CLINICAL BEHAVIORAL PHARMACOLOGY: METHODS FOR EVALUATING MEDICATIONS AND CONTINGENCY MANAGEMENT

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We evaluated methods for comparing the effects of dextroamphetamine (Dexedrine), thioridazine (Mellaril), and contingency management in the control of severe behavior problems. A reversal design was used in which medications were systematically titrated and assessed in unstructured as well as structured settings with three clients. Subsequently, behavioral procedures including time-out, differential reinforcement of other behavior, and visual screening, were used in a multiple-baseline design across settings. The assessment and design methods were useful in comparing the interventions. Dextroamphetamine decreased inappropriate behaviors and improved academic behaviors in one client, but no reliable effects were observed in the other two clients. Thioridazine was variable across clients, settings, behaviors, and dosages. Contingency management produced consistent decreases in inappropriate behaviors and small improvements in academic performance.

DESCRIPTORS: behavioral medicine, behavioral treatment, drug effects, behavioral assessment, retardation

There is a long history of pharmacologic attempts to control aberrant behavior (Bradley, 1937), and in recent years both the variety of drugs and the number of individuals for whom medication is prescribed have increased greatly. However, the use of medication for behavioral control has come under scrutiny (e.g., *Wyatt v. Stickney*, 1972). One reason is that many drugs have serious side effects (Levenson, 1981). Neuroleptics have been associated with tardive dyskinesia and adverse effects on learning and performance (Aman & Singh, 1980; Marholin, Touchette, & Stewart, 1979; Sprague, Barnes, & Werry, 1970; Wysocki, Fuqua, Davis, & Breuning, 1981), and stimulant medications can cause insomnia, weight loss, and possible depression of growth rate in children (Walker, 1982).

There are also serious methodological shortcomings in many published studies (cf. Marholin & Phillips, 1976). Most studies used global clinical impressions or standardized tests to measure treatment efficacy (Werry, 1978). Direct and reliable measurement of behavior has been the exception (Hollis & St. Omer, 1972; Sprague et al., 1970; Wysocki et al., 1981). In addition, between-subject group designs have been most frequently used, thereby restricting conclusions about drug effects to statistical comparisons of group means (Breuning, Davis, & Poling, 1982; Marholin & Phillips, 1976). The disadvantages of statistical between-group comparisons have been described extensively (Baer, 1977; Kazdin, 1977; Risley, 1970; Sidman, 1960). Such analyses have particular weaknesses in the evaluation of drug effects. For example, Wells, Connors, Imber, and Delameter (1981) discussed the benefits of within-subject comparison in light of the highly individual response to drugs. Analysis at the level of the individual subject would have clinical advantages and would be possible given the increasing sophistication of within-subject designs.

The scientific basis for using psychotropic medication with mentally retarded clients can be questioned. The widespread use of neuroleptics is based on the apparent similarity between the behavior of

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retarded individuals and that of psychiatric patients (Breuning *et al.*, 1982). Specific drug effects in the mentally retarded are not well known (Freeman, 1970; Lipman, 1970; Sprague & Werry, 1971), particularly in children, (Winsberg & Yepes, 1978).

There is a growing literature on the treatment of severe behavior problems with contingency management procedures (Breuning & Poling, 1982). However, there are few well-controlled studies comparing drug and behavioral treatments with the mentally retarded, and results are equivocal. In some studies, behavioral treatments have been more effective than neuroleptics (McConahey, Thompson, & Zimmerman, 1977) and stimulants (Ayllon, Layman, & Kandel, 1975; Christenson, 1975; Rapport, Murphy, & Bailey, 1982; Shafto & Sulzbacher, 1977; Wulbert & Dries, 1977). In another study, behavioral treatment combined with stimulant medication was more effective than either treatment alone (Wells *et al.*, 1981).

