilities (see Willis & Schaie, 1986). Other studies, however, have failed to provide similar evidence (Ceci & Liker, 1986; Dörner & Kreuzig, 1983; Frederiksen, 1986; Wagner & Sternberg, 1985), suggesting that performance on practical problems may be independent from performance on traditional measures of intellectual functioning. Thus, the latter group of investigators have argued that different and relatively independent forms of intelligence may account for performance on abstract versus practical problems (i.e., theory of multiple independent intelligences; see Walters & Gardner, 1986).

Most work examining the relations between basic abilities and practical problem solving has been done with paper-and-pencil measures (Cornelius & Caspi, 1987; Hayslip & Maloy, 1992; Willis & Schaie, 1986). Critics of this approach, however, have questioned whether the reported correlations between abilities and everyday problem solving reflect a "true relationship" or whether they simply reflect a relationship resulting from the similar testing procedures (Salthouse, 1990). It has also been questioned whether a person's score on a paper-and-pencil test is predictive of his or her performance on a behavioral measure of everyday problem solving (Salthouse, 1990). The present study permitted an examination of this question by relating older adults' performance on ability tests to their performance on a behavioral measure of everyday problem solving, the OTDL.

The fourth objective of this study was to use path analysis to examine correlates of older adults' performance on the OTDL.

Thus, this study extended previous work that has primarily focused on the bivariate relations among person variables (i.e., age, education, and health), cognitive abilities, and everyday problem solving. As Park (1992) has pointed out, however, what is needed to advance the conceptual and empirical understanding of everyday cognition is the testing of models of relations including indicators from multiple domains of functioning.

The model examined in this study is rooted in a hierarchical perspective of everyday problem solving. In essence, the hierarchical view postulates that multiple cognitive abilities and processes are involved in any kind of everyday problem solving and that different everyday problems require the activation of different constellations of cognitive abilities (Willis & Schaie, 1986, 1993). Specification of the pattern of relations among the basic cognitive abilities and everyday problem solving was informed by recent research on age differences in memory and speed of processing and their effect on intellectual functioning (Hertzog, 1989; Lindenberger, Mayr, & Kliegl, 1993; Salthouse, 1991; Schaie, 1989). Specifically, it was hypothesized that memory span and speed of processing are the basic processing resources (Salthouse, Kausler, & Saults, 1988) affecting older adults' performance on tasks of daily living indirectly through the ability factors of fluid and crystallized intelligence.

In addition to cognitive variables, the model also incorporated person variables as correlates of older adults' everyday competence. Participants' age was included in the model because research has shown a negative relationship between self-reported functional status and age (Fillenbaum, 1985). This relationship has been shown to be most pronounced for old-old individuals. Educational level was included as a global indicator of participants' socioeconomic background. Furthermore, four distinct indexes of participants' health—general health impairment, hearing impairment, vision impairment, and cardiovascular impairment—were included in the model. These health factors described participants' health using both subjective and objective measures (Hultsch, Hammer, & Small, 1993). Thus, the path analysis model examined person variables and cognitive abilities as correlates of older adults' everyday problem solving. In particular, the model specified age, education, and health factors as exogenous variables; cognitive abilities as mediating variables; and participants' performance on tasks of daily living as the criterion variable. This model represented a first attempt to examine one component of a more comprehensive model of everyday competence proposed by Willis (1991).

Method

Participants

Participants were 62 older adults (44 women and 18 men) with a mean age of 76.4 years (SD = 5.4, range = 66 to 87) and a mean educational level of 15.4 years (SD = 2.3, range = 9 to 20). Thirteen percent of the participants had up to 12 years of education, 22.3% had some postsecondary education, and 54.8% had a college degree or postbaccalaureate training. Participants' self-ratings on 6-point scales ranging from *very good* (1) to *very poor* (6) indicated good health (M = 1.7, SD = 0.6), good vision (M = 2.3, SD = 1.0), and good hearing (M = 2.3, SD = 1.2). Participants' mean life satisfaction rating, on a 7-point scale ranging from *extremely happy* (1) to *extremely unhappy* (7), was 2.2 (SD = 0.9), indicating that they were, on average, content with their lives. The average annual income was $27,000 (range = $6,000 to more than $50,000). Of the 62 participants, 42 (67.7%) were married, 15 (24.2%) were widowed, and 5 (8.1%) were single, divorced, or separated. All participants were Caucasian.

Participants were independently living residents of a life care community in southern Florida and were representative, demographically and socioeconomically, of residents of such communities (Longino, 1981). However, according to data from the 1990 U.S. census describing individuals 65 years of age and older (U.S. Department of Commerce, 1994a, 1994b), they would be considered educationally and socioeconomically advantaged. Our older adult sample represented a randomly selected subset of participants in a large research project on practical intelligence in later adulthood.

Procedure

The older adults participated in three sessions held over a 2-week period. The first two sessions were group sessions during which participants were administered 15 mental ability tests and the EPT. Participants were tested in small groups of 5 to 10 in a meeting place in the retirement community. The tests were administered by two graduate students, and a middle-aged female proctor was present at all testing sessions. All ability tests were administered under standardized timed conditions; the EPT was given under untimed conditions. Participants received $20 for their participation in both testing sessions.

In the third session, the OTDL was administered in a 1.5-hr in-home session. Tasks were administered with a standardized testing protocol. The instructions and questions for each task were presented on 4 × 6 in. (10.2 × 15.2 cm) index cards, and the same real-life testing materials were used for each participant. Participants were instructed to use the "think-aloud" method to describe their reasoning while they were working on each task. As a means of controlling for potential order effects, the sequence of task presentation was counterbalanced between participants. There was no financial compensation for participation in the in-home observation study.

Measures

Everyday Problem Solving

Participants' everyday problem solving was assessed with two objective measures: an observational measure and a paper-and-pencil measure.

Observed Tasks of Daily Living (OTDL). Participants were observed performing a total of 31 tasks in their own home. Participants used real-life materials (e.g., cake mix ingredients, medicine bottles, and a telephone book) to perform 9 food preparation tasks, 13 medication-related tasks, and 9 phone-related tasks. Each task required participants to solve a practical problem using a printed stimulus (e.g., cake mix instructions, medicine bottle labels, and a telephone rate chart). The tasks represented practical problems for which a solution was not immediately apparent, thus requiring inferential thinking. For example, participants were asked to modify the ingredients for a cake mix in accord with the instructions for a low-cholesterol diet. Thus, participants had to infer that an egg substitute rather than real eggs should be used and modify the directions accordingly in mixing the ingredients. Similar inferences were required in performing medication-related and phone-related tasks.

Tasks had been designed to meet two main criteria: (a) They were required to simulate actual tasks of daily living as closely as possible, and (b) they were required to have distinct observable elements permitting objective scoring of participants' performance. In addition, tasks had been selected to be similar in content domain to items of the EPT. However, in contrast to EPT items, our observed tasks were more complex and required the comprehension and combination of information

from multiple sources. For example, whereas the EPT required the comprehension of a single medicine bottle label, the corresponding OTDL task required participants to comprehend several medication labels and to use the information for loading a pill reminder correctly.

