The Effects of Antipsychotic and Antiparkinsonian Medication on Psychosocial Skill Learning

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Although research suggests that therapeutic outcomes for schizophrenic patients are enhanced when antipsychotic medication is combined with psychosocial skill learning, the manner by which the two approaches combine has not been well delineated. The combination is described in this article in terms of mediating cognitive variables. Two bodies of research were examined: (a) studies that investigated the relationship between information processing deficits of schizophrenia and psychosocial skill learning and (b) studies that examined medication effects on cognitive functioning. Research suggests that psychosocial skill learning is significantly related to visual vigilance and verbal recall. Research also suggests that low to moderate doses of antipsychotic medications improve vigilance of schizophrenic patients but have not been shown to consistently improve verbal memory; high doses, on the other hand, may significantly diminish vigilance. Anticholinergic medication, but not dopamine agonists, seems to exacerbate the verbal memory deficits of schizophrenia. The combined evidence suggests that low to moderate doses of antipsychotic medication may improve psychosocial skill learning. However, high-dose antipsychotics or anticholinergic medication may actually diminish skill learning.

Key words: **schizophrenia, social skills training, antipsychotic medication, cognitive deficit.** ***[Clin Psychol Sci Prac 2:251–262, 1995]***

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Psychopharmacological and psychosocial treatments have a long history in ameliorating the various dysfunctions and disabilities of schizophrenia. However, theoretical and practical considerations of the disorder that have emerged from psychosocial and psychopharmacological camps have been strangely divergent. Psychosocial treatments are grounded in social learning views of severe mental illness. Pharmacological treatments reflect a more biological perspective. Although investigators have not been able to resolve this difference, research suggests that drug and psychosocial treatments account for separate and synergistic effects on therapeutic outcome.

In this article, hypotheses about the interaction of drug and psychosocial treatment are described vis-à-vis information-processing mediators. Better understanding of the combination of these factors may provide a heuristic that will facilitate more specific investigations into the interaction of these treatments. Moreover, improved understanding will help clinicians to titrate pharmacological and psychosocial interventions in a manner that optimally enhances patient outcome.

THE COMBINATION OF MEDICATION AND PSYCHOSOCIAL SKILL LEARNING

Clinical investigators have suggested that drugs and psychosocial skill learning yield an additive effect, with the combination producing better outcomes than either intervention alone (Liberman, Corrigan, & Schade, 1989; Liberman, Falloon, & Wallace, 1984; Mueser, Wallace, & Liberman, in press). Psychosocial skill learning is a comprehensive treatment that includes strategies from social learning and operant psychology; these strategies help patients to broaden their repertoire of social and coping skills (Bellack & Mueser, 1993; Liberman, DeRisi, & Mueser, 1989). Skill learning includes introduction of

fundamental learning points about each skill, demonstration of the skill by a model, behavioral rehearsal of the skill by the patient, contingent social and material reinforcement for performing successive approximations of the skill, and homework to facilitate generalization of the skill to settings outside the training milieu.

Psychosocial skill learning strategies, when combined with pharmacological treatment, seem to produce greater reduction in symptoms, better increments in social functioning, and lower relapse rates (Bellack, Turner, Hersen, & Luber, 1984; Dobson, McDougall, Busheikin, & Aldous, 1993; Eckman et al., 1992; Hogarty et al., 1986, 1991; Paul & Lentz, 1977; Wallace & Liberman, 1985). In a classic example of this research, Hogarty et al. (1986) randomly assigned patients to one of four treatment conditions of which two conditions are of particular interest here: medication alone and medication plus skills training. Results showed that after 1 year of treatment, over 40% of subjects in the medication-alone group relapsed while only 20% of subjects in the medication and skills training program relapsed. In a subsequent report, Hogarty et al. (1991) showed that large differences in relapse rates among 1986 subject groups continued up to 21 months after treatment.

Additional analyses examined whether the combination of effects was indeed additive. Post hoc analyses from the study by Hogarty et al. (1991) showed that the significantly smaller relapse rates in the medication plus skills training group were not solely attributed to improved medication compliance. More than likely, the enhanced repertoire of skills found after participating in a skills training program served as a buffer to life stressors and hindered symptom exacerbation. Similarly, a recently completed study by Hayes, Halford, and Varghese (summarized in Mueser et al., in press) found a relationship between learned skills and subsequent functioning. Medicated patients who acquired more skills after training showed better social adjustment and fewer psychiatric symptoms.

