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The Effects of Combining Behavioral Counselling with Nicotine Fading and Smoke Holding in Medically At-Risk Adult Smokers

Terry Steven Bradford
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THE EFFECTS OF COMBINING BEHAVIORAL COUNSELLING
WITH NICOTINE FADING AND SMOKE HOLDING
IN MEDICALLY AT-RISK ADULT SMOKERS

by

Terry Steven Bradford

A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Doctor of Philosophy
Department of Psychology

Western Michigan University
Kalamazoo, Michigan
June 1990
The present study examined the effects of nicotine fading and a taste aversion procedure during behavioral treatment for smoking cessation. Nine subjects were initially assigned to one of two groups. Informed consent and physician waivers were obtained. Behavioral counselling was provided with the objective of subjects becoming self-control agents. After baseline, patients were taught to apply nicotine fading techniques. Subjects also received instruction and practice in goal setting and in using alternative responses, relaxation, and so forth. Three consecutive daily sessions of smoke holding were then done, during which subjects were instructed to stop smoking, followed by maintenance sessions. Results indicated that nicotine fading and smoke holding may be viable techniques when used in conjunction with behavior therapy. A follow-up telephone survey at 2-years 3-months found that one participant had remained free of cigarettes; specific effects on other
subjects' responses were noted. Suggestions were derived and discussed in terms of these results.
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The effects of combining behavioral counselling with nicotine fading and smoke holding in medically at-risk adult smokers

Bradford, Terry Steven, Ph.D.
Western Michigan University, 1990
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Terry Steven Bradford
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CHAPTER I

INTRODUCTION

Consequences of Smoking

Debate continues about the ultimate outcomes of a particular individual's smoking patterns. The evidence strongly suggests that the ultimate aversive consequences of smoking cigarettes increase with the frequency, the intensity, and the duration of nicotine use. The long-term health consequences of smoking are both dose dependent and cumulative: the greater the use, the greater the probability that health problems might occur (Shopland & Bagrowsky, 1986).

Fielding (1985) cited evidence suggesting that 30% or 170,000 coronary deaths per year were directly attributable to cigarette smoking. Up to 30%, or 125,000 of annual cancer deaths are directly attributable to smoking. He suggested that for every cigarette smoked a 25 year-old male can expect to lose about 4.5 minutes of life. For those who have smoked 20 cigarettes per day, this translates to a loss of up to 4.6 years, while for those who have smoked 40 cigarettes per day this formula indicates a potential loss of 8.3 years of expected
longevity. Further, Fielding suggested that U.S. smokers' direct health costs were about $16 billion per year. Indirect losses attributable to smoking in terms of lost productivity, illness, and death were estimated at about $37 billion annually.

Challenges to Smoking

Social and legal changes are afoot. Michigan has recently passed and implemented a highly restrictive anti-smoking bill, the so-called Michigan Clean Indoor Air Act of 1986. It has been unevenly implemented in public meeting places, with the intent of eliminating public smoking. The main effect of such legislation seems to have been that more people are now interested in smoking cessation or, alternatively, have expressed increased interest in learning to control when and where they might smoke.

One important outcome that has occurred since the first report on the health effects of smoking by the U.S Surgeon General was issued in 1963 was that the proportion of U.S. smokers has diminished from about 45% to a current level of about 27% of the adult population, according to the 1979 U. S. Surgeon General's report (U.S. Department of Health, Education, and Welfare, 1979).
Difficulties Experienced in Smoking Control

The previous findings seem to suggest that quitting smoking is fairly easy. Other researchers' reports have reinforced this implication (Schacter, 1977, 1978, 1982; Schacter, Kozlowski, & Silverstein, 1977). Alternative data suggest that persons quitting on their own may represent a different population from those who come to clinics (Cohen et al., 1989; Edwards, 1986; Hunt, Barnett, & Branch, 1971; Marlatt & Gordon, 1979).

For those coming to clinics for help in quitting, it may be more difficult (Edwards, 1986; Hunt et al., 1971). Recent data suggest that though the number of smokers has decreased, consumption per smoker has increased (Shopland & Bagrowsky, 1986). The implication here is that those who have continued to smoke may belong to a group that has repeatedly tried to quit and failed, possibly smoking more and enjoying it less. Those individuals may be more representative of a core group of subjects who have had a much longer history of smoking and, thus, may have been more strongly influenced by the contingencies involved in smoking behaviors. Other possibilities are that the remaining smokers were more resistant to earlier tactical approaches to smoking cessation or that more light smokers quit smoking than relatively heavier smokers.
CHAPTER II

REVIEW OF RELATED LITERATURE

Biobehavioral Model

Current behavioral science writing seems to view smoking behavior as a highly individualized, ritualistic repertoire. It is also thought to be multiply controlled, having components which are both operant and respondent in nature. Described in another way, smoking behavior has been viewed by some as a strongly conditioned "habit" (Lichtenstein, 1982; Marlatt & Gordon, 1979; Pomerleau, 1979) and as a "weak addiction" (Edwards, 1986; Polin, 1982).