The psychometric properties of the 31 observational tasks were examined to obtain a reliable and parsimonious set; tasks that were solved correctly by 80% or more of the participants and that correlated negatively with the item–total score of their scale were excluded. Application of these criteria resulted in the elimination of 10 tasks (i.e., the final set included 21 tasks). The average item–total correlations were .82 for the retained food preparation tasks, .63 for the medication use tasks, and .84 for the phone use tasks. The average item–total correlation for all observed tasks was .77. Table 1 provides a brief description of the 21 tasks. A detailed description of one prototypical task from each of the three domains is presented in the Appendix.

Participants' responses were recorded in writing and scored later by means of a standardized scheme.[1] The scoring of participants' performance focused on the cognitive aspects of their problem-solving behavior. Problems with manipulating the real-life materials that were due to noncognitive factors (e.g., lack of manual dexterity as a result of arthritis, which may create difficulties in opening a pill reminder) were noted in the observation protocol; however, these problems did not affect participants' scores on OTDL tasks.[2]

Cohen's (1960) kappa was calculated to examine the reliability of 20 randomly selected protocols scored by two independent raters. Mean coefficients of agreement were .92 (range = .84 to .98) for food preparation tasks, .91 for medication tasks (range = .77 to 1.00), and .95 (range = .84 to 1.00) for telephone tasks. The mean kappa across tasks from all three domains was .93 (range = .77 to 1.00), indicating that the protocols were scored reliably.

Table 1
Behavioral Measure of Practical Problem Solving: The Observed Tasks of Daily Living

Format	Task description
	Food preparation
Direction	Setting the timer of a microwave oven
Direction	Stopping and resetting the microwave timer
Direction	Baking a cake in a microwave oven
Chart	Using a cooking and reheating chart I
Chart	Using a cooking and reheating chart II
Chart	Comprehending nutritional information on cereal boxes
Form	Filling out a cookbook order form
	Medication intake
Direction	Comprehending information on medicine bottle labels
Direction	Calculating days of pill supply
Direction	Comprehending information on a drug leaflet
Chart	Loading a pill reminder I
Chart	Loading a pill reminder II
Chart	Comprehending information on patient medication chart I
Chart	Comprehending information on patient medication chart II
Form	Filling out a medication passport
Form	Filling out a patient record
	Telephone use
Direction	Activating call forward mechanism
Direction	Canceling call forward mechanism
Chart	Checking itemized calls on phone bill
Chart	Checking local calls on phone bill
Form	Filling out a telephone service application form

Examination of validity issues is particularly difficult with regard to everyday problem-solving measures such as the OTDL because there is no "gold standard" for assessing everyday functional competence in old age. The traditional and most widely used measure of everyday functioning is participants' self-perceived competence in the seven IADL domains (see Fillenbaum, 1985; Lawton & Brody, 1969). Participants' OTDL performance correlated significantly ($r = -.50$, $p < .001$) with the number of IADLs for which they reported a limitation (food preparation, $r = -.35$, $p < .01$; medication taking, $r = -.46$, $p < .001$; and telephone use, $r = -.36$, $p < .01$). In agreement with findings from previous research (Fillenbaum, 1985), however, participants reported themselves to be functioning at a higher level than shown in objective assessments (e.g., clinician ratings and behavioral tests). In this study, the percentages of participants reporting themselves capable of preparing meals, taking medications, and using the telephone without any assistance were 73%, 95%, and 98%, respectively. In contrast, most participants experienced some difficulty in performing observed tasks from these three domains completely correctly (see Table 2).

Everyday Problems Test (EPT). The EPT (Willis & Marsiske, 1993) is a paper-and-pencil measure that assesses adults' ability to solve problems of daily living that involve printed material. Participants use printed stimuli (e.g., an actual prescription drug label) to solve two practical problems associated with each stimulus (e.g., calculating the number of days a pill supply will last). Thus, the focus of the EPT is on "assessing the adult's cognitive competence to reason and solve problems associated with daily living" (Willis & Marsiske, 1993, p. 3).

The EPT has 84 items representing seven scales. The scales have been established through confirmatory factor analysis with data from 417 community-residing older adults (Willis & Marsiske, 1993). The scales assess seven distinct domains of daily living: meal preparation and nutrition, medication use and health behaviors, telephone use, shopping, financial management, household management, and transportation. Reliability (Cronbach's alpha) for the total test is .94. The test–retest reliability (stability), assessed over a 2-month interval, was .94 (Willis & Marsiske, 1993). With regard to validity issues, the EPT is significantly related to each of three measures frequently used in the assessment of older adults' functional competence: (a) self-ratings on IADLs ($r = .23$, $p < .05$), (b) performance on a measure of functional literacy (Educational Testing Service, 1977; $r = .87$, $p < .001$), and (c) spousal ratings of limitations in IADL competence (Marsiske, 1992; $r = -.24$, $p < .05$). The EPT is worded at an eighth-grade reading level, well below the median educational level of the average older adult.

Mental Abilities

A battery of 15 mental ability tests was used to assess participants' basic intellectual abilities. The battery was developed within the fluid and crystallized model of intelligence (Cattell, 1971) and included multiple marker tests of four broad, second-order dimensions of intelligence: fluid intelligence, crystallized intelligence, memory span, and speed of processing. The battery's factor structure has been examined by P. B. Baltes, Cornelius, Spiro, Nesselroade, and Willis (1980) and

[1] Copies of the task instructions, questions, and scoring procedure can be obtained from Manfred Diehl.

[2] We are aware that, especially in old-old individuals, extraneous noncognitive factors such as manual dexterity may become increasingly important for performing tasks of daily living. Indeed, occupational therapists who work with elderly clients in rehabilitation settings often spend as much or even more time in practicing the noncognitive aspects of IADL performance than in practicing cognitive components.

Table 2
Performance on the Observed Tasks of Daily Living

Domain and task description	*M*	*SD*	Participants producing totally correct answers (%)
Food preparation			
Setting the timer of a microwave	6.00	2.24	24.2
Stopping and resetting the timer	5.66	2.18	17.7
Baking a cake in a microwave	5.44	2.17	9.7
Cooking and reheating chart I	5.41	2.62	16.1
Cooking and reheating chart II	5.84	2.34	14.5
Comprehending nutritional information on cereal boxes	4.28	2.29	11.3
Filling out a cookbook order form	4.73	2.64	12.9
Medication intake			
Comprehending information on medicine bottle labels	5.46	2.09	9.7
Calculating pill supply	1.16	3.04	12.9
Comprehending information on a drug leaflet	4.21	3.03	19.4
Loading pill reminder I	5.88	3.22	45.2
Loading pill reminder II	6.97	2.70	56.5
Patient medication chart I	5.37	2.42	25.8
Patient medication chart II	6.82	1.89	35.5
Filling out a medication passport	4.76	2.44	9.7
Filling out a patient record	6.28	2.22	16.1
Telephone use			
Activating call forward mechanism	7.21	2.20	53.2
Canceling call forward mechanism	7.04	3.01	66.1
Checking itemized calls on phone bill	5.66	3.38	35.5
Checking local calls on phone bill	6.63	2.78	53.2
Filling out a service application form	5.52	2.56	24.2

Note. Scores ranged from 0 to 9.

by Willis, Jay, Diehl, and Marsiske (1992). All of the tests have well-established psychometric properties and have been used extensively in research studies with older adults (see Willis et al., 1992). The battery has been described in detail by Willis et al. (1992); thus, only brief descriptions are provided here.

Fluid intelligence. The primary abilities of figural relations, induction, and spatial orientation represented the fluid intelligence factor. The marker tests of these abilities require participants to discern a pattern of relationships within a sequence of figures, letters, or numbers or to distinguish between rotated or mirror image representations of a stimulus figure or object.

