The psychosocial environment and cognitive rehabilitation in the elderly

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Introduction

Normal ageing typically involves some decline in cognitive abilities which can result in a loss of independence and, in some cases, institutionalization. As the population in most western countries ages, interest in these changing abilities has grown among researchers, clinicians and health policy makers. The high economic and social costs of increasing dependence create large incentives for maintaining and promoting independence in this population. Thus, two questions are of particular interest. Can we slow the rate of cognitive decline in older people? Can we improve cognitive functioning in the normal ageing population?

This chapter addresses these questions in the following manner. The first part reviews the cognitive changes associated with normal ageing, focusing on those related to biological change. The next section considers the impact of nonbiological changes on cognitive function. Developmental changes in the brain occur within a broader psychosocial context and researchers are increasingly noting the importance of this context for cognitive function. The third section reports the results of a major research study that investigated the relationship between cognitive performance and psychosocial adjustment in both community-dwelling and institutionalized elderly.

Whereas the first three sections of the chapter discuss multiple factors involved in cognitive status in the elderly, the last two consider what can be done about cognitive decline. The penultimate section reviews research into cognitive rehabilitation in the elderly. Unfortunately, the techniques used have met with limited success. This may be due in part to the failure of most research to take into account the total environment within which ageing occurs. The final section sketches a broader approach for promoting and maintaining a high level of cognitive function in the elderly, one that assumes the fundamental importance of psychosocial influences.

Cognitive changes in normal ageing

- Cognitive decline with advancing age is related to progressive deterioration within the frontal and medial temporal lobe regions of the brain.
- Explicit memory, working memory, high-level attentional tasks, and executive functions are especially vulnerable to ageing.
- Implicit and procedural memory, overlearned intellectual skills, and sustained attention are relatively well preserved.

Although age-related cognitive decline is highly variable, there is no question that some cognitive abilities are particularly susceptible to the effects of ageing. Indeed, an important distinction can be made between cognitive skills, such as certain types of procedural learning and implicit memory, that are relatively immune to the ageing process, and those that are more vulnerable, such as the ability to form associations between unrelated events or solve new problems. Not surprisingly, the more vulnerable functions are identified with areas of the brain that experience considerable structural and physiological change in old age, specifically the frontal lobes and the medial temporal lobes.
Although the entire brain decreases in size and weight with age (Waxman and deGroot, 1995), changes at the histological and biochemical levels are greatest in the medial temporal lobe system and the frontal lobes. These changes include reductions in the number of neurons and in synaptic density, changes in dendritic structure, development of neurofibrillary tangles and senile plaques, changes in neurotransmitter systems, and reductions in functional interactions with other brain areas (Azari et al., 1992; Golomb et al., 1993; West, 1993; Grady et al., 1995; Moeller et al., 1996; Scheibel, 1996). To gain an understanding of the impact of these changes, the cognitive abilities of patients with frontal lobe or medial temporal lobe lesions have been compared to those of older and younger adults.

Patients with lesions to the medial temporal lobe, including the hippocampus, experience severe memory loss for personal experiences (explicit memory) and when tested in the laboratory perform poorly on tests of recall and recognition. Although not as severe, normal old people exhibit a very similar type of memory loss (Craik, 1991; Huppert, 1991; Moscovitch and Winocur, 1992), while other cognitive abilities including attention span, general intelligence, and remote memory are relatively preserved. In a recent meta-analysis of age differences in memory function, Verhaeghen, Marcoen and Goossens (1993) examined over 100 effect sizes between older and younger subjects and found that all but two were significant. In general, age differences are largest for free recall, less for cued recall, and less again for recognition (Craik, 1991). Interestingly, these effects appear to be more related to acquisition and retrieval difficulties than to reduction in storage capacity (Moscovitch and Winocur, 1992; Zec, 1995). This suggests that age differences in memory performance may be substantially reduced if older adults have the opportunity to learn material to the same level as younger adults. This can often be achieved simply through additional instructions and may be an important factor in developing cognitive rehabilitation programmes for older adults.