Despite these positive findings, results from other studies suggest that combinations of psychosocial treatment and medication may not always produce additive effects (Hemsley, 1978). For example, a subsample of medicated patients who also participated in a resocialization program did not manifest an improved pattern of social interaction (Schooler & Spohn, 1982). Similarly, Hogarty and Goldberg (1973) found that a subgroup of medicated patients were unresponsive to treatment and relapsed at a much greater rate than peers. Investigators in the latter study concluded that cognitive limitations of the sample impeded skill acquisition, which in turn hampered therapeutic benefit. Negative findings like these challenge the synergy of psychopharmacological and psychosocial treatments and suggest that the combination between these innovations needs to be better understood.

A Model That Explains the Combination of Treatments

How might the combination of psychosocial and psychopharmacological treatments be conceptualized to explain these divergent findings? A multilevel representation of the relationship between medication administration and rehabilitation outcome is outlined in Figure 1. According to this model, neuroleptic medication directly affects neurophysiological processes, which in turn influence several psychological processes including cognition, arousal, and emotion (Iversen & Iversen, 1981; Seiden & Dykstra, 1977). Changes in psychological processes may enhance the individual's skill learning abilities so that his or her repertoire of interpersonal skills is subsequently improved.

Acquisition of skills may then lead to improved performance of social skills. Note that the model in Figure 1, like Bandura (1971), distinguishes between the original acquisition of skills and the subsequent use of these skills to obtain various interpersonal and functional goals. Although the focus of this article is medication effects on psychosocial skill acquisition, considerations about medication and performance are provided at the end. Patients with an improved skills repertoire will have better outcome, that is, diminished symptoms, more social supports, and a better quality of life. Conversely, patients with impeded skill learning and performance (perhaps because of iatrogenic effects of medication) will have a diminished rehabilitation outcome.

Of the three psychological processes that might mediate the effects of neurophysiological changes (due to psychotropic medication) on psychosocial skill learning, this article focuses on cognition. Cognition was examined as a mediator in this article because two independent bodies of research have been especially well developed. One set of studies has described psychosocial functioning in terms of various information processing deficits that may impede skill learning. The second body of research has examined the relationship between antipsychotic and

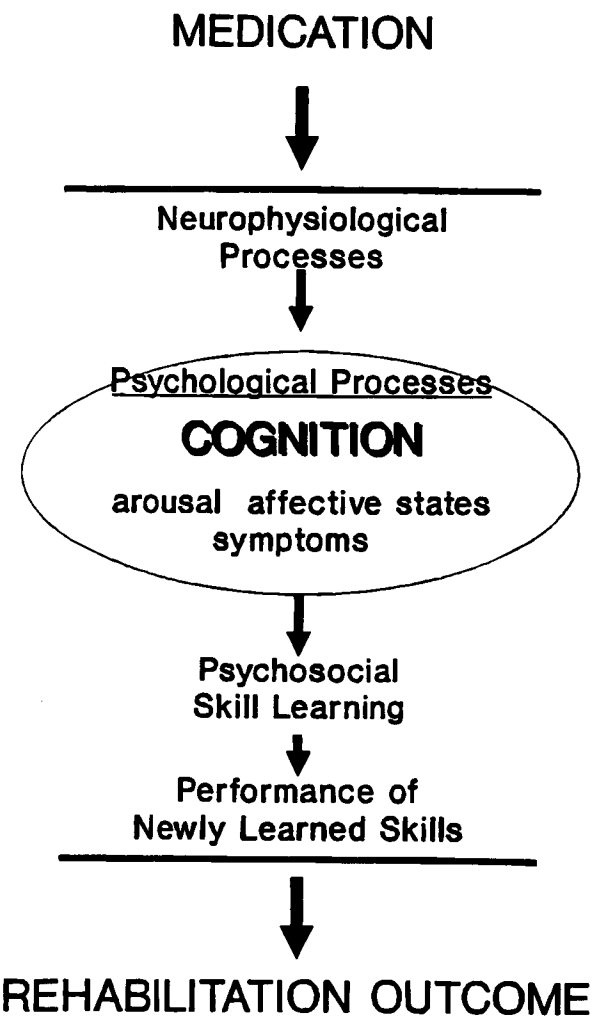

Figure 1. A theoretical representation of the relationship between medication and psychosocial skill learning. Note that several interrelated psychological processes mediate these effects.