Crystallized intelligence. Crystallized intelligence was represented by the primary ability of verbal comprehension. The marker tests for this primary ability require participants to identify, from several words, the synonym of a stimulus word.

Memory. This factor was represented by the primary ability of memory span. The marker tests assessed the number of digits participants could hold in memory in backward order and the number of simple words they could hold in memory in forward order. Memory within the original Cattell (1971) framework focused on memory span, which was assumed to be more closely associated with fluid intelligence. Recently, the backward digit span test has been characterized as a measure of working memory (see Jurden, Reese, Cohen, & Puckett, 1992).

Speed. The primary abilities of perceptual speed and number represented this factor. The marker tests for these abilities assessed the speed with which participants were able to make simple visual discriminations and to subtract or multiply two-digit numbers.

The number measures, originally hypothesized to load on the crystallized intelligence factor, loaded instead on the speed factor. A strong association between perceptual speed and simple numerical measures, particularly in old age, has also been found in confirmatory factor analyses of similar psychometric ability batteries (Schaie, Willis, Jay, & Chipuer, 1989). In combination, these findings suggest that performance on simple numerical tasks may reflect primarily the speed of reproducing overlearned material.

Sociodemographic Background

Variables describing participants' sociodemographic background, such as age, sex, years of formal education, marital status, and annual family income, were assessed by means of a structured personal data form.

Health Status

Participants' health status was assessed with subjective self-assessments and objective health indexes such as number of current prescription drugs (see Hultsch et al., 1993; Steinhagen-Thiessen & Borchelt, 1993). Self-ratings of health have been shown to be correlated with a number of medical conditions (Fillenbaum, 1979; Kaplan & Camacho, 1983; Liang, 1986; Mossey & Shapiro, 1982), with physician evaluations of overall health (Friedsam & Martin, 1963; LaRue, Bank, Jarvik, & Hetland, 1979; Maddox, 1962, 1964; Maddox & Douglass, 1973), and with future survival (Kaplan & Camacho, 1983; LaRue et al., 1979; Mossey & Shapiro, 1982).

Participants rated their health, vision, and hearing on 6-point scales ranging from *very good* (1) to *very poor* (6). In addition, participants reported number of annual doctor visits, number of days they had been hospitalized during the previous year, and whether they were wearing one or two hearing aids. Information (name, dosage, and purpose) was also obtained regarding all currently taken prescription drugs. Across several studies, confirmatory factor analyses have shown that these

health-related variables form four common factors: general health impairment, hearing impairment, vision impairment, and cardiovascular impairment (Willis, Diehl, Gruber-Baldini, Marsiske, & Haessler, 1990; Willis, Marsiske, & Diehl, 1991).

The general health impairment factor included self-ratings of health and reports of the number of doctor visits and days of hospitalization during the previous year. The hearing impairment factor consisted of participants' self-rated hearing score and a score for wearing hearing aids. The vision impairment factor was composed of the vision self-rating and the number of drugs a participant was taking in three ophthalmic drug categories. The cardiovascular impairment factor included the number of drugs taken in five cardiovascular drug categories. For each of these health impairment factors, higher scores indicated a higher degree of impairment.

Results

Study findings are presented in five sections. First, descriptive statistics on participants' OTDL performance are presented. Second, findings are reported from confirmatory factor analyses examining whether the OTDL represent distinct task domains. Third, findings with regard to the convergent validity of the OTDL with the corresponding scales of the EPT are presented. Fourth, correlations between participants' performance on basic cognitive abilities and on tasks of daily living are reported. Finally, findings regarding a structural model of relations among person variables, cognitive variables, and performance on the OTDL are presented.

OTDL Performance

Because different tasks consisted of a different number of behavioral steps, tasks were rescaled to a common metric, resulting in scores that ranged from 0 (for completely incorrect solutions for all tasks) to 9 (for completely correct solutions). Table 2 presents the mean and standard deviation for each task and the percentage of participants who produced completely correct solutions (i.e., had a score of 9).

As Table 2 shows, fewer than 50% of the participants were able to perform most tasks in a completely correct manner. Participants showed better performance on phone-related tasks than on tasks related to food preparation and taking medications.

Domains of Everyday Problem Solving

The factor structure of the OTDL was examined through confirmatory factor analysis with LISREL 7 (Jöreskog & Sörbom, 1989). The maximum likelihood method was used to estimate model parameters based on the correlation matrix. A priori, a three-factor measurement model was specified distinguishing the three domains of daily living for which tasks had been designed. This model was compared with a single-factor model of the OTDL. Following the suggestions of Raykov, Tomer, and Nesselroade (1991), the fit of this measurement model (and all following models) was evaluated by inspecting the estimated parameters and using four overall goodness-of-fit indexes: the chi-square statistic, the chi-square likelihood ratio (χ^2/df), Jöreskog and Sörbom's (1989) goodness-of-fit index (GFI), and the root mean square residual (RMSR).

The goodness of fit of this measurement model was acceptable, $\chi^2(24, N = 62) = 42.72$, $\chi^2/df = 1.78$, GFI = .90, RMSR = .08, and significantly better than the fit of the single-factor model, $\Delta\chi^2(3) = 8.06$, $p < .05$. The standardized parameter estimates are presented in Table 3.

As Table 3 shows, all factor loadings were statistically significant with the exception of two composites, suggesting that the tasks were reasonable markers of the three hypothesized domains of daily living. Inspection of the normalized residuals revealed that only two residuals were significantly different from zero, suggesting that the model reproduced the relationships

Table 3
Factor Loadings and Uniquenesses for Measurement Model of the Observed Tasks of Daily Living

Variable	Domain of daily living: Food preparation	Medication intake	Telephone use	Uniquenesses
	Factor loadings			
Food preparation: directions	.68			.51
Food preparation: charts	.75			.40
Food preparation: forms	.26[a]			.93
Medication intake: directions		.49		.74
Medication intake: charts		.76		.38
Medication intake: forms		.53		.69
Phone use: directions			.28[a]	.92
Phone use: charts			.33	.89
Phone use: forms			.84	.26
	Factor intercorrelations			
Food preparation	—			
Medication intake	.57	—		
Phone use	.37	.44	—	

[a] Failed to reach significance at $p < .05$.

Table 4
Convergence Between the Observed Tasks of Daily Living (OTDL) and the Everyday Problems Test (EPT)

Variable	Domain of daily living 1	2	3	Uniquenesses
	Factor loadings			
EPT: food preparation	.86			.15
OTDL: food preparation	.47			.74
EPT: medication intake		.68		.48
OTDL: medication intake		.77		.32
EPT: telephone use			.73	.39
OTDL: telephone use			.43	.79
	Factor intercorrelations			
Food preparation	—			
Medication intake	.70	—		
Telephone use	.63	.57	—	

Note. All factor loadings were significant at $p < .05$.

among the observed variables sufficiently. The reliabilities (Cronbach's alpha) of the three derived scales were .72 (food preparation), .63 (medication use), and .42 (telephone usage). The factor loadings shown in Table 3 were used to calculate factor score weights and the factor scores used in all of the analyses to follow. Factor scores were standardized to *T*-score metric ($M = 50.0$, $SD = 10.0$). Path analyses were performed with the three factor scores combined into a linear composite (see Liang, Lawrence, Bennett, & Whitelaw, 1990) indicative of participants' overall performance on the OTDL.