Frontal lobe lesions also result in a number of cognitive impairments that are experienced by older adults, including difficulty with working memory (Moscovitch and Winocur, 1992, 1995) and source memory (Shimamura, Janowsky and Squire, 1991), as well as impairments in effortful forms of attention (Stuss et al., 1995) and problem solving (Albert and Moss, 1996). Working memory refers to the ability to retain information for a relatively short period of time while performing other cognitive operations, as is often required in tasks that involve comparisons or the updating of information. Source memory refers to memory for the contextual information surrounding target events such as where and when the event occurred, as well as situational characteristics associated with the event. (See Shimamura et al., 1991; Moscovitch and Winocur, 1992, 1995, for a fuller discussion of specific working and source memory tasks that are sensitive to ageing effects.) Working and source memory require ‘online’ manipulation of information, a feature that also characterizes effortful attention and problem solving. It is not surprising then that tasks that require divided, alternating or selective attention also result in slower and more errorful performance in older subjects than in younger ones (McDowd and Birren, 1990; Zec, 1995).

Effortful attention is thought to be part of the executive control system, as are problem-solving skills that require abstract thought and the ability to generate and execute plans. Deficits in tasks that utilize these cognitive abilities are consistently found in older adults (Albert and Moss, 1996) and in patients with frontal lobe lesions (Stuss, Eskes and Foster, 1994). For example, series completion tasks, the WAIS-R similarities subtest, and some tests of higher level attentional processes fall within the broad category of age-sensitive tests of executive function (Albert and Moss, 1996).

In contrast to the well-documented decline in the functions described above, others do not typically reveal age differences. For example, memory for stored knowledge is relatively well preserved across the life-span (Albert and Moss, 1996) as are subtle and indirect types of (implicit) memory that reveal the unconscious effects of past experience. Examples of tests of implicit memory on which the elderly perform normally include most tests of repetition priming (e.g. word-fragment completion, lexical decision), as well as various non-timed procedural learning tasks (Moscovitch and Winocur, 1992). Patients with frontal and medial temporal lobe lesions also perform well on these tasks.
(Butters and Stuss, 1989; Shimamura et al., 1991), which suggests that other brain structures mediate implicit memory. An exception to this pattern of spared implicit memory in old age is found in word-stem completion tests of repetition priming. In stem completion, subjects are presented with the first few letters of previously primed and nonprimed words. Implicit memory is reflected in a greater probability of identifying the primed words. Unlike other tests of repetition priming, age differences have been reported on this task (Meiran and Jelicic, 1995; Winocur, Moscovitch and Stuss, 1996). Of particular note is that these differences have been related to variability in frontal lobe function as measured by neuropsychological tests (Winocur et al., 1996; Nyberg et al., 1997). Nevertheless, the fact that critical cognitive functions remain relatively intact in normal old age has important implications for designing cognitive rehabilitation strategies that compensate for impaired abilities.

**Psychosocial well-being and cognitive functioning**

- Psychosocial status can impact positively on the developmental process of ageing.
- Psychosocial and related factors that affect cognitive status in older adults include education, life-style, locus of control, self-efficacy beliefs, and affect.
- Many psychosocial/environmental factors are amenable to change, thus providing a possible avenue for influencing cognitive status.

Successful ageing is influenced not only through biological processes but also by psychosocial and environmental factors, including the physical environment, lifestyle, and various personal and social variables. Evidence is now accumulating which shows how these factors can affect the general health status of older adults, including their ability to function effectively at the cognitive level. This section reviews this evidence, highlighting those factors that contribute to or protect against cognitive decline.

Few researchers have attempted to model the complex interaction between the variables that make up an individual's psychosocial and cognitive profile (Albert et al., 1995; Uchiyama et al., 1996). Rather, work in this area has focused on individual or select groups of variables. Given the multitude of variables involved, it is notable that several are consistently identified in studies that have attempted to investigate psychosocial and environmental influences on cognitive change in the elderly. These include external factors such as education, living situation, lifestyle, and nutritional status, and internal influences such as locus of control, self-efficacy beliefs, and affect. Other factors have been identified, such as the personality variable, introversion, but for the most part their influence appears to be smaller (Gold and Arbuckle, 1990; Arbuckle et al., 1992).

Of the demographic factors, education may be the most powerful, as its influence on cognitive status remains consistently significant when other psychosocial variables are covaried (Hultsch, Hammer and Small, 1993). Lower levels of education have been found to be predictive of cognitive decline in old age (Arbuckle et al., 1992; Evans et al., 1993). Interestingly, education is most strongly associated with performance on tasks that involve abstract thought processes (Inouye et al., 1993). Of course, early educational experience is not amenable to change and, consequently, from the point of view of enhancing cognitive function in a practical sense, other psychosocial variables are of more interest.