Recently, some investigators have proposed the view that smoking behavior can best be understood as a dynamic phenomenon of the interaction between the internal (biological) environment and the environment external to the organism, with relative strength and topography ever changing in relation to changes within and outside of the organism (Edwards, 1986; Polin, 1982; Pomerleau, 1979). The described model has been called a "biobehavioral" model.

A "boundary theory" has been proposed which seems to unify many of the disparate observations of subject
behavior relative to changing levels of nicotine. This theory suggests that nicotine levels are behaviorally maintained within narrow but variable upper and lower limits. When driven either above or below these levels subjects react by consuming greater or lesser amounts of nicotine, respectively (Kozlowski & Herman, 1984).

Siegel (1979) has indicated another source of influence in the development of this highly "addictive" pattern of behavior: its relatively higher resistance to extinction may be partially accounted for by classical conditioning processes. In this formulation very strong symptoms of withdrawal can be seen when the usual predrug cues associated with smoking are no longer followed by the ingestion of nicotine. This extinction procedure produces drug-compensatory conditioned responses which may be the basis for withdrawal symptoms and self-reports of craving (p.164). Many of the anomalies associated with the constructs of addiction and tolerance seem to be more fully explained by such a classical conditioning model.

A large body of research has been done on the reinforcing aspects of nicotine (Orleans, Shipley, Williams, & Haac, 1981a & 1981b). Nicotine is a necessary and sufficient condition for free-operant smoking to continue (Crowley, 1972; Gritz & Siegel, 1979; Jarvik, 1973; Lichtenstein, 1982; Rogers, Wilbur, Bass, & Johnson, 1985). The reinforcing value of nicotine may or may not
require operations to establish its initial effectiveness as operant reinforcement, though its effectiveness as reinforcement is certainly open to manipulation (Hutchinson & Emley, 1985).

These findings are provocative and seem to suggest more intense scrutiny of tactics and strategies pertaining to smoking behavior, prevention, cessation, and relapse control (Lichtenstein, 1982; Marlatt & Gordon, 1979; Orleans, Shipley, Williams, & Haac, 1981a).

Treatment Strategies

Various treatment strategies based on a biobehavioral model have been derived. Some of these have included self-management and habituation of smoking behaviors (Pomerleau & Pomerleau, 1984), nicotine fading (Foxx & Axelroth, 1983; Foxx & Brown, 1979; Prue, Scott, Martin, & Lomax, 1983), shock aversion therapy (Azrin & Powell, 1968); and, taste aversion using cigarette smoke and consummatory responses as the foci of treatment.

So-called "rapid smoking" techniques have been the focus of many studies (Danaher, 1977a & 1977b; DeRicco, 1977; DeRicco, Brigham, & Garlington, 1977; Erickson, Tiffany, Martin, & Baker, 1983; Hall, Sachs, Hall, & Benowitz, 1984; Lichtenstein, 1971; Lichtenstein & Glasgow, 1977; Poole, Sanson-Fischer, & German, 1981; Poole, Sanson-Fischer, German, & Harker 1980; Raw &
Russell, 1980; Russell, Wilson, Patel, Cole, & Feyerabend, 1973), as has smoke holding as part of taste aversion conditioning (Kopel, Suckerman, & Baksht, 1979; Tori, 1978), both producing variable results.

More recently, the combination of nicotine fading and either rapid smoking or smoke holding has been attempted with some success (Lando & McGovern, 1985).

In many of these approaches the main tactics and strategies have relied on training the subject to act as his or her own therapist. These have culminated in requiring the subject to reduce the effects of the environmental control on smoking by narrowing "stimulus control" (Nellis, Emurian, Brady, & Ray, 1985), by directly reducing the number of cigarettes smoked by subjects graphing their data and using formal problem-solving strategies (Foxx & Axelroth, 1983; Pomerleau & Pomerleau, 1984).

**Titration Effects**

Some recent research in the areas of nicotine maintenance suggests that by simply decreasing the number of cigarettes the organism's nicotine levels decrease, evoking counter changes in smoking topography. The way in which the cigarette is smoked actually changes, with an increased puff duration, frequency, and velocity. This results in stabilized or slightly increased nicotine blood
levels over a reduction in number of cigarettes (Benowitz, Jacob, Kozlowski, & Yu, 1986; Chait, Russ, & Griffiths, 1985; Lombardo, Davis, & Prue, 1983; Ossip-Klien et al., 1983; Prue, Scott, Martin, & Lomax, 1983).