Convergent Validity of Measures

A confirmatory factor analysis specifying a multitrait–multimethod model was performed to examine the convergent validity between the OTDL and the corresponding scales of the EPT. That is, scales that purported to measure the same construct were specified to load on the same common factor. Findings showed that the corresponding OTDL and EPT scales had significant loadings on the a priori defined domain factors (see Table 4). The goodness of fit for this measurement model was acceptable, $\chi^2(6, N = 62) = 14.46$, $\chi^2/df = 2.41$, GFI = .90, RMSR = .07. The three domain factors were moderately correlated (correlations ranged from .57 to .70). Bivariate correlations between corresponding factor scores derived from observational assessment and paper-and-pencil assessment, corrected for unreliability of the measures, were .43 for food preparation ($p < .001$), .58 for medication intake ($p < .001$), and .27 for telephone use ($p < .05$). Taken together, these findings indicated that there was a considerable amount of shared variance between the corresponding scales of the OTDL and the EPT and that the two different assessment strategies measured the same common factors of everyday problem solving.

Basic Cognitive Abilities and Everyday Problem Solving

Pearson product–moment correlations were calculated to examine the relations between basic cognitive abilities and participants' performance on the OTDL. The resulting correlation coefficients between the factor scores, corrected for unreliability of the measures, are presented in Table 5.

As Table 5 shows, the correlations between the four second-order ability factors and the OTDL factors were positive and, with the exception of two coefficients, statistically significant ($p < .05$). Higher scores on cognitive ability measures were associated with higher performance on the OTDL. Significant correlations ranged from .31 to .68, indicating a substantive amount of shared variance. All three OTDL factors had their strongest association with the fluid intelligence factor.

Path Analysis Model of Everyday Problem Solving

Path analysis was used to examine a structural model of relations among person variables, basic cognitive abilities, and performance on the OTDL. Table 6 presents the correlations among the variables included in the path analysis model.

Three path analysis models were estimated with LISREL 7 (Jöreskog & Sörbom, 1989). The first model specified the null model in which no relations among exogenous and mediating variables or among the mediating variables themselves were postulated. The fit of this model was poor, $\chi^2(46, N = 62) = 189.90$, $\chi^2/df = 4.13$, GFI = .60, RMSR = .24. The second model was a recursive model in which all exogenous variables were predictors of all mediating variables and the criterion variable. In addition, the cognitive abilities of speed of processing and memory were specified to be predictors of fluid and crystallized intelligence, and all four cognitive abilities were specified to be predictors of participants' performance on the OTDL. This model fit the data well, $\chi^2(8, N = 62) = 4.98$, $\chi^2/df = 0.62$, GFI = .99, RMSR = .03. The improvement in goodness of fit, in comparison with that of the null model, was statistically significant, $\Delta\chi^2(38) = 184.92$, $p < .001$. However, this model had a number of statistically nonsignificant paths ($p > .05$). In particular, the direct paths of education, general health impairment, vision impairment, hearing impairment, and cardiovascular impairment to participants' performance on the OTDL did not reach the .05 level of significance. Furthermore, the direct paths of speed of processing and memory to participants' OTDL performance were not significant. Thus, a third model retaining the statistically significant paths ($p < .05$) was estimated. This reduced model is shown in Figure 1.

The fit for the reduced model was good, $\chi^2(32, N = 62) =$

Table 5
Correlations of Cognitive Abilities With Observed Tasks of Daily Living (OTDL) Factors

Cognitive ability	OTDL factor: Food preparation	Medication intake	Telephone use
Perceptual speed	.43***	.37**	.31*
Memory	.21	.44***	.14
Fluid intelligence	.50***	.68***	.42***
Crystallized intelligence	.41***	.41***	.36**

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 6
Correlations Among Person Variables, Cognitive Ability Factors, and Performance on the Observed Tasks of Daily Living (OTDL; N = 62)

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Age	—	.10	.08	.05	.01	.24	−.38	−.36	−.10	−.37	−.42
2. Education		—	−.16	−.10	−.12	−.16	.04	.05	.30	.17	.05
3. Physical health impairment			—	.18	.11	.46	−.05	−.49	−.03	.05	.11
4. Hearing impairment				—	.00	.08	−.32	−.30	−.09	−.27	−.13
5. Vision impairment					—	.05	−.20	−.05	−.05	−.10	−.03
6. Cardiovascular impairment						—	−.20	−.49	−.11	−.09	−.02
7. General speed							—	.32	.38	.52	.48
8. General memory								—	.40	.50	.33
9. Crystallized intelligence									—	.53	.50
10. Fluid intelligence										—	.68
11. OTDL											—

Note. Correlations of less than −.22 and greater than .22 are statistically significant at $p < .05$.

27.47, $\chi^2/df = 0.86$, GFI = .93, RMSR = .07. Moreover, it provided a significantly better fit to the data than the null model, $\Delta\chi^2(14) = 162.43$, $p < .001$, and a fit that was not significantly worse than that of the first recursive model, $\Delta\chi^2(24) = 22.49$, $p > .05$. Table 7 presents the direct, indirect, and total effects (Sobel, 1988) of the exogenous and mediating variables on the criterion variable.

Figure 1 and Table 7 show that age was the only exogenous variable having a significant direct effect ($\beta = -.22$, $p < .05$) on participants' observational task performance. This effect was negative, indicating that older individuals performed less well on the observational tasks. Age also had a negative indirect effect on participants' OTDL performance through cognitive abilities. Education affected participants' everyday problem-solving scores indirectly through crystallized intelligence. General health impairment, hearing impairment, and cardiovascu-

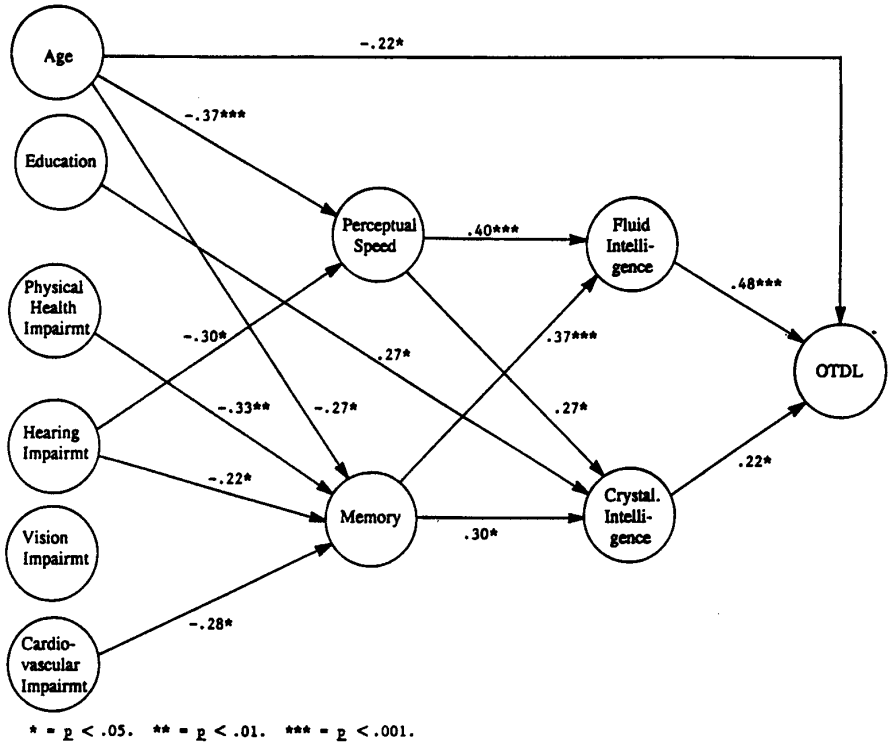

Figure 1. Path analysis model of older adults' performance on the Observed Tasks of Daily Living (OTDL).