Unlike education, living environment, which contributes significantly to overall functional status, is potentially modifiable. An extensive literature documents the deleterious effects of relocation in the elderly, although most of these studies emphasize health and measures of well-being (Ferraro, 1982). However, there is some evidence that directly relates environmental factors to cognitive function in the elderly. For example, Winocur and Moscovitch (1990) found that high-functioning, institutionalized old people performed worse on standard cognitive tests than closely matched community-dwelling counterparts. As most elderly people must change their living situations at one time or another, and because of the known impact of relocation on well-being, it is important that we identify the specific environmentally related variables that may affect cognitive performance. The next section, which reports findings of the authors' recent work in this area, addresses this issue.

Lifestyle variables that impact on cognition in the
Ageing population include nutrition, exercise and mental activity. Older people with deficiencies in specific vitamins and minerals (e.g. folate, vitamin C etc.) tend to perform poorly on cognitive tests, particularly memory and abstract thinking tests (Goodwin, Goodwin & Garry, 1983; Wenk, 1989; Penland, 1994). In contrast, older people who are physically active and enjoy mental stimulation in various forms perform at a higher level on tests of cognitive performance than do less active older people (Chodzko-Zajko et al., 1992; Hultsch et al., 1993; Albert et al., 1995; Goldberg, Dengel and Hagberg, 1996).

Although relatively little is known about the effect of varying nutritional status across the lifespan, increasing physical activity can produce substantial benefits. Several studies provide evidence that elderly people who engage in regular, strenuous activity suffer less cognitive decline than less active individuals (Chodzko-Zajko et al., 1992; Hultsch et al., 1993; Albert et al., 1995, Goldberg et al., 1996; but see Emery, Huppert and Schein, 1995). If, as the bulk of the available evidence suggests, physical activity does have a positive influence on cognitive function, this can be taken into account in designing supportive environments for the elderly.

Internal psychological variables, such as locus of control, self-efficacy beliefs and affect, are all closely related to functional status in the elderly. Furthermore, they appear to be responsive to change and, like lifestyle factors, may provide another avenue for interventions directed at optimizing cognitive function. Of these three variables, locus of control, that is the extent to which we believe we control the external environment, has been the focus of most of the research. Nevertheless, the impact of this variable on cognitive status in the elderly has been and remains controversial. For example, Arbuckle et al. (1992) found that older people with higher levels of internal control performed better on one of four memory measures, although earlier research indicated that perceived control was not predictive of memory (Arbuckle, Gold and Andres, 1986).

One possibility is that the diverse findings with respect to locus of control are related to the complexity of the construct. For example, the impact of locus of control on cognitive status may be mediated through perceptions of social support (Buschmann and Hollinger, 1994), the individual's coping style (Shaw, 1992; Ruth and Coleman, 1996) and general affect (Hyer, Matteson and Siegler, 1982). Notwithstanding the controversy and complexity, perceived control emerges consistently as a predictor of cognitive status. Furthermore, it also covaries with cognitive status over time (Winocur, Moscovitch and Freedman, 1987a). Thus, interventions targeted at changing perceptions of control may tap into a mechanism for enhancing cognitive function in the elderly. The study described below provides further insight into the relationship between control and cognitive function.

Self-efficacy beliefs, that is, beliefs about one's ability to perform or be effective in various situations, are also linked to both coping and cognition in the elderly (Seeman, Rodin and Albert, 1993; Garfein and Herzog, 1995; Ruth and Coleman, 1996). Such beliefs have been shown to predict metamemory scores (McDougall, 1994) and to protect against cognitive decline (Albert et al., 1995). As with feelings of control, self-efficacy beliefs are closely related to affect (Cavanaugh and Green, 1990) and are amenable to change, even in older adults (McAvay, Seeman and Rodin, 1996). Of particular interest is the finding that these beliefs vary across domains. For example, beliefs about instrumental activities of daily living (e.g. arranging transportation) are better predictors of cognitive performance than beliefs about other life areas (Seeman et al., 1993). Thus, self-efficacy beliefs may be another target for interventions designed to enhance cognitive function.

The relationship between affect and cognitive function in the elderly has been investigated with a particular emphasis on depression, which is prevalent among older adults (Riley, 1994b). Even in samples of healthy older adults, those who score higher on measures of depression have lower cognitive scores, particularly on memory tasks (Perlmuter and Nyquist, 1990; West, Barron and Crook, 1992). A similar relationship is seen between those who report being sad, withdrawn and tense as opposed to happy, gregarious and relaxed (Depta, Singh and Pomara, 1993). There is also evidence of a direct relationship between clinical depression and cognitive function. It is well known that cognitive performance is adversely affected in old
people suffering from depression. In light of evidence that older people who are successfully treated for depression also improve in terms of cognitive function (Zarit, Gallagher, and Kramer, 1981; Beats, 1996), it is reasonable to speculate that manipulations aimed at improving affect in normal older adults may also have beneficial effects on cognitive function.