antiparkinsonian medications and cognitive deficits. Unfortunately, investigations in these areas have occurred somewhat independently such that research methods across the two bodies of literature are not always comparable. Still, some cognitive investigators have argued that research instruments that measure similar information processing constructs covary highly (Fodor, 1983; Shallice, 1988). Hence, measures of verbal memory used in psychosocial skill learning are likely to assess the same construct as measures used in medication research. Combining findings from these two research areas will generate hypotheses that can be used to develop prospective research designs; these studies will address questions about the interaction of psychosocial skill learning and psychopharmacology.

PSYCHOSOCIAL SKILL LEARNING AND INFORMATION PROCESSING

Despite the success of skill learning programs, severely mentally ill patients who suffer significant cognitive deficits are impaired in their ability to acquire targeted interpersonal behaviors in traditional skills training programs (Liberman, Massel, Mosk, & Wong, 1985; Massel, Corrigan, Liberman, & Milan, 1991; Wong & Woolsey, 1989). To interpret these findings, clinical investigators have explained cognitive limitations related to skill learning in terms of information processing theory (Bellack, Morrison, & Mueser, 1989; Brenner, 1989; Corrigan, Schade, & Liberman, 1992; Liberman et al., 1986; Spaulding, Storms, Goodrich, & Sullivan, 1986). According to this perspective, psychosocial skill learning is viewed as a complex cognitive process requiring the perception and encoding of interpersonal cues, the consolidation of this information into accurate social representations, and the subsequent retrieval from memory of appropriate responses.

Clinical investigators have especially focused on the severely mentally ill patient's ability to learn social skills and two information processing functions: attention and memory. Unfortunately, researchers have not always carefully considered the various definitions of attention and memory in reporting their relationships with skill learning. For example, the development of limited capacity theories (Kahneman, 1973) and parallel distributed processing models (McClelland, Rumelhart, & PDP Research Group, 1989) has made attention a more complex construct than implied by Broadbent's (1958) filter theory. For this article, we have limited our discussion to visual vigilance to avoid the confusion that is engendered by generic terms like *attention*. Deficits in visual vigilance have been well studied in schizophrenia (Nuechterlein & Dawson, 1984). Unfortunately, the occasional investigator in studies reviewed in this article measured "attention" rather than one of the more specific processes that attention implies. In these instances, we adopted the investigators' less precise language to report their findings.

Memory is an equally complex function that includes encoding information vis-à-vis extant cognitive schema, recognizing the encoded information, consolidating

information into long-term memory, and recalling consolidated information later (Baddeley, 1982; Wingfield & Byrnes, 1981). The majority of research that has examined memory correlates to psychosocial skill learning has involved recall of verbal information and will be the focus of this review. This function is typically measured using word lists or short texts.

Information Processing Correlates of Psychosocial Skill Learning

Studies that have examined the relationship between psychosocial skill learning and information processing have used both cross-sectional and longitudinal designs to measure skill learning. In cross-sectional studies, investigators have used one-time measures of skill learning. For example, subjects in one study were tested on their ability to learn from written instructions and videotaped vignettes (Corrigan, Wallace, Schade, & Green, 1994). Results showed verbal recall to be a significant predictor of skill learning.

Studies have also examined the relationship between visual vigilance and the cross-sectional measure of psychosocial learning (Bowen et al., 1994; Corrigan, Wallace, et al., 1994; Kern, Green, & Satz, 1992). A computerized measure of visual vigilance (i.e., identify the number 0 from a series of 480 single digits flashed on the screen) was used in these studies. Bowen et al. (1994) found a significant, inverse relationship between scores on the vigilance measure and skill learning. Similarly, Kern et al. (1992) found that visual vigilance was significantly correlated with change scores on their cross-sectional measure of social skill learning. However, Corrigan, Wallace, et al. (1994) failed to find a significant association between the two measures, although a negative relationship was found with nonsignificant trends.