Table 7
Direct, Indirect, and Total Effects of Person and Cognitive Variables on Older Adults' Performance on the Observed Tasks of Daily Living

Predictor variable	Direct effect (β)	Indirect effect (β)	Total effect (β)
Age	−.22*	−.16*	−.38***
Education	.00	.06	.06
Physical health impairment	.00	−.08*	−.08*
Hearing impairment	.00	−.13**	−.13**
Cardiovascular impairment	.00	−.07	−.07
Perceptual speed	.00	.25***	.25***
Memory	.00	.24***	.24***
Fluid intelligence	.48***	.00	.48***
Crystallized intelligence	.22*	.00	.22*

*$p < .05$. **$p < .01$. ***$p < .001$.

lar impairment affected participants' everyday problem solving indirectly through cognitive abilities. Greater impairments were associated with lower scores on measures of speed and memory, which, in turn, affected participants' performance on measures of fluid and crystallized intelligence and on the OTDL.

As hypothesized, speed and memory had no significant direct effects on older adults' OTDL performance. Their indirect effects through the ability factors of fluid and crystallized intelligence, however, were statistically significant. Crystallized and fluid intelligence had a positive direct effect on older adults' OTDL performance; that is, higher fluid and crystallized intelligence scores were predictive of higher scores on the observational tasks. Of all of the predictor variables, fluid intelligence was the most salient correlate of older adults' everyday problem-solving performance.

Discussion

The goal of this study was to examine the usefulness of a set of tasks of daily living, the OTDL, for the behavioral assessment of older adults in three domains of everyday problem solving. The convergent validity of the OTDL with a paper-and-pencil test of everyday problem solving and the relations between basic cognitive abilities and older adults' performance on the OTDL were examined. Furthermore, path analysis was used to examine a structural model of the correlates of older adults' everyday problem-solving performance.

An important issue in a newly emerging field such as everyday problem solving is whether the phenomenon under study can best be represented multidimensionally or unidimensionally. In this study, we addressed this issue by examining whether tasks related to food preparation, medication intake, and phone use represented distinct domains of problem solving. Findings from confirmatory factor analyses indicate that a measurement model that specified three separate factors of everyday problem solving provided a significantly better goodness of fit to the observed data than a single-factor model. Thus, this study's findings suggest that older adults' performance on tasks of daily living such as those of the OTDL is more adequately conceptualized as a multidimensional than a unidimensional phenomenon. Evidence for the multidimensionality of everyday problem solving has also been provided by Marsiske and Willis (1995). These authors showed that three different measures of everyday problem solving showed only small interrelations, suggesting that they tapped different aspects of everyday cognition.

The findings of the present study also indicate that the newly developed set of behavioral tasks reliably assessed older adults' everyday problem solving in two of the three domains of everyday functioning. The internal consistency of the telephone use scale was less than desirable, and further work needs to be done to improve its reliability. The convergent validity of the OTDL was examined in two different ways. First, participants' scores on the OTDL were correlated with the number of IADLs for which they had reported needing some assistance. The resulting correlations showed an association between greater number of self-reported IADL limitations and lower performance on the OTDL for all three domains.[3] Second, confirmatory factor analyses provided evidence for the convergent validity of the OTDL domains with the scales of the EPT. Taken together, these findings provide empirical support for the convergent validity of the OTDL with a self-report assessment of older adults' functional competence and with their performance on a paper-and-pencil measure of everyday problem solving.

To date, two major groups of assessment procedures have been used to determine older adults' functional competence for tasks of daily living. The first group involves self-report instruments, whereas the second group involves performance-based assessment instruments that focus primarily on self-care activities (see Willis, 1991). Performance-based assessment procedures that focus on more complex and challenging IADLs are needed for at least two reasons. First, several studies (Kuriansky, Gurland, & Fleiss, 1976; Little, Hemsley, Volans, & Bergman, 1986; Rogers & Holm, 1990) have shown that self-report measures may be problematic because many older adults have difficulty evaluating their everyday competence accurately. This lack of accuracy often results in overestimation or underestimation of their actual performance (see also Myers, Holliday, Harvey, & Hutchinson, 1993), a finding supported by the present study as well. Second, the few established observational measures of everyday competence focus too narrowly on self-care-related activities of daily living (see Myers et al., 1993; Rogers & Holm, 1990) or on tasks with too low a ceiling for healthy community-residing older adults (see Loewenstein et al., 1989). Given this state of affairs, we suggest that objective and detailed assessment of community-residing elderly people's everyday competence should, in addition to other established assessment procedures, incorporate in situ simulations such as the OTDL (Willis, 1991).

Behavioral assessment of everyday problem solving may be

[3] Additional evidence for the convergent validity of the OTDL was obtained for 28 study participants who were retested 12 months later. The correlation between their overall OTDL performance and number of self-reported IADL limitations 12 months later was −.46 ($p < .05$). No significant relations, however, were found between these older adults' overall OTDL performance and their performance on Denney and Pearce's (1989) and Cornelius and Caspi's (1987) everyday problem-solving measures; the correlations were .24 and .33 (both $ps > .05$), respectively.

of particular importance in determining the functional competencies of cognitively challenged older adults (see Willis, in press) in different areas of everyday functioning. For example, recent trends in legal judgments affecting older adults (e.g., guardianship law) reflect increasing advocacy of the assessment of domain-specific functional abilities rather than the global assessment of competence (see Smyer, Kapp, & Schaie, in press). These trends represent a major challenge to gerontologists with regard to defining and objectively assessing the functional abilities relevant for independent living in old age. Grisso (1986) and others have argued that older people's functional competencies to perform IADLs are of primary interest in legal guardianship cases. Thus, measures such as the OTDL are needed to provide means for objectively assessing older adults' functional competencies relevant for living independently in a society that undergoes rapid technological and sociocultural change (see Pifer & Bronte, 1986). The impact of objective functional assessment may be greatest for the old-old (i.e., individuals 75 years of age and older) and the oldest-old (i.e., individuals 85 years of age and older) given that this group of older adults is the fastest growing segment of the U.S. population (U.S. Senate Special Committee on Aging, 1987–1988; Willis, in press). Old-old and oldest-old adults are also most likely to show the effects of normative age-related changes in intellectual functioning (see Schaie, 1994).

The present study found sizable correlations between older adults' performance on the OTDL and their basic cognitive abilities. Examination of the relations between older adults' basic cognitive abilities and their everyday problem solving showed that there was a meaningful pattern of direct and indirect relations, indicating that multiple basic abilities contributed to participants' performance on the OTDL. Taken together, these findings provide further empirical evidence in favor of a hierarchical perspective of everyday cognition (Willis & Schaie, 1986, 1993). The main assumptions of this perspective have been outlined by Willis and Schaie (1993) and can be summarized in three postulates. First, problems encountered in everyday life require, in general, the activation and application of multiple mental abilities and processes for their solution. Second, different types of everyday problems require the application of different mental abilities. Third, competence with regard to basic cognitive abilities and processes is a necessary but not sufficient condition for the successful solution of everyday problems; domain-specific knowledge is likely to be required as well for successful everyday problem solving.