Thus, clinicians are faced with insufficient and conflicting information when deciding on pharmacotherapy, contingency management, or some combination for an individual. Only Wells *et al.* (1981) examined a decision-making process for comparing the effects of these two approaches. They demonstrated the utility of behavioral assessment and within-subject designs, but only one subject was evaluated, the observer was not blind to treatments, and stimulants were the only medication evaluated. There remains a need for decision-making methods with which clinicians can determine relative efficacy of pharmacologic and behavioral treatments.

We evaluated the comparative effects of neuroleptic medication, stimulant medication, and contingency management procedures with severely and profoundly mentally retarded individuals. One objective was to develop comprehensive observation methods for monitoring behavior in different clinical settings. A second objective was to demonstrate the utility of within-subject designs in comparing medication and behavioral treatment effects.

METHOD

Clients

Three mentally retarded males were selected on the basis of (a) classification of severe or profound mental retardation; (b) documentation of severe behavior problems in both academic and nonacademic settings; and (c) formal request for medication assessment by a physician. Each had been admitted to a hospital for the developmentally disabled for the purpose of conducting drug evaluations.

Doug, an 11-year old, was referred for aggression, disruption, self-stimulation, mouthing of objects and body parts, and poor attending behavior during academic tasks. He lived with his parents and attended a public special education class. He had been diagnosed as hyperactive and severely mentally retarded with unknown etiology, and had been placed on methylphenidate (Ritalin) for the management of hyperactivity and various inappropriate behaviors. However, medication had been administered on an outpatient basis and his parents questioned its efficacy. He had not received any medication for the management of his behavior problems for at least 1 year prior to this study.

Terry, a 21-year old, was referred for aggression, disruption, self-stimulation, and poor attending behavior during academic tasks. Terry lived at home and attended a public special education classroom, with severe behavior problems reported in both settings. He had been diagnosed as severely mentally retarded and hyperactive secondary to phenylketonuria (PKU). At the time of referral, Terry was receiving 300 mg of thioridazine (Mellaril) and had a long history at various dosages with this medication. Because his parents reported that thioridazine aggravated his behavior problems, it had been terminated approximately 1 month prior to the study.

Bobby, a 12-year old, was referred for aggression, disruption, and poor attending behavior during academic tasks. At the time of admission, he was living in a state residential facility. Pending reduction of aberrant behaviors, he was scheduled for community placement with a foster family and

enrollment in a public special education classroom. He had been diagnosed as hyperactive and profoundly mentally retarded with unknown etiology. Bobby had been receiving medication for the control of seizure activity for some time prior to admission and continued to receive this medication throughout the study. The referring agency listed him as candidate for medication, although he had not previously received medication for behavior problems.

Settings and Materials

Academic training sessions were conducted in a 2.4 m × 2.4 m treatment room in the hospital designed to simulate an academic classroom in which preacademic tasks are presented; the room was equipped with a small table and two chairs. A second setting was a 15 m × 8 m playroom in the hospital in which free-play activities were alternated with periods of semistructured activities. The playroom contained two large rectangular tables, a number of chairs, various toys and instructional materials, and two storage cabinets. In both settings, observations were made through a one-way mirror from an adjoining room.

Materials

During each session a client was presented with preacademic materials including wooden puzzles, wooden blocks, and paper and pencil. The trainer used a digital wristwatch to time the sessions and other events occurring within the session. The observer used a portable cassette player to cue observation intervals.

Measurement

General deportment. The following target behaviors were identified based on reports of parents and teachers, as well as informal observations of clients on admission.

1. *Aggression:* hitting, slapping, scratching, pinching, pushing, kicking, biting, or hair-pulling directed at another person; also included were hitting another person with an object or pouring liquid on a person.

2. *Disruption:* throwing or kicking objects, knocking objects off an elevated surface, or upsetting objects.

3. *Self-stimulation:* repetitive, nonfunctional motor movements such as body rocking, head rolling, and hand weaving.

4. *Mouthing:* any contact between inedible objects (including body parts) and the lips or mouth.

