MIDLIFE MYTHS

Issues, Findings, and Practice Implications

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Adult Intelligence

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This chapter discusses issues related to adult intelligence in middle age. Two middle-aged adults facing intellectual challenges are briefly described. In 1964 Wayne Hazelwood joined IBM as a typewriter assembler (*New York Times*, May 17, 1985, p. 15). He was good at his job, but IBM made changes in the way they manufactured typewriters. Wayne's job was no longer necessary. So, in 1975 Wayne began an intensive training program and became a Selectric typewriter quality inspector. He did well, but new developments in typewriter technology again required the learning of new skills. In 1980 Wayne took a training course in manufacturing instruction. Most recently, in 1985 Wayne began his fourth career at IBM as a member of the electronic card assembly technical staff. Over his 21-year work life, Wayne has repeatedly applied his intellectual abilities to learn new information and technical skills.

Susan graduated from college, married, and is now the mother of two preadolescent children. She and her husband are concerned about the financial strain of having two children in college in a few years. In addition, Susan is eager to continue her own professional development. She is applying for graduate studies in library science. Part of her graduate program will focus on computer technology involved in information management and retrieval. Susan, at age 40, will be acquiring a number of complex, new analytical skills.

Societal stereotypes have suggested that childhood and adolescence are the primary periods for intellectual development (Willis, 1985). Our society has concentrated virtually all of formal schooling within the early part of the life span. It was assumed that the individual could acquire during the early years the knowledge and intellectual abilities required to carry out the responsibilities of adulthood. Just as the individual reached biological maturity in adolescence or early adulthood, there was the assumption that intellectual development also "peaked" early in the life span. As early signs of biological aging began to become evident in middle age (e.g., gray hair, changes in body composition), it was assumed that the individual's level of intellectual functioning was beginning to diminish.

In our rapidly technologically advancing society, however, it becomes increasingly important for middle-aged adults to perform at a high level of intellectual competence (Cross, 1981). It is in middle age that many adults assume major familial, professional, and societal responsibilities (Havighurst, 1972). These require not only the application of previously developed knowledge and abilities but also the acquisition of new information and skills. Can adults in middle age be expected to meet these intellectual demands?

In this chapter, the literature on developmental changes in intellectual functioning across adulthood will be reviewed, with particular focus on middle age. We will begin by considering the construct of intelligence and how it has been measured. Second, we will discuss age-related changes in intellectual performance. Third, we will examine several variables that contribute to individual differences in the level of intellectual functioning in adulthood.

Measurement of Intelligence

When asked to nominate individuals considered to be extremely intelligent, one often begins by identifying certain behaviors "characteristic" of intelligent people, and then chooses individuals who exhibit these behaviors. Such behaviors may include solving problems efficiently or learning new tasks quickly. It is important to note that intelligence is a theoretical construct and is not directly observable. It must be inferred from observing an individual's behavior. The more situations in which we observe intelligent behavior, the more confident we become in our estimate of a person's intelligence. Assessment of intelligence via IQ tests works according to the same principle: the individual is presented with a series of tasks, and his or her responses are judged in terms of level of competence.

Intelligence is not identical with competent behavior. Many factors can affect competent behavior in addition to intelligence. Consider, for example, an individual's performance on a math test. Certainly, the individual's intelligence is an important factor in performance on a math test. The individual's prior educational training in mathematics, the motivation to do well on the test, and the individual's anxiety in test-taking situations, however, are additional factors that will affect performance.

Of particular concern in this chapter are factors other than intelligence that might differentially affect the performance of adults of different ages. For example, many young adults, still in school, will have had more recent experience in taking tests, thereby being more "test-wise" and suffering less test anxiety than many middle-aged and older adults, who have had little recent experience with test taking. Likewise, when IQ tests are administered under speeded conditions, many older adults suffering sensory or behavioral (e.g., arthritis) handicaps may be disadvantaged in their ability to respond quickly. The role of factors other than intelligence needs to be taken into consideration in interpreting test performance, particularly when performance of adults of different ages is to be compared.