The present study also addressed the question of the convergent validity of a paper-and-pencil test of everyday problem solving with a behavioral measure of everyday competence. This issue has been raised by several authors (e.g., Denney, 1989; Salthouse, 1990) who have questioned whether older adults' scores on paper-and-pencil tests of everyday problem solving are predictive of their actual performance on similar tasks in real life. Our study permitted the examination of this question by relating participants' performance on the EPT to their performance on the OTDL. The results indicated that there were sizable correlations between participants' scores on the two measures. Thus, there is empirical evidence, although for a limited number of task domains, that paper-and-pencil measures of everyday problem solving such as the EPT have convergent validity.

The present study extended previous research on everyday cognition by examining a path analysis model of everyday problem solving. This model included not only cognitive abilities but also personal characteristics such as age, education, and indicators of participants' health status. The results indicated that participants' age affected their performance on the observational tasks both directly and indirectly. Most interesting, age had a significant direct effect on participants' everyday problem solving even after its indirect effects through cognitive abilities had been taken into account. Indeed, besides fluid intelligence, age had the strongest total effect on older adults' problem-solving performance (see Table 7). This result is in contrast with findings reported by Salthouse (1993) showing that the direct effect of age on verbal task performance was small when perceptual speed, motor speed, and vocabulary were specified as mediating variables.

Findings from this study showed that health variables such as hearing impairment and cardiovascular impairment affected participants' everyday problem solving indirectly through cognitive abilities. Individuals with more severe health impairments scored lower on speed and memory, which, in turn, affected their performance on measures of fluid and crystallized intelligence and everyday problem solving. The absence of significant direct effects of health impairments on everyday problem solving may serve as an indication that older adults often adjust to health-related impairments and their effects on the demands of daily life by developing compensatory strategies (Bäckman & Dixon, 1992) and strategies of selective optimization (P. B. Baltes & M. M. Baltes, 1990). However, the possibility that the absence of significant direct effects of health impairments on older adults' OTDL performance may reflect a method artifact cannot be ruled out, given that all of the health measures were obtained through self-report. More direct measures of physical health and sensory functioning might have resulted in direct or stronger indirect relations with OTDL performance (see Linden-berger & Baltes, 1994).

Interestingly, crystallized intelligence, which is generally seen as the accumulated cultural knowledge relevant for everyday problem solving, was not as strong a correlate of observational task performance as fluid intelligence. Indeed, fluid intelligence was the strongest correlate of participants' everyday problem-solving performance. These findings are consistent with results reported by Hayslip and Maloy (1992) and Willis and Schaie (1986). Their studies showed that adults' fluid intelligence score was the strongest predictor of their performance on the Basic Skills Assessment Test (Educational Testing Service, 1977), a paper-and-pencil measure of practical problem solving that uses everyday printed materials as stimuli. Although this relation seems to be counterintuitive, there are some plausible reasons for why it has been found in several studies. For example, items on both the Basic Skills Assessment Test and the OTDL are experimenter defined and thus may contain some elements that, although not completely uncommon, may be somewhat unfamiliar to older adults. If this is the case, then older adults' accumulated or domain-specific knowledge is likely to be of secondary importance in obtaining a successful problem solution because they first need to rely on more basic

principles of problem solving that are a function of fluid intelligence. These basic processes may involve a redefinition of the problem so that familiar problem-solving strategies can be applied, or they may involve a systematic search for relevant information in the existing knowledge base so that a problem-solving strategy can be developed.

It is important to note several caveats that may limit the generalizability of the study's findings. First, it must be acknowledged that the study sample was relatively small and biased in favor of educationally and socioeconomically advantaged older adults. The sample may also have been more homogeneous than an ordinary community-based sample with regard to health characteristics. Second, it must be acknowledged that the memory ability factor was assessed in a relatively narrow fashion with measures of memory span rather than more specific measures of working memory. Use of more specific measures of working memory may yield stronger relations between memory and health-related variables and between memory and other basic cognitive abilities. Third, it needs to be acknowledged that the OTDL, as currently composed, represent only one possible realization of everyday tasks from the domains of food preparation, medication intake, and telephone use. Other tasks or other realizations of the same or similar tasks are possible and need to be examined systematically. Fourth, the OTDL described in this study have not been examined with regard to their discriminative and predictive validity. Thus, it is currently not known how well these tasks perform in discriminating between individuals who are completely independent in performing tasks of daily living and individuals who are semi-independent and in need of assistance. Similarly, it is currently not known whether the OTDL possess predictive validity with regard to individuals who may be at risk for institutionalization. Future research needs to address these very important issues.

Two additional caveats center around the path analysis model. First, although the model was developed on the basis of previous research, it was accepted after modifications within a single sample. This strategy, although often necessary in new areas of research such as everyday problem solving, runs the risk of capitalizing on unique characteristics of the study sample. Second, the rather small sample available for this study limits the statistical power to reject poor models and reduces the discriminatory power with regard to plausible alternative models (see Tanaka, 1987). Therefore, more research will be needed to examine whether the model established in this study can be confirmed with larger independent samples.

In summary, this study showed that the OTDL is a useful performance-based measure of older adults' ability to solve problems from three important domains of daily life. Sizable correlations were found among older adults' performance on the observed tasks, their basic cognitive abilities, and their performance on the corresponding scales of a paper-and-pencil measure of everyday problem solving. Performance on the OTDL was significantly related to the number of IADLs for which participants reported needing assistance, thus providing some evidence of convergent validity with an independent measure of functional competence. Finally, a path analysis model examined the correlates of older adults' everyday problem-solving performance. Results showed that age affected elderly participants' problem-solving performance both directly and indirectly through cognitive abilities. Health-related variables affected older adults' problem-solving performance only indirectly through the cognitive abilities of speed of processing and memory, which, in turn, were related to fluid and crystallized intelligence. Consistent with other research, fluid intelligence was the most salient correlate of older adults' everyday problem solving. Thus, despite some limitations of this study, we believe that performance-based assessment of everyday problem solving is a promising approach that warrants further research. This approach may be important in obtaining a better understanding of the different dimensions involved in older adults' everyday problem solving and functional competence.

References

Bäckman, L., & Dixon, R. A. (1992). Psychological compensation: A theoretical framework. *Psychological Bulletin, 112,* 259–283.

Baird, A., Brines, B., & Stoor, E. (1992, November). *What tasks are the most important for successful independent living in elders?* Paper presented at the annual scientific meeting of the Gerontological Society of America, Washington, DC.

Baltes, M. M., Wahl, H. -W., & Schmid-Furstoss, U. (1990). The daily life of elderly Germans: Activity patterns, personal control, and functional health. *Journal of Gerontology: Psychological Sciences, 45,* P173–P179.

Baltes, P. B., & Baltes, M. M. (1990). Psychological perspectives on successful aging: The model of selective optimization with compensation. In P. B. Baltes & M. M. Baltes (Eds.), *Successful aging: Perspectives from the behavioral sciences* (pp. 1–34). New York: Cambridge University Press.

Baltes, P. B., Cornelius, S. W., Spiro, A., Nesselroade, J. R., & Willis, S. L. (1980). Integration versus differentiation of fluid/crystallized intelligence in old age. *Developmental Psychology, 16,* 625–635.