5. *Inattention:* eyes not oriented toward task materials or trainer, or out-of-seat for at least a 3-s duration during any 10-s recording interval.

6. *Appropriate behavior:* the absence of inappropriate target behaviors, and the occurrence of generally appropriate behavior (e.g., sitting quietly).

Data were collected on all the target behaviors during two academic training sessions each day—one in the morning and the other in the afternoon—Monday through Friday. A 10-s partial-interval recording system was used throughout the 15-min academic sessions. With Doug and Terry, 5-s recording intervals were interposed between the 10-s observation intervals.

With the exception of aggression and disruption, behaviors in the playroom were recorded using an observation system identical to that used in the academic sessions. To obtain a more representative sample of behaviors throughout the day, data were collected during six 5-min samples interspersed between 8:30 a.m. and 5:00 p.m., with three of the samples taken in the morning, and three in the afternoon. Due to the relatively infrequent occurrence of aggression and disruption in the playroom, the frequency of those behaviors was recorded during the time the playroom was open daily. Also, because tasks in the playroom setting were variable, inattention was *not* recorded in this setting.

Academic performance. Fifteen preacademic tasks were administered in a random order during academic training sessions. Tasks were selected in conjunction with special educators and included printing letters, performing color and form discrimination tasks, assembling puzzles, and stacking blocks. Data collected on Doug and Terry in-

cluded mean task duration and the number of tasks completed; task accuracy was expressed as percent correct. For Bobby, the number of tasks completed at 100% accuracy was tabulated, because when he completed a task during pilot sessions, it was invariably completed at 100% accuracy.

Interobserver agreement. Assessment of interobserver agreement on general deportment and academic measures was conducted during approximately one-third of all sessions throughout the study. Agreement indices were computed for the interval recording system by dividing the number of agreements by the number of agreements plus disagreements and then multiplying by 100. Occurrence, nonoccurrence, and combined agreement were determined for each behavior (Bijou, Peterson, & Ault, 1968). All occurrence indices were above 80%, with the exception of disruption (78%) and inattention (76%) for Doug in the academic setting. Both nonoccurrence and combined indices for these measures were above 90%. Agreement indices for the event recording system used in the playroom and the academic performance measures were calculated by dividing the smaller number of occurrences by the larger number and multiplying by 100. Agreement was above 90% on all academic performance measures.

Procedures

During academic training sessions, a client was seated at a table facing a trainer who instructed the client to begin a task, e.g., "Doug, please do the turtle puzzle." If no contact was made with the task materials, or if the task materials were used inappropriately (e.g., in the act of self-stimulation), the request was repeated every 30 s for 3 min (a total of six requests). If the client had not finished the task within 3 min, materials were removed and a new task presented. A prebaseline assessment had established that accurate completion of each task within the 3-min interval was within the clients' repertoires. If the client got out of his seat, he was asked to sit down and complete or initiate the task. This request was repeated once per minute for the rest of the session (a maximum of 15 requests per session).

In the playroom, staff interacted with several clients, at least one of whom was a study participant. Clients were urged to engage in a variety of activities such as coloring, playing catch, listening to music, and using table-top materials. Time spent in the playroom was considered less demanding than the academic sessions because clients could choose any available activity.

Baseline 1. Throughout this condition, clients were not receiving psychotropic medication. Twice daily academic sessions and daily playroom observations were conducted during this and all succeeding experimental conditions. During both types of sessions there were no systematic consequences for either appropriate or inappropriate behavior. However, response interruption was occasionally used if necessary to terminate aggression or property destruction.

Medication 1 (dextroamphetamine). In this condition each client was administered dextroamphetamine by nursing staff at 9:00 a.m. and 3:00 p.m. Behavioral observers were not aware of the administration of medication during this or any other phase of the study. All clients received an initial dose of 5 mg/day. Dosage levels were titrated by 5 mg, separated by at least 2 days per increase. Maximum dosage was 20 mg/day for Doug and Terry and 10 mg/day for Bobby. Clients continued to be observed in the playroom and academic training settings. Conditions were identical to baseline in that there were no systematic consequences for either appropriate or inappropriate behaviors.