Clearly, age-related cognitive decline is not purely a biological function. Research demonstrating the influence of psychosocial and environmental variables on cognitive function suggests a means for enhancing and supporting cognitive function that has rarely been explored. However, a first step in developing appropriate interventions is the identification of those variables that reliably correlate with age-related cognitive performance. The next section reports data from what appears to be the first major investigation of these relationships.

The Canadian Aging Research Network (CARNET) Study of Psychosocial Influences on Cognitive Function in Normal Old People

- Institutionalized, healthy old people consistently performed at a lower level on cognitive tests than matched community-dwelling old people.
- Difficulties with psychosocial adjustment affected cognitive function in institutionalized and community-dwelling old people.
- Optimism, activity, locus of control and general happiness emerged as important psychosocial predictors of cognitive status.

It is only recently that research has addressed the possibility that difficulties at the psychosocial level contribute to cognitive decline. This is somewhat surprising in view of the concern often expressed by the elderly over declining mental capacity and the potential link between (real or imagined) cognitive loss and overall functional status.

As a first step in addressing psychosocial adjustment, Winocur and Moscovitch reviewed data from several experiments that revealed age differences in tests of learning and memory (Winocur and Moscovitch, 1983; Moscovitch and Winocur, 1983; Winocur, Moscovitch and Witherspoon, 1987b). In each study, subjects were elderly individuals living in their own homes in the community or in various institutional settings. All subjects were carefully selected on the same criteria and there were no differences between community and institutional groups in terms of potentially confounding variables (e.g. age, IQ, health status, education). The institutions all had facilities to accommodate highly functioning individuals, with the following features in common: a central dining room that served at least one main meal each day, health care staff, a social programme, and a supervised activity programme.

When organized in terms of living environments, the data consistently showed that community-dwelling older adults significantly outperformed those living in institutions. Subsequently, in an independent study, Winocur and Moscovitch (1990) confirmed the generally superior performance of community-dwelling subjects, especially on cognitive tests that assessed functions associated with the prefrontal cortex and hippocampus. In other words, environmental factors seem to exacerbate the process of decline in those abilities most vulnerable to the ageing process.

An interesting finding of the Winocur and Moscovitch (1990) study was that the institutionalized elderly's cognitive performance was much more variable than that of the community-dwelling group. Closer examination revealed that 30 per cent of the institutionalized group were high functioning, with scores comparable to the community group. The other 70 per cent were low functioning, with performance on several tests reminiscent of the performance of brain-damaged amnesic patients similarly tested in other experiments (Winocur and Weiskrantz, 1976; Winocur et al., 1987a; Winocur, Kinsbourne and Moscovitch, 1989).

Just as there were no apparent differentiating features between the community-dwelling and institutionalized subjects, there were no obvious differences between the higher and lower functioning institutionalized groups that could account for the observed variability. One possibility was that residents differed in their psychosocial adjustment to institutional life, and that this affected cognitive abilities and overall functional status. This hypothesis was explored in another study in which a new group of institutionalized elderly was administered a series of cognitive tests together
with psychosocial tests that assessed perceived control, general activity and stress level (Winocur et al., 1987a). As indicated in the previous section, these variables, which contribute significantly to overall well-being, have been linked to cognitive status in the elderly. The results of this study showed a positive correlation between perceived control, activity and cognitive test performance. Moreover, follow-up testing indicated that variations in the psychosocial domain over time were accompanied by corresponding changes in cognitive function. These results pointed to a striking interaction involving ageing effects, environmental factors, psychosocial adjustment, and cognitive function. Furthermore, as many of the cognitive tests used in these experiments were common neuropsychological measures of brain–behavioural relationships, brain function can be included as a variable in this interaction.

These data suggest that older people living in institutions may experience difficulties in relation to their environments. However, it was not clear whether the results reflected a unique effect of institutionalization or a more universal expression of how well older adults in general interact with environments that differ dramatically in terms of support, stimulation and enrichment. To explore this further, a longitudinal study (the CARNET study) was conducted to determine more precisely the relationship between cognitive function and psychosocial adjustment in community-dwelling or institutionalized older people.

