Age-Related Change in Cognitive Function

ROBERT S. WILSON, DAVID A. BENNETT, AND ANDREA SWARTZENDRUBER

Introduction

This chapter considers cognitive functioning in persons age 65 or older. Persons within this age group commonly report difficulty with memory and other cognitive abilities compared to an earlier period. These perceptions may contribute to concern about Alzheimer’s disease (AD) and other dementing illnesses. In view of the prevalence of AD and other conditions that affect cognition in this age group (e.g., Parkinson’s disease, stroke), such concern is understandable. Indeed, impaired cognitive function in older persons is associated with loss of independence, increased morbidity and mortality, and reduced quality of life. Not surprisingly, therefore, considerable scientific effort has been expended in attempts to understand age-related cognitive decline, its neural bases, and factors which may modify or delay it.

At present, there is no general agreement about which aspects of decline in cognitive abilities are due to “normal” aging and which are due to an early dementing illness such as AD. We have chosen to focus, therefore, on the difficult issue of identification of impaired cognition in elderly persons. First, we outline current evidence regarding loss of cognitive abilities among older persons. Next, we consider neuropsychological approaches to determining cognitive impairment in elderly persons in light of cognitive aging research. In the final section, we discuss directions for future research and clinical practice.

Age-Related Cognitive Impairment

Methodological issues loom large in the study of age-related cognitive impairment. Many of these issues are not peculiar to cognition, but are critical for studies of many conditions related to aging. One especially important issue, in our view, is the use of longitudinal studies. Because cognitive abilities are related to many factors, in addition to age, inferences about cognitive impairment from cross-sectional data are often based on uncertain assumptions and involve substantial risk of bias. For example, although the average score on many neuropsychological tests is lower in older than in younger people, there is typically more variability in the older age group, with some persons performing better than persons in the younger age group, and a subset performing relatively poorly. Studies that attempt to understand interindividual variability in cognitive abilities are of major importance. Direct measurement of change in cognitive function is the best way to understand person-specific patterns of cognitive decline. Although cross-sectional studies can show differential associations of specific cognitive functions with age and possible neural bases of such impairment, longitudinal studies are required to gain a fuller understanding of individual patterns of change in specific cognitive functions, as well as
Longitudinal cognitive research is complex, time-consuming, and costly. In addition, it poses a number of difficult operational, psychometric, and analytic challenges. Perhaps not surprisingly, therefore, relatively little longitudinal cognitive research has been published. Further, findings of many published studies are hard to interpret due to attrition, floor or ceiling effects on cognitive measures, and questionable analytic strategies. Fortunately, recent analytic advances and their successful application to longitudinal studies of other age-related conditions have made this approach to the study of cognitive aging more feasible (Evans, 1991; Rogosa, 1988).

Another methodological concern is the need to investigate at least some issues in cognitive aging among people drawn from defined populations. Use of population-based samples permits the study of the full spectrum of cognitive abilities exhibited by older persons. Findings from studies of volunteers may be difficult to interpret when older age groups are selected to be equivalent to younger age groups on variables which are known to be related to age on a population basis (e.g., education, health, medication use).

Perhaps the most basic question is whether cognitive decline occurs regularly among persons age 65 or older. Cross-sectional studies consistently report an inverse correlation between age and performance on most cognitive tasks (Lindenberger, Mayr, & Kliegl, 1993; Scherr et al., 1988; Wechsler, 1987). These studies also stress substantial individual differences in cognitive function exhibited by older persons, ranging from levels equivalent or superior to those seen in younger persons to clinically manifest dementia. Longitudinal studies suggest similar conclusions. Two recent longitudinal studies are notable for (a) use of population-based samples and (b) high rates of initial and follow-up participation (Colsher & Wallace, 1991; Evans et al., 1993). Decline on a 10-item mental status test (Pfeiffer, 1975) was observed over an interval of approximately 3 years in one study (Evans et al., 1993) and 6 years in the other (Colsher & Wallace, 1991), and age was associated with degree of decline in each study.

Although there is consensus that cognitive decline occurs in many older persons, there is limited knowledge of the factors that contribute to individual differences in decline. A number of potential risk factors are currently under investigation, including education and other markers of socioeconomic status, gender, race, smoking, parkinsonism, volume of the hippocampus on magnetic resonance imaging (MRI), and presence of one or two apolipoprotein E ε4 alleles. Of these factors, only education has been shown to predict rate of cognitive decline in population studies (Colsher & Wallace, 1991; Evans et al., 1993). That is, persons with few years of formal education show a relatively greater rate of cognitive decline than do more educated persons. Although level of education has long been recognized as a factor affecting cognitive and neuropsychological performance tests, the association of education with change in cognitive function is not likely to be artifactual since any biases associated with education would presumably be equivalent at each measurement point. The meaning of the association between education and cognitive decline is uncertain. Education might directly affect cognition, or the correlation might reflect some other variable(s) related to both education and cognitive decline. Of course, it is reasonable to assume that a substantial amount of decline observed in population-based samples may be due to common clinical conditions (e.g., AD) known to cause cognitive impairment in this age range. However, even when persons with such conditions are excluded, substantial age-related differences in cognitive functioning remain.

Much scientific effort has been devoted to the study of differential association of age with specific forms of cognition. Although age-related differences are clearly more pronounced on some tests than on others, virtually all cognitive performance measures show such differences. Indeed, even abilities considered relatively impervious to age-related decline like reading, word knowledge, and implicit memory have been shown to correlate with age in prior research (Chiarello & Hoyer, 1988; Fromm, Holland, Nebes, & Oakley, 1991; Salthouse, 1993). Below we briefly discuss declarative memory, working memory, and perceptual speed, functions which show pronounced age-related differences and are critical to any neuropsychological understanding of aging.

Perhaps the most widely recognized cognitive