Baseline 2. The second baseline phase began on Monday morning, following discontinuation of medication the preceding Friday. This phase was identical to Baseline 1 and lasted 3, 8, and 4 days for Doug, Terry, and Bobby, respectively.

Medication 2 (thioridazine). Only Doug and Terry participated in this condition. Thioridazine was administered at 8:00 a.m., 1:00 p.m., and 8:00 p.m. Doug received an initial dosage of 25 mg/day, which was then titrated upward by 25 mg/day until a dosage of 100 mg/day was achieved. This phase lasted for 22 days, including weekends. Terry received an initial dosage of 100 mg/day, which was increased to 200 mg/day, and

finally 400 mg/day. This phase lasted 25 days including weekends. Dosage increases were separated by 5–10 days.

Baseline 3. The third baseline condition began on Monday morning, after medication had been terminated the preceding Friday to allow some degree of washout of the medication over the weekend. All conditions were identical to the two earlier baseline conditions.

Contingency management. With all three clients, aggression and disruption were treated with a combination of differential reinforcement of other behaviors (DRO) and time-out procedures. Inattention during academic sessions was treated through DRO procedures, and appropriate behavior was not directly targeted for intervention in either setting.

With Doug, DRO and time-out procedures were used to reduce aggression and disruption, first in the playroom and later in the academic setting. When Doug engaged in an aggressive or disruptive behavior, he was taken to a time-out chair in a corner and was required to remain in the chair for 3 min with a 30-s contingent delay, i.e., he had to be quiet for 30 consecutive seconds in order to leave the time-out area. Data collection was discontinued during time-out periods. In the playroom, staff were instructed to praise Doug for about 15 s if aggression or disruption had not occurred for a 15-min period. A shorter DRO was used in the academic setting. Praise and food were delivered initially every 30 s if aggression or disruption had not occurred. The schedule of reinforcement was then systematically faded to one praise statement or piece of food per minute. Oversized wool mittens were used for Doug's mouthing of hands and objects or stereotypic object juggling. The mittens had a shoelace around the wrist and a special flap so that Doug could not untie the lace with his teeth. All behaviors (except aggression and disruption, which resulted in time-out) were ignored while Doug was wearing the mittens. The mittens remained on for 5 min with a 15-s delay for mouthing occurring in the final 15 s. Observation was discontinued while the mittens were on. Following the introduction of contingencies, Doug was required during academic sessions to attend to the

task materials or to the experimenter throughout the 30-s interval, and to refrain from inappropriate behavior, in order to be rewarded.

With Terry, contingent visual screening (Zelig, Jenkins, Becker, & Bristow, 1976) combined with DRO was introduced to modify self-stimulation, first in the academic setting, and then in the playroom. Visual screening can be considered a time-out procedure in which the trainer contingently blocks the source of visual stimulation briefly, by placing a hand or a cloth bib over the client's eyes. This technique was appropriate for Terry because his self-stimulation involved rocking his head from side to side with eyes open. In addition to blocking visual stimuli the staff member/trainer prevented head rocking by gently holding Terry's head. When Terry occasionally resisted, visual screening was not removed until resistance had stopped for at least 5 s. During visual screening, DRO procedures identical to those used with Doug were used with Terry. Subsequently, DRO and time-out procedures identical to those used with Doug were introduced for aggression and disruption. Following the introduction of contingencies for self-stimulation in the academic setting, Terry was rewarded for attending to task materials or the trainer for a 30-s interval. The interval length was later increased to 1 min.