The participants in this study were administered cognitive tests together with tests that assessed various aspects of psychological well-being (Table 6.1). Testing was conducted on three occasions, each separated by eight to ten months. Despite the fact that all participants were carefully screened according to the same inclusion and exclusion criteria, community-dwelling older people generally displayed higher levels of cognitive function than those in institutions. Of particular interest was the finding that various psychosocial measures correlated significantly and similarly with cognitive test performance in both groups. This indicates that, while level of cognitive performance is affected by living environment, the general relationship between psychosocial status and cognitive function is characteristic of the normal elderly population at large. The psychosocial variables that correlated most consistently with cognitive function were locus of control, activity, general happiness, optimism and satisfaction with lifestyle. Table 6.2 provides the complete list of psychosocial variables that correlated significantly with cognitive function. Cognitive performance is reflected by a ‘cognitive index’ that is a composite measure of performance on all the cognitive tests.

An examination of the data over the three test periods revealed that variations in psychosocial status between test sessions were accompanied by parallel changes in the cognitive index. That is, decline or improvement in certain areas of psychosocial function, for whatever reason, was accompanied by changes in cognitive performance in the same direction. This pattern was reflected most clearly in comparisons involving the following psychosocial measures: locus of control, activity, optimism and happiness.

Although the CARNET study provides evidence that psychological well-being and cognitive function are closely related in elderly populations, it was not designed to specify causal relations. Nevertheless, it was possible to determine if performance on the psychosocial and cognitive tests in a particular session predicted performance in the other functional domain on subsequent sessions. In this analysis, optimism,
activity and happiness emerged as fairly reliable predictors of subsequent cognitive performance in the combined groups. Interestingly, overall cognitive function proved to be a predictor of activity, optimism and satisfaction with lifestyle. To some extent at least, these results indicate a complementary relationship whereby both types of variables are capable of influencing each other.

In summary, the results of this longitudinal study provide further evidence that age-related cognitive decline is not a linear process governed exclusively by biological change. It was known that psychosocial factors had an influence on cognitive performance. However, this study indicates that the impact may be greater than previously thought. The data also address the plasticity of the underlying mechanisms that mediate cognitive abilities. It is clear that poor performance by older people at a particular point in time does not necessarily reflect an irreversible loss of brain function. Rather, what appears to be age-related cognitive impairment may, in reality, be an inability to perform to potential as a result of mitigating factors. As the influence of these factors is reduced, cognitive function can recover dramatically. These results provide further data suggesting that cognitive function in the elderly is closely tied to the psychosocial environment. Thus, interventions that focus on vulnerable areas in the psychosocial domain may have the indirect effect of improving cognitive function.

### Cognitive rehabilitation

- Interest in applying rehabilitation techniques to cognitive decline in the elderly has increased with a growing understanding of brain–behaviour relationships, neural plasticity, and the impact of impairment on day-to-day function.
- Considerable research has explored the effects of mnemonic training on recall.
- The effects of teaching mnemonics are task specific and generally limited to the immediate posttraining time period.
- Multifaceted training which targets psychosocial skills appears to have some benefit in maintaining a higher level of cognitive function over time.

Interest in developing techniques for limiting age-related cognitive decline has been stimulated in the last 15 years as more has been learned about brain–behaviour relationships, neural plasticity, and the relationship between cognitive impairment and loss of independence in day-to-day function (Poon et al., 1992; Riley, 1994a; Zarit, Johannsson and Malmberg, 1995). Although we now know that this decline is related both to the biological process of ageing and to psychosocial factors, cognitive rehabilitation research has been directed exclusively at improving specific cognitive processes, and the bulk of this work has focused on memory function.

In general, approaches to cognitive rehabilitation are based on the premise that the adult brain has a natural ability to recover and reorganize and that this is, to some extent, activity dependent. For example, Cotman and Neeper (1996) reported that exercise increases neurotropin levels in rats' brains, and others (e.g. Diamond et al., 1985) have shown that enriched environments can promote cortical development in older rats. Generalizing from the animal research, it follows that physical activity can promote neural plasticity in the ageing brain by influencing the expression of particular neurotrophic factors that facilitate structural
change associated with behavioural function. Thus, some cognitive rehabilitation efforts have been directed at restoring or reactivating the neural mechanisms responsible for functional decline, whereas others attempt to teach alternative strategies to compensate for lost abilities.