Multidimensionality of Intelligence

A perennial question in the study of intelligence is whether intelligence is a single, general ability, or several different abilities. Binet, one of the early investigators of intelligence, favored the idea of general ability, known as the "g" factor (Anastasi, 1976). In the study of adult intelligence, however, the importance of studying several distinct abilities has been increasingly recognized (Willis & Baltes, 1980). The importance of studying different abilities will become evident later in the chapter, as we examine changes in level of performance across the life span. Longitudinal research indicates that there are different patterns of developmental change for different abilities.

How many abilities are involved in adult intelligence? Different models of adult intelligence have focused on different numbers and types of abilities. Some models focus on only a few salient abilities (Thurstone & Thurstone, 1941); other models have suggested as many as 120 distinct factors of intelligence (Guilford, 1967). Many of these ability factors have been identified using the statistical procedure of factor analysis. Some of the more commonly recognized ability factors are verbal, number, space, memory, perceptual speed, and reasoning. Verbal ability has been assessed by tests of reading comprehension, verbal analogies, and vocabulary. Number ability involves competence in basic mathematical computations (addition, subtraction, multiplication, division). Space ability involves competence in visualization, and mental rotation of figures in two- and three-dimensional space. Memory has been examined in terms of memory span (e.g., recall of a list of words), and associative memory (e.g., recall of pairs of words). Perceptual speed involves the ability to make simple visual discriminations quickly and accurately. General reasoning, or induction, involves the ability to identify a rule or pattern in a problem and to utilize that rule in solving subsequent problems.

Abilities and Activities in Adulthood

The abilities described above were initially studied in research with children. Early investigators, such as Binet, identified these abilities as being important predictors of children's ability to achieve in academic settings (Anastasi, 1976). While schooling is an important developmental task of childhood, adults frequently apply their intellectual abilities in other pursuits. Are these same abilities useful in studying adult intelligence? Findings from recent research indicate a qualified "yes" to the above question. For example, performance on traditional intelligence tests has been shown to be a useful predictor of entry-level competence in a number of professions (e.g., engineering, piloting, computer programming; Hills, 1957; Smith, 1964). Moreover, recent research indicates that these abilities are significant predictors of middle-aged and older adults' performance on a number of tasks of daily living (e.g., reading a medicine bottle label, comprehending a newspaper editorial, interpreting a bus schedule; Willis & Schaie, 1986, 1987).

Many activities of daily living are complex tasks that involve multiple abilities. For example, reading and interpreting a medicine bottle label certainly involves verbal ability, but the competence to determine the size of dosage required for a given individual also requires reasoning ability (Willis & Schaie, 1986). Likewise, reading a road map involves spatial ability and verbal ability. Thus it is useful to think of abilities as basic "building blocks" of competent behavior. Several "blocks" (i.e., abilities) are involved in order to perform a given complex task, such as reading a road map.

Developmental Changes in Intellectual Ability

A primary question of developmental psychologists focuses on how intellectual functioning changes as the individual progresses from young adulthood to middle age to old age (Willis & Baltes, 1980). Does the individual's performance on all abilities go "downhill" after young adulthood, as some societal stereotypes suggest? In order to examine this question, one needs some understanding of the two major research designs used in developmental research on adult intelligence.