For Bobby, DRO and time-out procedures were identical to those instituted for Doug and Terry's aggression and disruption. In the playroom, DRO and time-out were initially used to control aggression only. Subsequently, the procedures were also used for disruption in the playroom, and then later for both aggression and disruption in the academic setting. Bobby was then rewarded for attending to the task materials or the experimenter for an entire 15-s DRO interval. In addition, a guided compliance procedure was used to prohibit Bobby from ignoring the academic tasks. If Bobby did not initiate a task within 5 s of a request, he was manually guided through the task. For recording purposes, intervals in which guided compliance was applied were subtracted from the total number of intervals.

Follow-up. Prior to discharge, parents and teachers were given instruction in the use of con-

tingency management procedures. Training consisted of written programs, experimenter modeling, role-playing, supervised hands-on experience, and feedback.

After discharge, data were collected on Doug and Bobby in their special education classrooms. Fifteen-minute observation sessions, in which data were recorded on a partial-interval basis, were conducted at intervals of 8 and 13 months after discharge for Doug, and intervals of 1, 2, 3, and 7 months after discharge for Bobby. All behaviors observed during admission were recorded by one of the experimenters. The classroom teacher collected daily measures of aggression, disruption, and out-of-seat for Doug, and daily frequency of time-outs for Bobby. For Doug, who was in the same classroom prior to the study, the teacher had also collected data for 5 weeks prior to the study. Additional follow-up data were collected with Doug during an outpatient visit to the hospital in which observation procedures were identical to those during admission.

With Terry, direct follow-up observation by an experimenter was not possible due to the distance his family lived from the hospital. However, the school psychologist collected data on Terry's behavior in the school setting. Frequent telephone contact with Terry's parents allowed for additional monitoring of his behavior.

Experimental Design

The experimental design consisted of components of both reversal and multiple baseline designs (Baer, Wolf, & Risley, 1968). The reversal design used with Doug and Terry consisted of an ABACAD design in which A = no medication baseline, B = dextroamphetamine (Dexedrine), C = thioridazine (Mellaril), and D = contingency management. The reversal design used with Bobby was an ABAD. With all three clients, contingency management procedures were introduced in a mul-

tiple baseline design across the two settings. In addition, with Bobby, contingency management procedures within each setting were introduced in multiple baseline fashion across aggression and disruption.

RESULTS

General Deportment Measures

Doug. Figure 1 and Table 1 show the frequency and percent intervals of occurrence for target behaviors for Doug across both settings. Doug displayed moderate to high levels of problem behaviors prior to treatment.

The 5 mg/day of dextroamphetamine had no systematic effects on any behavior. At 10 mg/day self-stimulation and mouthing in the playroom decreased, as did inattention in the training setting. However, similar reductions in self-stimulation and mouthing were not found in the training setting, and aggression did not decrease in the playroom. When the dosage was increased to 15 mg/day and then 20 mg/day, self-stimulation and mouthing increased in both settings, and inattention in the training room returned to its baseline level.

With the introduction of thioridazine, there was no effect on Doug's behavior until the dosage increased to 50–100 mg/day. At these levels rates of aggression and disruption decreased in the playroom. Self-stimulation decreased in both settings, while mouthing decreased only in the training room. Inattention in the training room was not affected.

During DRO and time-out procedures, Doug's aggression and disruption decreased markedly. The mitten and DRO procedures resulted in almost total elimination of mouthing and self-stimulation in both settings. Inattention decreased in the training setting, apparently due to the DRO procedure, with a corresponding increase in the rate of appropriate behaviors across settings.

Figure 1. Percent intervals and frequencies of general deportment measures in the playroom and academic setting for Doug across experimental conditions.