Baltes, P. B., Dittmann-Kohli, F., & Dixon, R. A. (1984). New perspectives on the development of intelligence in adulthood: Toward a dual-process conception and a model of selective optimization and compensation. In P. B. Baltes & O. G. Brim, Jr. (Eds.), *Life-span development and behavior* (Vol. 6, pp. 34–77). Orlando, FL: Academic Press.

Berg, C. A., & Sternberg, R. J. (1985). A triarchic theory of intellectual development during adulthood. *Developmental Review, 5,* 334–370.

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

Camp, C. J., Doherty, K., Moody-Thomas, S., & Denney, N. W. (1989). Practical problem solving in adults: A comparison of problem types and scoring methods. In J. D. Sinnott (Ed.), *Everyday problem solving—Theory and application* (pp. 211–228). New York: Praeger.

Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin, 56,* 124–132.

Cattell, R. B. (1971). *Abilities: Their structure, growth, and action.* Boston: Houghton Mifflin.

Ceci, S. J., & Liker, J. (1986). Academic and nonacademic intelligence: An experimental separation. In R. J. Sternberg & R. K. Wagner (Eds.), *Practical intelligence—Nature and origins of competence in the everyday world* (pp. 119–142). New York: Cambridge University Press.

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement, 20,* 37–46.

Cornelius, S. W. (1990). Aging and everyday cognitive abilities. In T. M. Hess (Ed.), *Aging and cognition: Knowledge organization and utilization* (pp. 411–459). Amsterdam: Elsevier.

Cornelius, S. W., & Caspi, A. (1987). Everyday problem solving in adulthood and old age. *Psychology and Aging, 2,* 144–153.

Denney, N. W. (1989). Everyday problem solving: Methodological issues, research findings, and a model. In L. W. Poon, D. C. Rubin, & B. A. Wilson (Eds.), *Everyday cognition in adulthood and late life* (pp. 330–351). New York: Cambridge University Press.

Denney, N. W., & Pearce, K. A. (1989). A developmental study of practical problem solving in adults. *Psychology and Aging, 4,* 438–442.

Diehl, M., Willis, S. L., & Schaie, K. W. (1990, November). *Adults' perceptions about the relevance of printed materials for elders' independent living.* Paper presented at the annual scientific meeting of the Gerontological Society of America, Boston, MA.

Dixon, R. A. (1992). Contextual approaches to adult intellectual development. In R. J. Sternberg & C. A. Berg (Eds.), *Intellectual development* (pp. 350–380). New York: Cambridge University Press.

Dörner, D., & Kreuzig, H. (1983). Problemlösefähigkeit und Intelligenz [Problem-solving ability and intelligence]. *Psychologische Rundschau, 34,* 185–192.

Educational Testing Service. (1977). *Basic Skills Assessment Test: Reading.* Princeton, NJ: Author.

Fillenbaum, G. G. (1978). Reliability and validity of the OARS multidimensional functional assessment questionnaire. In Duke University Center for the Study of Aging (Ed.), *Multidimensional functional assessment: The OARS methodology* (2nd ed., pp. 20–28). Durham, NC: Duke University Press.

Fillenbaum, G. G. (1979). Social context and self-assessments of health among the elderly. *Journal of Health and Social Behavior, 20,* 45–51.

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: Erlbaum.

Ford, A. B., Folmar, 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,* 187–197.

Frederiksen, N. (1986). Toward a broader conception of human intelligence. In R. J. Sternberg & R. K. Wagner (Eds.), *Practical intelligence—Nature and origins of competence in the everyday world* (pp. 84–116). New York: Cambridge University Press.

Friedsam, H. J., & Martin, H. W. (1963). A comparison of self and physicians' health ratings in an older population. *Journal of Health and Social Behavior, 4,* 179–183.

Grisso, T. (1986). *Evaluating competencies: Forensic assessments and instruments.* New York: Plenum.

Hayslip, B., & Maloy, R. M. (1992). The interface between psychometric abilities and everyday cognitive functioning. In R. L. West & J. D. Sinnott (Eds.), *Everyday memory and aging* (pp. 190–198). New York: Springer-Verlag.

Hertzog, C. (1989). Influences of cognitive slowing on age differences in intelligence. *Developmental Psychology, 25,* 636–651.

Hultsch, D. F., Hammer, M., & Small, B. J. (1993). Age differences in cognitive performance in later life: Relationships to self-reported health and activity life style. *Journal of Gerontology: Psychological Sciences, 48,* P1–P11.

Jöreskog, K. G., & Sörbom, D. (1989). *LISREL 7: A guide to the program and applications* (2nd ed.). Chicago: SPSS.

Jurden, F. H., Reese, H. W., Cohen, S. H., & Puckett, J. M. (1992, November). *Cognitive resources in aging: Decomposition of effects.* Paper presented at the annual scientific meeting of the Gerontological Society of America, Washington, DC.

Kaplan, G. A., & Camacho, T. (1983). Perceived health and mortality: A nine-year follow-up of the human population laboratory cohort. *American Journal of Epidemiology, 117,* 292–304.

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,* S107–S109.

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

Labouvie-Vief, G. (1985). Intelligence and cognition. In J. E. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (2nd ed., pp. 500–530). New York: Van Nostrand Reinhold.

LaRue, A., Bank, L., Jarvik, L., & Hetland, M. (1979). Health in old age: How do physicians' ratings and self-ratings compare? *Journal of Gerontology, 34,* 687–691.

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

Liang, J. (1986). Self-reported physical health among aged adults. *Journal of Gerontology, 41,* 248–260.

Liang, J., Lawrence, R. H., Bennett, J. M., & Whitelaw, N. A. (1990). Appropriateness of composites in structural equation models. *Journal of Gerontology: Social Sciences, 45,* S52–S59.

Lindenberger, U., & Baltes, P. B. (1994). Sensory functioning and intelligence in old age: A strong connection. *Psychology and Aging, 9,* 339–355.

Lindenberger, U., Mayr, U., & Kliegl, R. (1993). Speed and intelligence in old age. *Psychology and Aging, 8,* 207–220.

Little, A. G., Hemsley, D. R., Volans, D. R., & Bergman, K. (1986). The relationship between alternative assessments of self-care ability in the elderly. *British Journal of Clinical Psychology, 25,* 51–59.

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,* P114–P121.

Longino, C. F. (1981). Retirement communities. In F. J. Berghorn & D. E. Schafer (Eds.), *The dynamics of aging* (pp. 391–418). Boulder, CO: Westview Press.

Maddox, G. L. (1962). Some correlates of differences in assessments of health status among the elderly. *Journal of Gerontology, 17,* 180–185.

Maddox, G. L. (1964). Self-assessment of health status: A longitudinal study of selected elderly subjects. *Journal of Chronic Disease, 17,* 449–460.

Maddox, G. L., & Douglass, E. (1973). Self-assessments of health: A longitudinal study of elderly subjects. *Journal of Health and Social Behavior, 14,* 87–93.

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

Marsiske, M. (1992). *Dimensionality and correlates of everyday problem solving in older adults.* Unpublished doctoral dissertation, Pennsylvania State University, University Park.

Marsiske, M., & Willis, S. L. (1995). Dimensionality of everyday problem solving in older adults. *Psychology and Aging, 10,* 269–283.

Morrell, R. W., Park, D. C., & Poon, L. W. (1990). Effects of labeling techniques on memory and comprehension of prescription information in young and old adults. *Journal of Gerontology: Psychological Sciences, 45,* P166–P172.