Two studies have also measured psychosocial skill learning by assessing patients longitudinally: prior to beginning a skills training class and upon completion. One of these studies measured skills as performed on a role-play test prior to participating in training sessions and after completing six hour-long sessions (Mueser, Bellack, Douglas, & Wade, 1991). Results showed that change scores on the role-play test were significantly associated with verbal recall memory. Findings from a second study, in which subjects participated in up to 320 hour-long sessions, were more complex (Kern et al., 1992). The measure of skill learning included an assessment of knowledge about the targeted skills (medication and symptom management) and a role-play test in which subjects were asked to demonstrate the skill. Change scores representing the difference between posttest and pretest scores on the skill learning assessment were not found to be associated with verbal recall. However, pretest performance on the role-play and knowledge tests was significantly associated with recall memory. These results support a cross-sectional association between psychosocial skill learning and verbal recall, but not a longitudinal correlation. This difference may suggest that memory deficits affect the immediate recall of newly learned skills, but have little relationship to long-term verbal memory. Alternatively, this difference may reflect the quality of the recall measure; typically, verbal recall measures included in these studies have examined immediate recollection rather than long-term memory.

Additional research needs to be conducted to cross-validate these findings. However, examination of the effect sizes representing the associations from these findings yields interesting conclusions. In particular, verbal recall is a robust measure of psychosocial skill learning accounting for up to one third of the variance in skill learning measures. This finding is not surprising. Learning skills and the ability to recall them are clearly intimate functions. Although psychosocial skills and verbal information do not seem to be interchangeable, psychosocial skills are taught in large part using verbal media. Still, these results do not merely represent shared method variance. Subjects in these studies are supposed not only to recall information taught to them during skills training but also to demonstrate these behaviors during structured role plays.

A similar pattern of associations was found between visual vigilance and skill learning. This finding also makes intuitive sense. Patients who are not vigilant to the skills demonstrated in psychosocial training groups should be less able to acquire these skills. To summarize, psychosocial skill learning is highly associated with verbal memory and visual vigilance.

This pattern provides some support for the hypothesis outlined in Figure 1; namely, psychotropic drugs that affect information processes like verbal recall and visual vigilance may significantly influence the course of psychosocial skill learning. However, it is unclear from this review whether the pattern of relationships represents the effects of these *specific* cognitive deficits or of a *generalized,* overall deficit. This is an important question for organiz-

ing the next section of this article. If this pattern represents a generalized deficit, then the relationships between medication and overall cognitive dysfunction need to be described. However, if the pattern represents specific deficits, for example, between verbal memory and psychosocial skill learning, then it is essential to describe the specific effects of medication on verbal memory and visual vigilance.

Investigators have examined whether the various information processing deficits of schizophrenia represent generalized or specific deficits with somewhat mixed findings (Blanchard & Neale, 1994; Saykin et al., 1994; Spaulding, Gerbin, & Dras, 1989). However, additional consideration of the studies reviewed above suggests that the association of verbal memory and visual vigilance with skill learning represents a specific deficit. Studies have shown that other information processing measures (i.e., iconic memory as measured on the span of apprehension and conceptual disorganization as measured on the Wisconsin Card Sorting Test) have not been significantly associated with psychosocial skill learning (Corrigan, Wallace, et al., 1994; Kern et al., 1992). Moreover, results of a multiple regression showed that two measures of information processing accounted for unique variance in psychosocial skill learning (Corrigan, Wallace, et al., 1994). Both these findings are not consistent with a generalized deficit. Future research needs to substantiate this conclusion. In the interim, the review of the effects of antipsychotic and antiparkinsonian medication on psychosocial skill learning considers specific relationships between medication and measures of verbal memory and visual vigilance.

THE EFFECTS OF ANTIPSYCHOTIC MEDICATIONS ON INFORMATION PROCESSING

Several comprehensive reviews have summarized research on the effects of neuroleptic and antiparkinsonian medication on the cognitive functioning of schizophrenic patients (Blanchard & Neale, 1992; Frith, 1984; Heaton & Crowley, 1981; Medalia, Gold, & Merriam, 1988; Spohn & Strauss, 1989). Rather than recapitulate these summaries, only findings germane to psychosocial skill learning for patients with schizophrenia will be highlighted. In particular, discussion will be limited to the effects of medication on visual vigilance and verbal memory. Three patterns of results about the effects of antipsychotic medication on these functions are discussed.