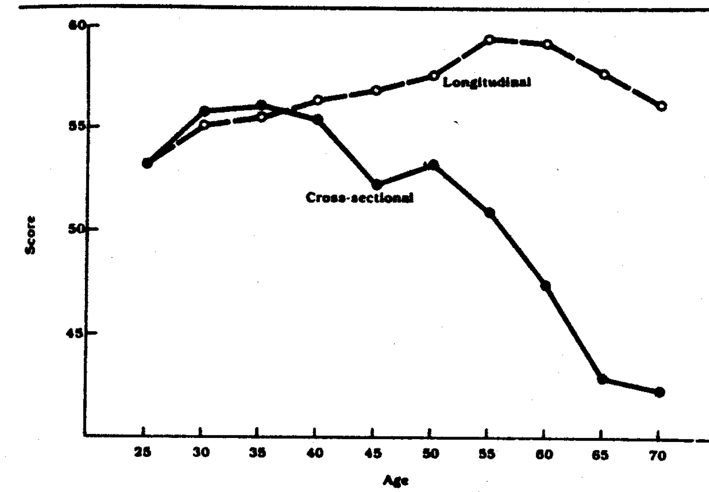

Figure 4.1. Comparable Cross-Sectional and Longitudinal Age Gradients for the Verbal Meaning Test

SOURCE: K. W. Schaie and C. R. Strother (1968). A cross-sequential study of age changes in cognitive behavior. *Psychological Bulletin, 70*, 671-680. Copyright 1968 by the American Psychological Association. Reprinted by permission.

Cross-Sectional Studies

The most widely used design in studying intellectual functioning has been the cross-sectional method (Botwinick, 1977). Using this method, the researcher compares the intellectual performance of adults of different ages at one point in time. For example, in 1960, the researcher might have compared the verbal ability performance of adults aged 20, 30, 40, 50, 60, 70, 80, and 90 years. The common finding across a number of cross-sectional studies was that young adults perform at a somewhat higher level than middle-aged adults, and that middle-aged adults perform at a somewhat higher level than older adults. This pattern of age differences is shown in Figure 4.1 (Schaie & Strother, 1968).

The interpretation of early cross-sectional studies was that these age differences in performance between young, middle-aged, and older adults reflected age-related decline. It was assumed that the middle-aged and older adults had performed at the same level as the younger adults when they were in their twenties and thirties. Their performance was assumed to have declined with increasing age.

Longitudinal Studies

Findings from longitudinal studies of intellectual functioning presented quite a different picture than those from cross-sectional studies (Schaie, 1983a). In longitudinal studies, the same individuals are studied across time. Longitudinal findings indicate that verbal ability, for example, continues to develop throughout middle age (Schaie & Strother, 1968). In contrast to cross-sectional findings, verbal ability peaks in late middle age, rather than in young adulthood. Reliable age-related decline in verbal ability does not occur until the late sixties.

Figure 4.2 presents longitudinal data from Schaie's longitudinal study (Schaie, 1983a) across the age range from young adulthood to old age for men and women for five different abilities. Note that, for all of the abilities studied, intellectual functioning in middle age is stable. There is no reliable decline until the early sixties. Note also that there are different patterns of age-related change for different abilities. Reliable age-related decline occurs somewhat earlier for some abilities than for others. Abilities such as numerical computations and spatial reasoning that involve speeded performance, and abstract reasoning, show earlier patterns of decline than abilities such as verbal ability. In addition, there are gender differences in intellectual performance. On average, men perform at a somewhat higher level than women on spatial ability, whereas women perform at a higher level than men on reasoning ability. There are also gender differences in patterns of age-related change. Men and women exhibit onset of age-related decline at somewhat different ages for certain abilities.

The findings from longitudinal studies, then, indicate that middle age is a period of relative stability in intellectual functioning. There is no reliable decline in intellectual performance in the middle years. Indeed, for some abilities, such as verbal ability, peak level of performance occurs in late middle age rather than in young adulthood. Thus findings from longitudinal studies indicate that intellectual ability continues to develop throughout the middle years.