Table 1
Condition Means for Deportment in the Play Setting and Deportment and Academic Performance in the Academic Setting

	Baseline 1		Dextro-amphetamine		Baseline 2		Thioridazine		Baseline 3		Contingency management	
	Play	Acad	Play	Acad	Play	Acad	Play	Acad	Play	Acad	Play	Acad
Doug												
Aggression	7	1	9	0.5	9	0	4	0.3	14	2	2	0
Disruption	1	3	0.5	4	2	3	3	2	9	5	2	0.4
Self-stimulation	43	36	59	67	64	42	39	21	47	40	2	0.7
Mouthing	45	54	50	61	73	41	47	36	44	43	18	0.2
Appropriate	32	30	39	17	14	37	37	34	27	32	78	88
Inattention	—	36	—	33	—	18	—	41	—	43	—	11
Mean task duration in seconds per session	—	33	—	53	—	31	—	33	—	20	—	26
Mean number of tasks completed per session	—	6	—	4	—	4	—	5	—	6	—	6
Terry												
Aggression	0.4	0	0.3	0	7	0	9	0.03	1	0.3	0.3	0.1
Disruption	14	6	6	6	15	2	47	9	8	1	2	0.8
Self-stimulation	60	49	79	50	74	51	85	47	86	42	1	9
Appropriate	28	29	19	30	21	27	8	28	9	36	96	76
Inattention	—	51	—	56	—	61	—	58	—	45	—	12
Mean task duration in seconds per session	—	139	—	148	—	122	—	98	—	142	—	50
Mean number of tasks completed per session	—	4	—	5	—	7	—	7	—	6	—	7
Mean task accuracy percent correct per session	—	56	—	54	—	86	—	87	—	67	—	92
Bobby												
Aggression	54	2	19	0	91	10	—	—	—	—	7	0.1
Disruption	27	14	11	7	29	60	—	—	—	—	7	2
Appropriate	83	57	87	75	82	30	—	—	—	—	87	86
Inattention	—	43	—	25	—	69	—	—	—	—	—	14
Mean number of tasks completed at 100% accuracy	—	3.8	—	6.2	—	2.5	—	—	—	—	—	6.7

Figure 2. Percent intervals and frequencies of general deportment measures in the playroom and academic setting for Terry across experimental conditions.

Figure 3. Percent intervals and frequencies of general deportment measures in the playroom and academic setting for Bobby across experimental conditions.

Terry. Results for Terry are shown in Figure 2 and Table 1. His behavior was generally quite variable during baseline, both within and across settings.

Dextroamphetamine had no systematic effect on Terry's behaviors at lower dosage levels. When 20 mg/day were administered, inattention increased, and appropriate behavior decreased in the academic setting.

When thioridazine was administered at dosages of 200–400 mg/day, aggression decreased in the playroom, the only setting in which it had consistently occurred. However, disruption showed a marked increase during this condition in both settings, particularly the playroom. The increased disruption in the playroom was more apparent at 100–200 mg/day than at the dose of 400 mg/day. Self-stimulation occurred at a high rate in both settings. At 400 mg/day self-stimulation increased in the training room; a similar trend was not observed in the playroom because self-stimulation was already high. Inattention during academic training sessions did not change.

The effect of contingency management could not be systematically evaluated for Terry's aggression and disruption because these behaviors occurred infrequently during both baseline conditions. However, with the introduction of DRO procedures and visual screening, self-stimulation decreased markedly. The DRO procedure also decreased inattention in the training setting and increased appropriate behaviors in both settings.

Bobby. Bobby also exhibited variability within and across settings as shown in Figure 3 and Table 1. Aggression and disruption in both settings, and inattention in the academic setting, increased during baseline; likewise, appropriate behavior in the academic setting decreased.

Bobby's performance changed dramatically when he was given 10 mg of dextroamphetamine per day. Aggression and disruption in the playroom decreased in both settings. Inattention decreased in the training room, and appropriate behavior increased. When dextroamphetamine was withdrawn, aggression, disruption, and inattention ap-

Table 2
Percent Intervals of Occurrence of Target Behaviors for
Doug and Bobby in Special Education Classroom

	Months			
	8	13		
<hr/>				
Doug				
Aggression	0	0		
Disruption	0	0		
Self-stimulation	6	0		
Mouthing	70	7		
Inattention	7	2		
Appropriate	23	91		
<hr/>				
	Months			
	1	2	3	4
<hr/>				
Bobby				
Aggression	0	0	0	0
Disruption	0	0	0	3
Inattention	4	14	9	8
Appropriate	96	86	90	89

proached, and in some cases surpassed, baseline levels.