Low to Moderate Doses of Antipsychotic Medications May Improve Deficits in Visual Vigilance

Antipsychotic medications seem to improve vigilance when prescribed in low to moderate doses. Patients who receive moderate doses of antipsychotic medication earn better scores than unmedicated patients on measures of vigilance (Orzack, Kornetsky, & Freeman, 1967; Spohn, Lacoursiere, Thompson, & Coyne, 1977). Medication also reduces the adverse impact of external distractors on schizophrenic patients' attentional functioning (Oltmanns, Neale, & Ohayon, 1978; Strauss, Lew, Coyle, & Tune, 1985; Wahba, Donlon, & Meadow, 1981). Research, however, has not unequivocally found that "attentional" processes improve with low to moderate doses of antipsychotic medication. Serafetinides, Collins, and Clark (1972) failed to show that 12 weeks of medication improved performance on various attentional tasks. Research on readiness to respond is likewise mixed. Studies have shown that simple reaction time has not been responsive to medication effects (Held, Cromwell, Frank, & Fann, 1970; Spohn, Coyne, & Spray, 1988). However, Spohn et al. (1977) showed that reaction time significantly decreased for medicated, compared to unmedicated, patients.

Investigators were cautious in summarizing these data, but nevertheless concluded that low to moderate doses of neuroleptic medication specifically improve patients' vigilance to their environment (Medalia et al., 1988). The negative findings discussed above may have resulted from iatrogenic effects of medication. Subjects who experienced decrements in early information processing after ingesting antipsychotic medication may have received higher than optimal doses of the medication, an issue that is discussed more fully below.

Antipsychotic Medications Have Less Apparent Effects on Verbal Memory

The influence of psychopharmacological treatments on verbal learning tasks (e.g., list learning, paragraph recall, and paired-associates recall) seems to be negligible. The preponderance of evidence suggests no relationship between change in performance on verbal memory tasks and low to moderate doses of antipsychotic medication (Koh, Grinker, Marasarz, & Forman, 1981; Koh & Kayton, 1974; Koh, Kayton, & Berry, 1973; Pearl, 1962; Small, Small, Milstein, & Moore, 1972; Whitehead & Thune, 1958). The effects of medication on learning

might be specifically inferred from three investigations that included Digit Symbol from the Weschler Adult Intelligence Scale as the dependent measure. Results showed that ability to learn number-symbol pairs was not improved after medication (Killian, Holzman, Davis, & Gibbons, 1984; Orzack et al., 1967; Serafetinides & Clark, 1973).

High Doses of Antipsychotic Medication May Diminish Information Processing

Optimal therapeutic effects of antipsychotic medication are achieved at moderate dose levels (500–700 chlorpromazine equivalents); significantly surpassing this point may result in diminished clinical outcome and may lead to extreme exacerbation of the side effects common to these drugs (Baldessarini, Cohen, & Teicher, 1988). If we extrapolate this assertion to cognitive functioning, one might expect that high doses of neuroleptic medication diminish vigilance and memory functions. In support of this hypothesis, one study found a significant negative correlation between chlorpromazine equivalents of ingested neuroleptic medication and performance on an "attentional" measure (Sweeney, Keilp, Haas, Hill, & Weiden, 1991); the range of medication in this study was broad (100–3500 chlorpromazine equivalents). Other research has shown that high doses of neuroleptic medication significantly reduced attention (Pearl, 1962) and delayed reaction time (Spohn, Coyne, Lacoursiere, Mazur, & Hayes, 1985). These findings suggest a neuroleptic ceiling at which point improvement in readiness to respond and information intake may plateau or drop.

As an alternative strategy for testing the deleterious effects of medication on cognition, investigators have examined the relationships between prominent side effects of medication and cognitive functioning. Side effects include sedation, dry mouth, photosensitivity, blurred vision, and various movement disorders including akathisia, dystonia, akinesia, and dyskinesia (Van Putten & Marder, 1987). While no studies have examined how sedation and cognitive functioning covary, it is expected that vigilance and verbal memory scores of patients will decrease with the soporific effect of medication. Similarly, gross movement disorders (e.g., severe dystonias or akathisias) that impede test performance would be expected to diminish cognitive test scores.