Cohort Differences

What accounts for the difference between findings of cross-sectional and longitudinal studies? Cohort or generational differences are at issue (Schaie, 1983a). Cross-sectional studies compare individuals of different ages *and*

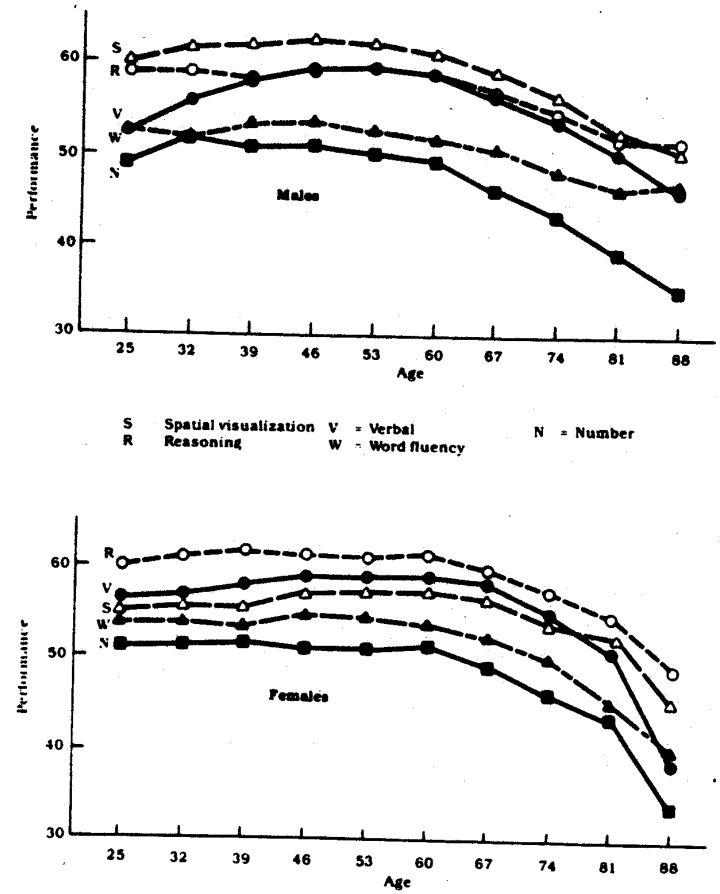

Figure 4.2. Longitudinal Changes for Five Thurstone Primary Mental Abilities

SOURCE: K. W. Schaie (1983). The Seattle Longitudinal Study: A twenty-one year exploration of psychometric intelligence in adulthood. In K. W. Schaie (Ed.), *Longitudinal studies of adult psychological development*. New York: Guilford Press. Used by permission.

different cohorts. That is, age and cohort are confounded in cross-sectional studies. For example, if 40- and 75-year-olds are compared in 1985 in a cross-sectional study, these individuals differ not only in age, but also in birth cohort; the 75-year-olds were born in 1910 and the 40-year-olds in 1945. The life experiences of these two cohorts differ, even when examined at the same chronological age. For example, the 1945 birth cohort has a higher level of education, on average, than the 1910 cohort.

Figure 4.3 presents cumulative mean differences in ability performance for 10 birth cohorts (1889, 1896, 1903, 1910, 1917, 1924, 1931, 1938, 1945, 1952). Cohort differences for inductive reasoning and numerical ability performance are shown (Schaie, 1986; Willis, in press). For inductive reasoning, there has been a positive cohort trend. Successive cohorts have performed at a higher level than previous cohorts, when compared at the same chronological age. On the other hand, there is a curvilinear cohort trend for numerical ability. The 1910-1924 birth cohorts performed at a higher level than did earlier or later cohorts, when compared at the same chronological age.

These data indicate that there are cohort differences in performance level, and that the pattern of these cohort differences vary by the ability studied. The distinct life experiences of the various cohorts contribute to these cohort differences in level of intellectual functioning. The experiences of cohorts are known to differ on important variables, such as educational level, medical care, nutritional resources, and historical events (e.g., war, economic depression).