Whereas influencing neural plasticity provides a broad objective of cognitive rehabilitation, specific impairments have led to the design of particular interventions. Thus, as older people are less likely to use effective organizational schemes when encoding information (Ysavage and Rose, 1983), considerable research has been directed at improving memory through teaching organizational strategies (mnemonics). Although there is a variety of mnemonic strategies, three have been especially influential – the method of loci, the use of imagery, and techniques for processing new information more deeply.

The method of loci technique has been employed in various forms for more than 20 years. The basic technique requires subjects to name several locations within a familiar environment and form an association between the locations and the items to be remembered. Several studies indicate that older subjects can effectively use this strategy to improve recall of list items in both experimental and certain practical situations (Robertson-Tchabo, Hausman and Arenberg, 1976; Anschutz et al., 1985; Ysavage, 1985; McCauley, Eskes and Moscovitch, 1996). Similarly, there are reports that encouraging elderly individuals to use visual imagery as a learning aid results in improved memory performance. These techniques have been shown to be helpful with a variety of stimulus material, including faces, names, environmental objects and word lists (West, 1995). On the other hand, the practical use of both techniques seems to be limited, in view of evidence that benefits are often small and that older people do not spontaneously use them in real-world situations (Robertson-Tchabo et al., 1976; Anschutz et al., 1987; Wood and Pratt, 1987; Scogin and Bienias, 1988; Kotler-Cope and Camp, 1990; West, 1995).

It is well known that accurate memory is directly related to the depth to which information is processed at the time of encoding. Information that is encoded together with meaningful associations is more likely to be remembered accurately than the same information superficially encoded (Craik and Lockhart, 1972). Older people do not typically process information as deeply as young adults, and this appears to be an important factor underlying age-related decline in memory function (Craik, 1977). On the other hand, investigators (Craik and Simon, 1980; Moscovitch, 1982) have shown that instructions to encode more deeply can improve memory performance in old people. Some studies found that young people may also benefit from such instructions, and so it is not clear that this technique reliably reduces age differences in tests of memory. Moreover, there is no indication that, following laboratory instruction, old people process information more deeply in their daily lives, once again raising questions about the practical utility of this approach.

There are a number of critical questions about the use of mnemonics that are difficult to answer with single studies. However, a recent meta-analysis allows some general conclusions about mnemonic training (Verhaeghen, Marcoen and Goossens, 1992). First, this meta-analysis confirmed that training older people to use mnemonics to learn and remember highly specific information does result in improved performance relative to nonintervention and placebo-treatment control procedures. Interestingly, there were no significant differences in effects related to the type of mnemonic taught. However, a critical finding of this analysis was that, although posttraining improvement was noted for targeted tasks, improvement did not generalize to other memory tasks. Nor was there evidence of much transfer outside the laboratory setting. In other words, learning mnemonic strategies in highly specific situations, while useful, did not lead to improved memory ability in a practical sense.

The limited success of singular approaches is somewhat offset by evidence that multifaceted training methods have produced more encouraging results. For example, Bäckman and his colleagues (Stigsdotter and Bäckman, 1989; Neely and Bäckman, 1993) showed that a comprehensive training procedure designed to relax older adults, focus their attention, and teach them to encode information-to-be-remembered more deeply resulted in improved memory for that material over a three-year period. Elderly subjects also do better when
cues are available to remind them to use previously trained strategies (Hayslip, Maloy and Kohl, 1995). In addition, Flynn and Storandt (1990) found that including an intervention that provided counselling and support with respect to anxiety associated with memory decline contributed significantly to improved performance. Taken together, these results build on the premise that multiple factors contribute to the overall cognitive status of older adults and indicate, therefore, that a multidimensional approach may be most efficacious.

The limitations inherent in training programmes that target specific abilities have led to new approaches for improving cognitive function in patients with brain damage. These techniques frequently capitalize on processes that resist the effects of neurological impairment, such as those that support implicit and procedural memory. Glisky and her colleagues (Glisky, Schacter and Tulving, 1986; Glisky, 1995) were able to teach computer and business-related skills to patients with severe memory impairments by providing them with cues necessary to ensure accurate completion of the tasks, and then gradually removing the cues. Similarly, Wilson and her colleagues used an error-less learning strategy to teach brain-damaged patients with memory disorders to programme an electronic memory aid (Wilson, Baddeley and Evans, 1994). These techniques may also be useful in older adults (see Chapters 21 and 22).