Studies have shown significant positive relationships between extrapyramidal side effects (EPSE) and reaction time (Spohn et al., 1985; Strauss et al., 1985), disorientation (Waddington & Youssef, 1986a), and intellectual impairment (Waddington & Youssef, 1986b; Waddington, Youssef, Molloy, O'Boyle, & Pugh, 1985). Patients who show minor movement disorders react more slowly and seem to be more disoriented than those who do not. Regardless of whether cognitive deficits precede EPSE, or EPSE exacerbates already deficient cognition, these findings suggest that the neural dysfunction associated with chronic use of high-dose neuroleptic medication underlies both phenomena.

Summary of Antipsychotic Effects

The combined findings about therapeutic and iatrogenic effects of medication suggest a curvilinear relationship between medication levels and attentional tasks like vigilance. The biphasic relationship between medication dose and vigilance is similar to the relationship between medication level and psychotic symptoms outlined by Baldessarini et al. (1988). These investigators argued that dose of antipsychotic medication has a negative monotonic relationship with psychotic symptoms only to moderate levels. The psychotic symptoms of patients are likely to diminish when patients are prescribed low to moderate doses. However, the benefits of antipsychotic medications diminish when moderate levels are significantly exceeded. In fact, research by Chouinard, Jones, and Annable (1978) suggests that high doses of antipsychotic medication may actually exacerbate psychosis.

In similar fashion, there exists a hypothetical dose level where vigilance plateaus and no additional gain is noted (see Figure 2). If this value is exceeded—perhaps when sedation, movement disorders, or both become marked—functions related to information intake may actually diminish. Hence, one goal of symptom/side effect monitoring and medication titration may be to adjust medication levels within this narrow window of optimal clinical state, diminished side effects, and visual vigilance.

Note that the inverted U-shaped curve in Figure 2 is specific to information intake functions like visual vigilance. In terms of more complex cognitive functions like verbal memory, findings from the literature are tentative. These studies suggest that low to moderate doses of antipsychotic medication have neither a therapeutic nor a deleterious effect. However, research has not, to our knowledge, examined the relationship between verbal memory and relatively high doses of antipsychotic medication. It nevertheless seems reasonable to suggest that

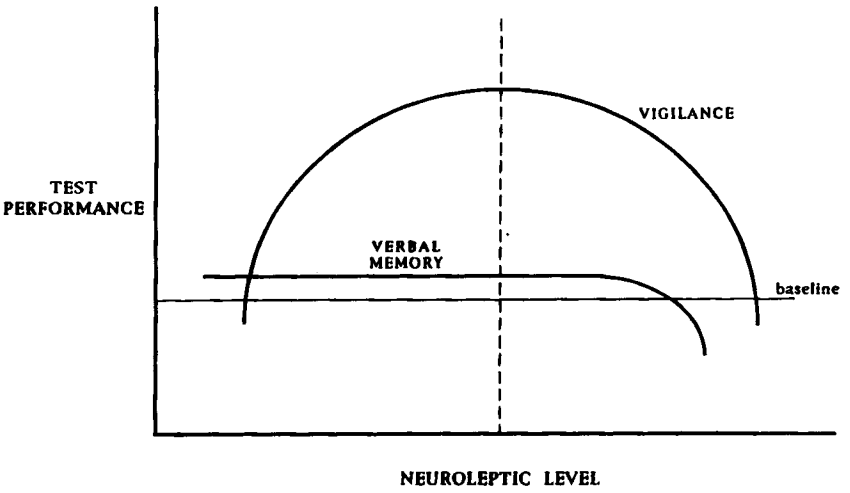

Figure 2. The relationship between antipsychotic drug dose and visual vigilance or verbal recall memory. Note the changes from baseline when the patient received no medication.

the side effects that hinder vigilance would also diminish verbal recall, a hypothesis that needs to be examined in future research.