Interpretations of cross-sectional studies often assume that older individuals functioned at the same level as younger individuals when at the same chronological age. Cohort comparisons, as shown in Figure 4.3, indicate that this is rarely the case. There are distinct cohort differences in level of intellectual functioning across the adult years. It is only when successive cohorts are studied longitudinally across the same age range that these cohort differences are identified. Thus cohort longitudinal studies contribute valuable information on how individuals change in intellectual functioning across the adult years and on cohort differences in level of intellectual performance.

It should be noted, however, that there are some limitations to longitudinal studies (Schaie, Labouvie, & Barret, 1973). As individuals are studied over time, less advantaged individuals (e.g., in education, health, occupation) are more likely to drop out of the study, such that the remaining subjects are more advantaged than the original sample. Thus the findings of longitudinal studies are somewhat positively biased. The significance of these limitations, however, can often be assessed and controlled for via independent sampling and statistical procedures (Schaie, 1983a; Siegler, McCarthy, & Logue, 1982).

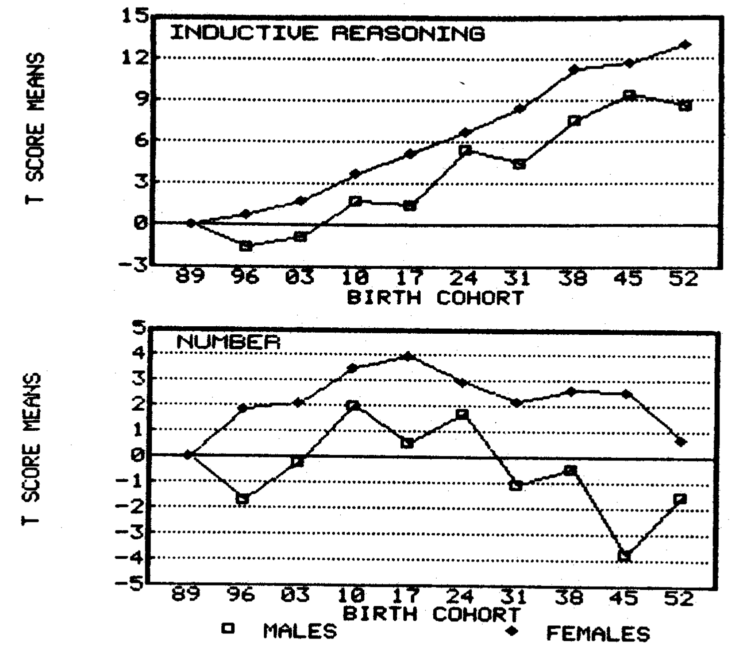

Figure 4.3. Cumulative Cohort Differences for Two of the Three Thurstone Primary Mental Abilities (inductive reasoning, number)

SOURCE: K. W. Schaie (1986, September). *Social context and cognitive performance in old age.* Paper presented at the meeting of the American Sociological Association, New York.

Health, Life-Style, and Intellectual Functioning

The findings presented thus far on intellectual functioning have focused on normative, or average, patterns of age-related change. While normative patterns of age-related change in intellectual functioning do not occur until the early sixties, there are wide individual differences in performance. Some individuals show significant changes in intellectual performance in midlife, while a few remarkable individuals show little decline even into the eighties. In this section, some of the variables associated with these individual differences are considered. The focus is on variables of particular relevance in midlife.

Health

In middle age, individuals begin to experience some early signs of normative aging, such as graying of hair, change in body composition, and menopause. These types of biological changes occur in most, if not all, individuals; however, there are wide individual differences in the timing of these changes. In addition to these normative changes, some individuals in midlife begin to experience signs of pathological aging as manifested by the presence of chronic diseases. Although chronic disease is not necessarily a part of normative aging, the likelihood of developing at least one chronic disease increases with increasing age (Shock, 1985; Siegler & Costa, 1985). It is important, then, to study intellectual development in the absence of chronic disease, as well as to examine how specific diseases affect cognitive functioning throughout adulthood.