Contingency management decreased Bobby's aggression and disruption in both settings. These decrements were slightly greater than those in the dextroamphetamine condition. Inattention also decreased to lower levels than during the drug condition, and appropriate behavior increased in the training room. Appropriate behaviors in the playroom remained at relatively high levels throughout the contingency management condition.

Academic Performance

Condition means for academic performance measures are also presented in Table 1. Doug's academic performance remained stable across all conditions except for a slight decrement with dextroamphetamine. There were no changes in the number of tasks completed per session. Although the results are not as clear with Terry, mean task duration was highest during the dextroamphetamine condition and lowest during contingency management. Mean percent correct was highest under contingency management procedures, al-

though the number of tasks completed per session did not vary markedly across conditions. Bobby's performance, expressed as the mean number of tasks completed at 100% accuracy, increased from the first baseline to the dextroamphetamine trial, and improved further with contingency management procedures.

Follow-up

Table 2 shows data from the special education classroom attended by Doug and Bobby. With both clients, few instances of inappropriate target behaviors were observed, and appropriate behavior was high. The exception is the 8-month follow-up with Doug during which he was mouthing during 70% of the intervals; he was chewing gum for the entire observation and all mouthing responses were instances of playing with the gum, rather than the typical hand-in-mouth topography noted under baseline conditions. Thus, Doug's performance in the special education classroom was maintained for 13 months after discharge and Bobby's appropriate behavior continued for 8 months. In both cases the clients were maintained through contingency management procedures in the absence of medication.

Pre- and posttreatment data collected by Doug's special education teacher show similar effects. The mean frequency of aggression/disruption decreased from 13.3 at the 5-week preadmission period to zero at the 4-week posttreatment period; out-of-seat behavior decreased from 25.6 to 2.6 episodes. Data collected by Terry's school psychologist as well as parent verbal reports indicated continued maintenance of appropriate behavior for up to 12 months. The one exception was resumption of self-stimulation in the form of head weaving several months after discharge. All other inappropriate target behaviors continued to be at very low levels in both the home and school settings. As with the other clients, Terry was maintained without medication.

DISCUSSION

These results suggest that the within-subject methodology provided a means for making indi-

vidualized data-based decisions regarding the comparative effects of medications and contingency management procedures. Repeated measures of a variety of behaviors during a series of conditions designed specifically for each client showed different therapeutic and nontherapeutic effects of these treatments in a clinical setting.

Dextroamphetamine had inconsistent effects not only across clients, but also dosage levels and different behaviors. There were small improvements in two clients on some behaviors at certain dosage levels, but adverse effects were observed with other behaviors, different dosages, or in different settings. The third client had a generally positive response at 10 mg daily. These mixed results are consistent with previous reports in the literature (Davis, 1971; Davis, Sprague, & Werry, 1969; Sprague *et al.*, 1970; Walker, 1982).

Thioridazine also had inconsistent effect across behaviors, clients, and dosages. Doug showed minor positive effects along with an adverse effect, whereas effects with Terry were predominantly negative. These results are disturbing in light of the large number of mentally retarded persons receiving neuroleptic medication—86% of one institutionalized sample (Craig & Behar, 1980) and 58% of another noninstitutionalized group (Davis, Cullari, & Breuning, 1982). Furthermore, our data indicate that even a relatively low dosage of thioridazine (200 mg/day) can adversely affect inappropriate behaviors, a finding consistent with other reports (Aman & Singh, 1980; Wysocki *et al.*, 1981). Another danger is that although one behavior may improve, another may deteriorate. A decision to continue a particular medication regimen could be made without considering the possible negative effects on other behaviors. Comprehensive behavioral assessment procedures can increase the knowledge on which a clinician bases a decision to prescribe drugs.