THE EFFECTS OF ANTIPARKINSONIAN MEDICATIONS ON VERBAL MEMORY

Frequently, antiparkinsonian medications are prescribed to ameliorate some of the side effects of neuroleptic medication. Drugs used for this purpose fall into two classes: anticholinergic medication that antagonizes the effects of the neuroleptic drugs, and dopamine agonists that enhance neurotransmitter activity at the receptors. Decrements in verbal memory are especially noted when anticholinergic drugs are added to the medication regimen.

Several studies suggest that schizophrenic patients who use either benztropine (Cogentin) or trihexyphenidyl (Artane), two anticholinergic medications, show greatly diminished verbal recall (Baker, Cheng, & Amara, 1983; Hitri, Craft, Fallon, Sethi, & Sinha, 1987; McEvoy & Freter, 1989; Perlick, Stastny, Katz, Mayer, & Mattis, 1986; Sweeney et al., 1991; Tune, Strauss, Lew, Breitlinger, & Coyle, 1982; Van Putten et al., 1987). Interestingly, these effects depend on the level of patients' symptoms and may not be found in more severely disturbed individuals (Calev, Korin, Kugelmass, & Lerer, 1987). Post hoc analyses by Sweeney et al. (1991) suggest that verbal memory loss is not a function of the sedating effects of the medication but rather result from the blocking of cholinergic receptors.

The negative relationship between anticholinergic drug dose and verbal memory may elucidate why diminished cognitive functions result when higher doses of antipsychotic medication are administered. The anticholinergic effects of most antipsychotic medications increase as dose level is elevated. Moreover, certain antipsychotic medications show relatively higher anticholinergic effects than others; for example, thioridazine, mesoridazine, and chlorpromazine are all medications with relatively high anticholinergic effects. Therefore, antipsychotic medications with high anticholinergic effects would be expected to impede psychosocial skill learning more than an equivalent dose of antipsychotic medication with low anticholinergic potency.

Patients medicated with dopamine agonists like amantadine (Symmetrel) for side effects do not show the reductions in short-term verbal memory from baseline evident in patients medicated with benztropine or trihexyphenidyl (Fayen, Goldman, Moulthrop, & Luchins, 1988; Hitri et al., 1987; Van Putten et al., 1987). Dopamine agonists are also desirable because patients maintained on amantadine report less nagging complaints like dry mouth, blurred vision, and headaches than peers taking anticholinergic drugs (Gelenberg et al., 1989; Van Putten et al., 1987). These findings suggest that anticholinergic medication reduces short-term memory from baseline while dopamine agonists do not produce this deficit.

WHAT IS THE IMPACT OF MEDICATIONS ON PSYCHOSOCIAL SKILL LEARNING?

Two key findings have been gleaned from our review that answer this question: (a) Psychosocial skill learning is significantly related to verbal recall and visual vigilance, and

(b) low to moderate dose levels of antipsychotic medication may enhance vigilance but have little effect on verbal memory or learning. Therefore, if we were to consider the mediating effects of cognitive processes alone, one might conclude that patients receiving low to moderate doses of medication may show better skill learning than patients who are unmedicated. This increase would occur because appropriately medicated patients are attending to skills training sessions better.

Our literature review also suggests a negative relationship between medication and skill learning at moderate to high doses. First, skills training may likely be diminished in situations where behavioral rehearsal and task performance are impeded by extreme movement disorders or sedation. More directly, research suggests that vigilance may decrease as dose exceeds moderate levels; future research may show a similar relationship between dose and verbal memory. Impaired vigilance and recall will likely diminish skill learning.

Psychosocial skill learning may be further impaired by the anticholinergic medications that are prescribed to diminish side effects. Research suggests that benztropine and trihexyphenidyl decrease short-term recall in patient groups. As a result, the psychosocial skill learning of patients on these medications may be expected to diminish below baseline. Memory deficits attributed to anticholinergics are not found in patients who receive dopaminergic agonists like amantadine. Therefore, patients in skills training programs who are receiving amantadine for side effects are expected to acquire new behaviors more easily than patients receiving an anticholinergic medication. Of course, clinical investigators need to determine whether use of this less popular medication for EPSE leads to a different profile of side effects.