Some diseases affect intellectual behavior directly, by damaging the brain. An example is Alzheimer's disease, which was originally identified in middle-aged adults (Butler & Lewis, 1982). Currently, more attention is given to diseases of the Alzheimer's type found in older populations, because the prevalence of this disease increases in advanced old age. Other chronic diseases (for example, arthritis, diabetes) affect intellectual functioning indirectly by making it more difficult for adults to perform in a competent manner. The distraction of pain and financial concerns that accompany illness may also affect the quality of intellectual performance.

Cardiovascular disease is one of the most important diseases affecting intellectual functioning (Siegler & Costa, 1985). Its increasing importance in midlife is evidenced by the fact that heart disease is one of the two most prominent causes of death in middle age (Levy & Moskowitz, 1982).

Cerebrovascular diseases that affect the blood flow to the brain might have a direct effect on mental functioning. The reduced blood flow decreases the oxygen supply to brain cells, resulting in temporary "malnutrition" or permanent "starvation" and death of affected tissue. Even mild cardiovascular disease has been shown to be related to deficits in memory (Klonoff & Kennedy, 1966), and lower scores on the Wechsler Adult Intelligence Scale (Wang, Obrist, & Busse, 1970). Intellectual decline has been associated with blood pressure that was pathologically high (Eisdorfer & Wilkie, 1973).

Cardiovascular disease was also found to be related to generally lowered mental functioning in Schaie's longitudinal study (Hertzog, Schaie, & Gribbin, 1978). It was also noted, however, that cardiovascular disease was more common among people who were older and in the lower social class. When people of the same age and social class were compared, cardiovascular disease was related to significantly lower functioning on only two measures: number and a composite measure of intellectual ability. These findings indicate that one must be cautious in interpreting studies that compare individuals with and without a disease. Factors (for example, age, social class) correlated with the disease may be more important predictors of intellectual functioning than the disease per se.

Work

Does the type of work one engages in affect intellectual functioning in middle adulthood? A 10-year longitudinal study of the relationship between work complexity and intellectual flexibility showed that the two factors were reciprocally related (Kohn & Schooler, 1983). The complexity of the work environment was studied along three dimensions: routinization, closeness of supervision, and substantive complexity of work. Substantively complex work requires the worker to deal with ideas and people, and involves the use of initiative, thought, and independent judgment. Men who had jobs that required independent decision making and that involved working with a complex set of environmental circumstances tended to become more intellectually flexible through adulthood. These findings were maintained when prior levels of intellectual flexibility were controlled for. Thus the work one does affects how one thinks. Research indicates that the reciprocal relation between work and intellectual flexibility is evident for both men and women (Miller, Schooler, Kohn, & Miller, 1979).

Life-Style

There is also evidence that one's life-style can affect intellectual functioning. The relationship between changes in intellectual functioning over the prior 14-year period and the individual's life-style were examined within Schaie's longitudinal study of intellectual development (Gribbin, Schaie, & Parham, 1980). Four types of participants were identified. First, there were the "average" adults, average in social status, family continuity, and involvement in their environment. These individuals maintained their level of intellectual functioning over the 14-year period studied. Second, there were the "advantaged" adults, who were of high social status and who lived lives that required them to engage in new activities and learn new things. These advantaged individuals often showed improved intellectual performance over the 14-year period.

The third and fourth groups, in contrast, showed some decline in level of intellectual functioning. One group was labeled the "spectators," given that they tended to live a rather passive, static life-style and rarely were actively involved in challenging, new endeavors. The most unfortunate group in terms of intellectual decline were the "isolated older women," who had experienced some form of family dissolution (for example, divorce, widowhood) and had become isolated or disengaged. Thus these findings suggest that active engagement in life and successful involvement in tasks that require flexibility and new challenges are related to maintenance of intellectual functioning in the adult years.

Threat of Professional Obsolescence

One type of intellectual challenge that is particularly salient in midlife deals with professional obsolescence. Professional obsolescence has been defined as the use of information, concepts, or techniques that are less effective in solving problems than others currently available in one's field of specialization (Dubin, 1972). Obsolescence does not reflect an age-related loss of ability, rather it reflects individuals not continuing to learn and update themselves as new knowledge and techniques become available.