Contingency management procedures were more effective than both neuroleptic and stimulant medication with all three clients in reducing or eliminating severe aberrant behaviors and increasing appropriate behaviors. In all cases, behavior improved markedly over baseline levels, and in cases where

medication resulted in improvement, behavior management procedures produced superior effects. Inattention decreased in all clients with behavior management procedures, and two of the three had improved academic performance. Thus, our results extend previous findings by documenting the beneficial effects of contingency management as compared with neuroleptic and stimulant medication (Ayllon et al., 1975; Christenson, 1975; McConahey et al., 1977; Rapport et al., 1982; Shafto & Sulzbacher, 1977; Wells et al., 1981; Wulbert & Dries, 1977).

Also noteworthy is the fact that contingency management procedures transferred to natural environments after discharge from the hospital. The fact that all three clients were maintained on contingency management in the absence of medication supports the validity of assessment data.

Several issues suggest caution when interpreting the results. First, due to time constraints, clients' performances were not evaluated under placebo conditions, a typical control for expectancy effects in drug evaluation studies. However, because the clients were severely to profoundly mentally retarded, it is unlikely that their expectancy confounded the results. Second, longer return-to-baseline phases following termination of thioridazine may have been preferable in light of the longer serum half-life of this drug. This was not feasible because of time constraints imposed by medical staff. However, the generally negative results with thioridazine as well as the return of target behaviors to baseline levels make it unlikely that contingency management effects were enhanced due to thioridazine residuals. Third, because drug trials preceded contingency management with all three clients, the possibility of order effects cannot be ruled out. However, this appears not to have been the case because target behaviors generally approximated initial baseline levels during the return-to-baseline conditions preceding contingency management (cf. Wells et al., 1981). In addition, the sequence we used has generalizability to many natural settings in which clients on chronic drug regimens are subsequently exposed to contingency management procedures. Furthermore, neuroleptic

medications would have less likelihood of providing order effects than contingency management which may result in irreversible changes.

Several conclusions regarding the evaluation of drug effects in the mentally retarded seem warranted based on our results. First, regardless of which medication is being considered, there is a need for direct observation of medication effects on discrete categories of behavior. The variability of therapeutic effects across different response categories highlights the need to identify several appropriate and inappropriate response categories and to observe them across settings with varied demand characteristics.

Second, these results highlight the benefits of examining drug effects in individuals rather than on a group basis. Although only three clients participated, the highly discrepant drug effects point to the need for within-subject analyses. Group designs may be useful in some pharmacological investigations (e.g., evaluating long-term side effects), but the more molecular analyses afforded by within-subject designs suggest the need for widespread application (Breuning et al., 1982; Marholin & Phillips, 1976; Wysocki & Fuqua, 1982).

Third, contingency management procedures should be considered as a possible alternative, or at least complement, to drug therapy (cf. Wells et al., 1981). Based on the effects noted here across behaviors, clients, and settings, behavioral procedures could be expected to be successful with many of the problem behaviors for which mentally retarded individuals are placed on medication regimens. As a result, the potential harmful side effects noted with many medications could be avoided.

Finally, in those cases in which medication is determined to be necessary, stimulants should be considered a practical, less intrusive alternative to neuroleptic medications. Their use with severely and profoundly mentally retarded individuals has been limited, and results were mixed with the clients in this study. However, the positive effects observed with Bobby suggest that an evaluation of stimulant medication may be an appropriate first step prior to prescribing neuroleptic medica-

tion. Conducting a stimulant trial seems further warranted when considering the relatively short serum half-life which makes a brief examination of clinical effects feasible.

The evaluation of drug effects in the mentally retarded will continue to be an important area of investigation. This study has illustrated one approach to evaluating psychoactive medication in a clinical setting, and has highlighted the advantages of that approach. Additional research will be necessary to evaluate the effects of other medications with other types of problem behaviors and in less controlled settings.

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