CONCLUSIONS

We began this review by describing the additive effects of psychosocial and psychopharmacological treatments for schizophrenia. In an attempt to explain combined effects, cognitive processes were examined that we believed mediated the effects of medication on psychosocial skill learning. Our summary of the literature showed that low to moderate doses of medication may enhance psychosocial skill learning by helping medicated patients to be more attentive. However, antipsychotic medication, especially when prescribed at high doses, and anticholinergic medication given for side effects seem to diminish cognitive functioning. We concluded that decrements in cognitive functioning would contribute to diminished psychosocial skill learning. Hence, instead of an additive effect, this review suggests that medication and psychosocial treatment are described by an interaction.

This finding is important because it suggests useful hypotheses for future research into medication and skill learning interactions. In particular, future studies need to determine whether the dose-response curve describing antipsychotic medication and psychosocial skill learning describes an inverted U as hypothesized. Support of this assumption will, in turn, lead to useful guidelines about medicating patients participating in psychosocial programs. Such guidelines are likely to reflect low-dose medication strategies that have previously been promoted to reduce other iatrogenic effects of antipsychotic medication (Kane, 1983).

Future research needs to also determine whether mediating factors other than cognitive deficits explain the interaction in medication and skill learning; three such factors are discussed here. First, what are the effects of psychiatric symptoms? Patients with diminished psychosis (after medication) are better able to participate in, and learn from, skills training classes. Research that has described the relationships between psychotic symptoms and skill learning has been mixed, however. Bowen et al. (1994) found a significant association between conceptual disorganization and psychosocial skill learning. Patients who are thought disordered acquire and retain psychosocial skills less effectively than those who are not. However, results of other studies (Corrigan, Wallace, et al., 1994; Eckman et al., 1992) uncovered no significant associations between psychotic symptoms and skill acquisition. Unfortunately, findings from all these studies may have been limited because they were cross-sectional in design. Given the research about episodic and enduring quality of symptoms (Cromwell & Spaulding, 1978; Zubin & Spring, 1977), relationships between psychotic symptoms and psychosocial skill learning may only be found in longitudinal studies.

Alternatively, the additive effects of medication and skill learning may not have been explained in this article because of our narrow focus. Only one aspect of psychosocial skill learning was examined, the acquisition of interpersonal skills. Acquisition does not describe the regular use of newly learned social skills *en toto;* patients must also be provided sufficient reinforcement to per-

form a newly acquired behavior. Administration of antipsychotic medication may improve or undermine the patients' performance of newly learned skills by affecting their sensitivity to reinforcement and punishment. Classic research on laboratory animals has shown that moderate doses of neuroleptics led to diminished efforts to escape from punishers (Courvoisier, Fournel, Ducrot, Kolsky, & Koetschet, 1953; Verhave, Owen, & Robbins, 1959) and decreased response rate in fixed schedules of reinforcement (Byrd, 1974; Waller, 1961). This pattern suggests that medication diminishes sensitivity to punishment. Unfortunately, little research on medications and reinforcement contingencies has been conducted on patient samples. Such a research program may illustrate the additive effects of medication and skill learning.

A third way of understanding interactive effects may lie in examination of improved *social* cognition. Perhaps the ability to attend to social cues that signal appropriate interpersonal skills improves with medication. Research has shown a significant relationship between measures of visual vigilance and social cue perception (Corrigan, Green, & Toomey, 1994). Improved vigilance associated with antipsychotic medication may help patients to be more sensitive to their social environments. Similarly, investigations that have shown significant relationships between problem solving and early processing functions suggest that the ability to identify and articulate interpersonal problems improves as the medication levels of patients reach moderate levels (Corrigan & Toomey, in press; Spaulding, Weiler, & Penn, 1990). Patients are better able to use psychosocial skills as they more accurately perceive their world.

The relationship between medications and psychosocial skill learning is by no means unidirectional; psychosocial skill training is also likely to have effects on medication administration. Specifically, schizophrenic patients who learn interpersonal coping skills are better able to collaborate with their mental health care team (Boczkowski, Zeichner, & DeSanto, 1985; Corrigan, Liberman, & Engel, 1990). As a result, they are more likely to administer antipsychotic and anticholinergic medication according to prescription. Moreover, the psychiatrist can select and titrate medications more effectively when patients are providing information about their symptoms and side effects in an assertive manner.

The relationship between medication and psychosocial skill learning is bidirectional and likely to be explained by multiple variables. Better understanding of this relationship will help clinicians develop the most effective intervention plans.

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