Another avenue for intervention is suggested by reports, including the CARNET study described above, that psychosocial and cognitive function are closely related. Some psychosocial factors appear amenable to change through targeted interventions but, surprisingly, little work has been done in this area. Nevertheless, the available evidence is promising. For example, participants in a rehabilitation programme that included memory training and self-management training scored better on both cognitive and psychosocial measures than a control group (Bach et al., 1995). Implicit in the findings of Bach et al. is the concept that training programmes designed to optimize the 'fit' between environmental demands and the older person's resources and personal needs tend to result in overall enhancement of functional status (see also Kahana and Kahana, 1996). The Bach et al. study showed that cognitive performance is one aspect of functional status that benefits from interventions that take into account the entire individual.

Improving the fit between individuals and their environments has been attempted in a variety of ways – by maximizing individuals' resources or by manipulating psychosocial aspects of the environment. With respect to influencing cognitive function, the former approach entails teaching specific strategies. As we have seen, that approach, on its own, is limited in terms of effectiveness. However, combining it with a broader approach that takes into account psychosocial factors may prove to be more promising. In the next section, suggestions are presented for promoting cognitive abilities by working with various psychosocial variables.

Conclusions

- Preventing and reversing age-related cognitive decline may be possible through a multifaceted rehabilitation programme.
- A cognitive rehabilitation programme is proposed that takes into account research on psychosocial issues and targeted cognitive rehabilitation approaches.
- The proposed programme includes: (1) a psychosocial component to enhance dimensions of psychological well-being (self-efficacy beliefs, feelings of control, optimism); (2) cognitive training to teach practical strategies and promote their use in everyday life; and (3) a physical activity regimen for overall health benefits.

This chapter began with two primary questions: can we slow the rate of cognitive decline in older persons? Can we improve cognitive functioning in the normal ageing population? Although a resounding 'yes' would be an overstatement, the evidence reviewed makes us cautiously optimistic about answering these questions in the affirmative. The authors do not propose that age-related cognitive decline can be entirely prevented or reversed. Structural changes in the brain, particularly in the frontal and medial temporal lobes, seem an unavoidable part of the ageing process. Nevertheless, research on the determinants and covariates of
cognitive status in older people suggests that cognitive decline to some extent, at least, may be reversible.

As discussed, much of the research in this area has demonstrated limited success in terms of improving the day-to-day functioning of older adults through cognitive rehabilitation. However, some findings are encouraging. In addition to those already mentioned, it is worth noting that recent research demonstrates that a psychosocial rehabilitation approach does improve or maintain day-to-day functioning in older adults (Clark et al., 1997). It is these findings that the authors draw upon to provide the groundwork for the proposed programme. (See other chapters in this volume, e.g. Chapters 21 and 22, that discuss training techniques that improve cognitive function in neurological populations and have potential for use with relatively healthy, older adults.) The present proposal is based on the premise that a multifaceted approach promises the greatest benefits for achieving enhanced cognitive performance in the elderly. Given the number of factors associated with cognitive status in older people and the considerable variation in cognitive performance, a multifaceted programme indeed, does, seem reasonable.

Available evidence suggests that affect and specific psychosocial attributes, such as perceived control and optimism, influence cognitive status in the elderly. Although a definitive causal relationship has not been established, the CARNET study as well as other research have shown that individuals who are vulnerable to cognitive decline also have difficulties in terms of psychological well-being. Thus, an important component of the authors' programme is the early assessment of psychosocial status to detect particular areas of strengths and weakness. Having identified problem areas that could affect cognitive function, a targeted counselling programme would attempt to change negative attitudes and beliefs which, apart from their impact on other functional areas, are harmful in and of themselves.

There is also compelling evidence that individuals who engage in little physical activity are vulnerable in a variety of health-related areas and experience disproportionate cognitive decline. Thus, for example, the proposed programme incorporates a relatively strenuous physical exercise regimen, both for its overall health benefits as well as for the known effect on cerebral perfusion which can only benefit cognitive function. This programme will be individually designed so that it is meaningful to each person as meaningful activity has been shown to have a positive effect on older adults' functioning (Clark et al., 1997).

Finally, it is important to develop interventions with the aim of providing individuals with practical strategies that compensate for declining cognitive abilities. Research to date has focused largely on strategies whose effectiveness is limited primarily to the training contexts. The authors propose to build on positive results in laboratory situations while modifying training techniques so that they are relevant to 'real-life' situations.