Mossey, J. M., & Shapiro, E. (1982). Self-rated health: A predictor of mortality among the elderly. *American Journal of Public Health, 72,* 800–808.

Myers, A. M., Holliday, P. J., Harvey, K. A., & Hutchinson, K. S. (1993). Functional performance measures: Are they superior to self-assessments? *Journal of Gerontology: Medical Sciences, 48,* M196–M206.

Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.

Park, D. C. (1992). Applied cognitive aging research. In F. I. M. Craik & T. A. Salthouse (Eds.), *The handbook of aging and cognition* (pp. 449–493). Hillsdale, NJ: Erlbaum.

Pedhazur, E. J., & Schmelkin, L. P. (1991). *Measurement, design, and analysis: An integrated approach.* Hillsdale, NJ: Erlbaum.

Pifer, A., & Bronte, L. (Eds.). (1986). *Our aging society.* New York: Norton.

Poon, L. W., Rubin, D. C., & Wilson, B. A. (Eds.). (1989). *Everyday cognition in adulthood and late life.* New York: Cambridge University Press.

Puckett, J. M., & Reese, H. W. (Eds.). (1993). *Mechanisms of everyday cognition.* Hillsdale, NJ: Erlbaum.

Raykov, T., Tomer, A., & Nesselroade, J. R. (1991). Reporting structural equation modeling results in *Psychology and Aging:* Some proposed guidelines. *Psychology and Aging, 6,* 499–503.

Rogers, J. C., & Holm, M. B. (1990, November). *Objective and subjective methods of assessing activities of daily living.* Paper presented at the annual scientific meeting of the Gerontological Society of America, Boston, MA.

Salthouse, T. A. (1990). Cognitive competence and expertise in aging. In J. E. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (3rd ed., pp. 310–319). San Diego, CA: Academic Press.

Salthouse, T. A. (1991). Mediation of adult age differences in cognition by reductions in working memory and speed of processing. *Psychological Science, 2,* 179–183.

Salthouse, T. A. (1993). Speed and knowledge as determinants of adult age differences in verbal tasks. *Journal of Gerontology: Psychological Sciences, 48,* P29–P36.

Salthouse, T. A., Kausler, D. H., & Saults, J. S. (1988). Utilization of path-analytic procedures to investigate the role of processing resources in cognitive aging. *Psychology and Aging, 3,* 158–166.

Schaie, K. W. (1978). External validity in the assessment of intellectual development in adulthood. *Journal of Gerontology, 33,* 695–701.

Schaie, K. W. (1989). Perceptual speed in adulthood: Cross-sectional studies and longitudinal studies. *Psychology and Aging, 4,* 443–453.

Schaie, K. W. (1994). The course of adult intellectual development. *American Psychologist, 49,* 304–313.

Schaie, K. W., Willis, S. L., Jay, G. M., & Chipuer, H. (1989). Structural invariance of cognitive abilities across the adult life span: A cross-sectional study. *Developmental Psychology, 25,* 652–662.

Sinnott, J. D. (Ed.). (1989). *Everyday problem solving—Theory and application.* New York: Praeger.

Smyer, M. A., Kapp, M., & Schaie, K. W. (Eds.). (in press). *Impact of the law on older adults' decision-making capacity: Social, behavioral, legal, and ethical perspectives.* New York: Springer.

Sobel, M. E. (1988). Direct and indirect effects in linear structural equation models. In J. S. Long (Ed.), *Common problems/proper solutions: Avoiding error in quantitative research* (pp. 46–64). Beverly Hills, CA: Sage.

Steinhagen-Thiessen, E., & Borchelt, M. (1993). Health differences in advanced old age. *Ageing and Society, 13,* 619–655.

Sternberg, R. J. (1985). *Beyond IQ: A triarchic theory of human intelligence.* New York: Cambridge University Press.

Sternberg, R. J., & Wagner, R. K. (Eds.). (1986). *Practical intelligence—Nature and origins of competence in the everyday world.* New York: Cambridge University Press.

Tanaka, J. S. (1987). "How big is big enough?": Sample size and goodness of fit in structural equation models with latent variables. *Child Development, 58,* 134–146.

U.S. Department of Commerce. (1994a). *1990 census of population: Education in the United States.* Washington, DC: U.S. Government Printing Office.

U.S. Department of Commerce. (1994b). *1990 census of population: Social and economic characteristics.* Washington, DC: U.S. Government Printing Office.

U.S. Senate Special Committee on Aging (1987–1988). *Aging America: Trends and projections.* Washington, DC: U.S. Department of Health and Human Services.

Wagner, R. K., & Sternberg, R. J. (1985). Practical intelligence in real-world pursuits: The role of tacit knowledge. *Journal of Personality and Social Psychology, 49,* 436–458.

Walters, J. M., & Gardner, H. (1986). The theory of multiple intelligences: Some issues and answers. In R. J. Sternberg & R. K. Wagner (Eds.), *Practical intelligence—Nature and origins of competence in the everyday world* (pp. 163–182). New York: Cambridge University Press.

Willis, S. L. (1991). Cognition and everyday competence. In K. W. Schaie (Ed.), *Annual review of gerontology and geriatrics* (Vol. 11, pp. 80–109). New York: Springer.

Willis, S. L. (in press). Assessing everyday competence in the cognitively challenged elderly. In M. A. Smyer, M. B. Kapp, & K. W. Schaie (Eds.), *Impact of the law on older adults' decision-making capacity: Social, behavioral, legal, and ethical perspectives.* New York: Springer.

Willis, S. L., Diehl, M., Gruber-Baldini, A. L., Marsiske, M., & Haessler, S. D. (1990, March). *Description and prediction of intellectual change in older adults.* Paper presented at the Third Cognitive Aging Conference, Atlanta, GA.

Willis, S. L., Jay, G. M., Diehl, M., & Marsiske, M. (1992). Longitudinal change and the prediction of everyday task competence in the elderly. *Research on Aging, 14,* 68–91.

Willis, S. L., & Marsiske, M. (1993). *Manual for the Everyday Problems Test.* University Park: Department of Human Development and Family Studies, Pennsylvania State University.

Willis, S. L., Marsiske, M., & Diehl, M. (1991, November). *Older adults' performance on instrumental activities of daily living and mental abilities.* Paper presented at the annual scientific meeting of the Gerontological Society of America, San Francisco, CA.

Willis, S. L., & Schaie, K. W. (1986). Practical intelligence in later adulthood. In R. J. Sternberg & R. K. Wagner (Eds.), *Practical intelligence—Nature and origins of competence in the everyday world* (pp. 236–268). New York: Cambridge University Press.

Willis, S. L., & Schaie, K. W. (1993). Everyday cognition: Taxonomic and methodological considerations. In J. M. Puckett & H. W. Reese (Eds.), *Mechanisms of everyday cognition* (pp. 33–53). Hillsdale, NJ: Erlbaum.

Wolinsky, F. D., Coe, R. M., Miller, D. K., & Prendergast, J. M. (1984). Measurement of the global and functional dimensions of health status in the elderly. *Journal of Gerontology, 39,* 88–92.

Wolinsky, F. D., Coe, R. M., Miller, D. K., Prendergast, J. M., Creel, M. J., & Chavez, M. N. (1983). Health services utilization among the noninstitutionalized elderly. *Journal of Health and Social Behavior, 24,* 325–337.