Obsolescence is particularly relevant in midlife because most middle-aged individuals have terminated formal schooling years earlier. The length of the work life has been increasing since the turn of the century. In 1900, the average worker spent only 21 years in the labor force, often in the same job. In 1980, the average working life had grown to 37 years and many individuals were experiencing multiple job changes over the work life. In addition, our society is experiencing a knowledge explosion, such that the relevant knowledge one needs in one's career cannot be fully obtained in the years of formal schooling. The individual must continue to update throughout the adult years.

It is now estimated that 75% of all occupations involve some knowledge of computers (Naisbitt, 1984). Few middle-aged adults today, however, had experience with computers in their formal schooling. With the knowledge explosion and technological advances, the knowledge and skills one uses in one's occupation can change rapidly. The term *professional half-life* has been coined to describe the time it takes for 50% of one's professional knowledge to become invalid or obsolete (Dubin, 1972). For computer

scientists, the half-life is only two or three years; among engineers, it is five or six years (Cross, 1981).

Thus middle-aged individuals must continually seek mechanisms for updating their professional knowledge and skills. Given rapid technological change, occupations also become obsolete and individuals may be required to learn several new jobs within their work lives. Learning is, indeed, becoming a lifelong process (Willis, 1985). Individuals who are flexible, are willing to accept new assignments, and possess the basic cognitive abilities and skills needed to engage in learning new tasks are better prepared to deal with the challenges of professional updating.

Summary

Findings from longitudinal research present a picture of intellectual functioning in middle age that is somewhat different from that suggested by our stereotypical views. For a number of mental abilities, middle age is a period of stability in intellectual functioning. Indeed, some abilities, such as verbal ability, actually "peak" in middle age. Continued development in midlife is most evident for abilities that are extensively employed in tasks and responsibilities of daily living.

While there is a normative pattern of stability in intellectual functioning in middle age, there are wide individual differences in developmental patterns of change. Some adults exhibit decline in intellectual functioning in midlife, while others demonstrate growth patterns in many abilities. A number of variables have been found to be associated with individual differences in intellectual development and change. These variables include health, occupation, and life-style. Cardiovascular disease has been associated with earlier declines in intellectual functioning; however, social-status indicators may be more important predictors of intellectual change than cardiovascular disease per se. On the positive side, individuals who are actively engaged in life, seeking and experiencing new learning challenges, are particularly advantaged in maintaining intellectual functioning. Likewise, occupations that involve complex decision making and independent judgment appear to foster intellectual development.

Longitudinal studies that have examined the intellectual functioning of several generations at the same chronological ages have shown significant cohort differences in level of intellectual performance. For some abilities, such as inductive reasoning, a positive cohort trend has been found. For other abilities, however, negative or curvilinear cohort trends have been identified. Thus the influence of sociocultural change on intellectual performance appears to be differential for various abilities. Given rapid sociocultural change in some sectors of our society, it becomes important to consider both age and cohort, when comparing the performances of middle-aged and older adults with that of younger adults.

Although there is little evidence for significant normative decline in intellectual functioning in middle age, the adult in midlife is increasingly faced with the threat of technical or professional obsolescence. Obsolescence does not reflect age-related cognitive loss, but ineffective efforts to keep up to date with rapid informational and technological changes. Obsolescence is most evident in certain professions directly affected by technological advances. Virtually all adults, however, are vulnerable to becoming obsolete, unless updating occurs, as certain technologies (for example, computer-driven devices) are becoming more widespread in our society. Longitudinal research findings indicate that the mental abilities needed to acquire new information and technologies are intact and available to individuals in middle age. Individuals in midlife, however, must continue to develop and apply their intellectual abilities to meet the challenges of our technological society.

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