In general, a shift in emphasis is proposed such that rehabilitation efforts encompass what is known about the psychosocial variables associated with cognitive status. The purposes of the overall programme are to maximize cognitive potential, slow down the rate of decline and, in the process, contribute to a higher quality of life and a positive sense of well-being in older adults. The programme is based on empirical evidence, but future research will be necessary to determine the merit of the authors' recommendations. Indeed, the authors hesitate to put their recommendations forward in detail without initial pilot testing. However, the framework of their approach is laid out in the hope that it will be useful for others interested in developing cognitive rehabilitation programmes for the elderly.

The proposed programme combines three relatively diverse strands of therapy: a form of counselling/behavioural therapy to target psychosocial variables, cognitive training to target cognitive function, and complementary physical activity. In setting up this programme, it is proposed that each of these foci would form a module which would be graded to allow maximum individualization of programming. Each module would include pretesting and posttesting that are specific to its focus. Also, quality of life, cognitive function, and psychosocial status would be assessed before and after the programme.

The counselling/behavioural therapy module is guided by evidence that cognitive function in old age is related directly to psychosocial status. The programme would be designed around psychometric assessment
that identified specific psychosocial areas in which individuals are at risk. Thus, appropriate testing would look for difficulties in such areas as personal control, optimism, social activity, that is, areas of psychosocial function that have been found to correlate with cognitive performance in normal old people. People's beliefs with regard to psychosocial status would also be assessed to identify any discrepancy between perceived function and objectively determined measures. Rehabilitation strategies, following principles of behavioural therapy practice, would be individually designed to reduce and compensate for difficulties in identified areas. The programme would also be designed to promote self-awareness to help people monitor their progress and encourage personal initiatives that would usefully complement formal intervention (see Chapter 15 for a review of the benefits of promoting self-awareness). The authors think that this approach can enhance psychological well-being and self-efficacy beliefs which, in combination with appropriate cognitive-skills training, will help individuals to make optimal use of learned cognitive strategies in practical settings.

Cognitive-skills training would build on evidence that the elderly do respond, at least to a limited extent, to interventions aimed at improving cognitive function in specific areas. For example, we know that teaching mnemonics has a positive short-term effect on specific memory tasks but that, unless specifically targeted, there is little transfer to the real world. Thus, at the beginning of this module the authors propose asking participants to identify everyday incidents in which they experience difficulty (e.g. forgetting names, appointments, and/or scheduled activities). As research to date has demonstrated little generalization beyond the task on which training occurred, it is proposed to teach strategies appropriate to the class of events or activities represented by the specific tasks. For example, visual imagery mnemonics, typically taught in relation to laboratory tasks, could be taught in relation to remembering names, grocery lists, specific commitments, and so on. It is also proposed that participants be encouraged to keep a diary of planned events and to note when learned strategies are to be employed. These diaries should provide some indication of the individual's success in applying learned strategies, and should also provide direction for additional cognitive interventions. Proulx and his colleagues (see Chapter 16) have had considerable success using diaries or memory books for this purpose in their programme for improving cognitive performance in brain-damaged patients with severe cognitive disorders.

Finally, part of each training session would include some physical activity individually graded from simple group exercise programmes to much more strenuous fitness activities (see Dean, 1994; Kauffman, 1994). Participants would be encouraged to engage in a form of activity that they could continue on their own and the diary could also be used to track the individual's level of activity. Related to this is the fact that older people are notoriously neglectful of diet and often suffer from inadequate nutrition. In view of growing evidence of a relationship between nutritional status and cognitive function in the elderly, it may well prove desirable to include a nutritional counselling component into this aspect of the programme.

How might such a programme be implemented? Who would participate? Based on the results of previous research, including those of the CARNET study, individuals in institutions are especially at risk for age-related cognitive decline. New residents in institutions might provide the first sample for assessing such a programme. Participants in programmes at seniors' centres would provide a community-dwelling group for comparisons.

The model proposed has, in a sense, moved beyond the available research. However, as demonstrated by Clark and her colleagues (1997), such a programme is feasible and the authors believe that once appropriate modules are developed, it could be run with minimal professional support. A major advantage of this approach over previous cognitive rehabilitation efforts is that it incorporates psychosocial variables that have been shown to be closely related to cognitive status in the older population. It is suggested that this multifaceted, individualized approach has the potential to make meaningful changes in cognitive functioning among older adults that will not only enable them to maintain independence longer, but will also promote a sense of well-being and an enriched quality of life.
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