Problems may be generated in programmed attempts to change smoking because subjects tend to respond as total systems to any changes. That is, while one aspect of the system changes in a desired direction, other aspects may change in undesired ways. Reductions in nicotine levels often lead to compensation in smoking behaviors, increased emotional responding, dropping out of treatment, and general noncompliance with the treatment regimen. A growing body of literature seems to suggest that attempts at nicotine withdrawal can and do have such iatrogenic effects on subject behavior (Benowitz et al., 1986; Hatsukami, Hughes, & Pickens, 1985; Kozlowski & Herman, 1984; Rogers et al., 1985; Siegel, 1979).

With respect to nicotine withdrawal, the "titration-effect" tends to maintain a relatively constant band-width of nicotine in the body. Rapid increases or decreases out of this band seem to produce aversive effects, leading to a variety of countering behaviors. The subject of unplanned nicotine withdrawal may adjust to downward nicotine titration by drawing harder, drawing longer, drawing more frequently, covering the aerodynamic air holes used by some manufacturers to ventilate the
cigarette, pinching the butt end of the cigarette, smoking the cigarette to the very end of the tobacco, smoking more cigarettes, or relighting the cigarette, to describe a few possibilities (Benowitz et al., 1986; Gritz & Siegel, 1979; Raw & Russell, 1980; Russell et al., 1973).

Nicotine Fading

One group of techniques which has shown great promise is the straightforward approach of gradually fading the reinforcing stimulus while managing the presence of stimuli, evoking subject behavior while withholding reinforcement. In this case "nicotine" is the stimulus being faded. Nicotine fading has been approached in several ways. First reported on was the tactic of switching cigarette brands (Foxx & Brown, 1979). A second approach involves the use of a needle or pin to ventilate the butt end of the cigarette by adding holes to the distal end of the cigarette filter. A third approach involves the simple tactic of drawing a ring around the cigarette and discarding the cigarette when that ring is burned (Hyde, Anderson, Davis, Higgins, & Johnson, 1986).

A fourth nicotine fading procedure was developed based on the previous observations of countercontrolling responses. Nicotine fading was accomplished by the use of direct instructions to subjects about their smoking behaviors (Chait et al., 1985; Frederiksen & Simon, 1978).
In this approach subjects were coached, while they smoked, on the depth of puff, frequency, and duration of puffs. Since this tactic was devised as a laboratory approach to the solution of a side-effect problem, it relies on the use of pressure transducers and computers to assess these behaviors, though direct observation is possible.

Assessment Methods

Utility of the pressure transducer and computer as an applied or clinical assessment device is diminished by the increased time, high cost, inconvenience, relatively low portability, and distortion of the repertoire under study (i.e., "reactivity"). Some research has indicated that self-observation can improve the utility of such assessments in the treatment of smoking, but limitations occur frequently due to the unreliability of unaided self-observation (Fremouw & Brown, 1980; McFall, 1977; McFall & Hammen, 1971).

Despite these problems self-observation remains a cornerstone of any attempts to use self-control strategies, though the use of biochemical assay has also become a mainstay in the measurement of patient compliance (Gordis, 1979; Kozlowski, 1983; Orleans & Shipley, 1982). The accuracy of self-reports has been bolstered by the use of blood and breath analysis (King, Scott, & Prue, 1983). Chemical verification has also been bolstered by the
arrival of lower cost tests for nicotine, its metabolites cotinine and thiocyanate, and cheap, portable machines for carbon monoxide testing (Hughes, Frederiksen, & Frazier, 1978).

Increasing Treatment Compliance

Several techniques have been used to improve the general utility of self-observation of smoking behavior and the assessment of therapeutic progress and outcomes.

First, accurate training of subject behaviors is important. By using videotape a permanent record of highly relevant behavior patterns can be made for study and subject training. Videotape provides an opportunity to study the behaviors in greater detail. Videotaped smoking episodes could lead to improvements in reliability measures and reductions in reactivity.

Second, collection of physiological data such as carbon monoxide and body fluids can improve both the reporting and adherence to the regimens, in addition to providing supportive evidence for changes in smoking patterns (Glynn, Gruder, Jegerski, 1986; King et al., 1983).

Third, instructing subjects that certain procedures will yield certain types of data can produce a "bogus-pipeline" effect (Glynn et al., 1986; Murray & Perry, 1987). For example, subjects could be instructed that a
procedure has been developed which allows for very accurate assessments of smoking behavior based on observations of cigarette filters (Kozlowski, 1981; Kozlowski, Rickert, Pope, & Robinson, 1982). Subjects so instructed tend to report use patterns in more detail and with greater reliability.

Fourth, having subjects indicate which significant other might provide collaborative evidence may also strengthen the reliability of self-reports.

Fifth, the use of behavioral contracts and response-contingent deposit return contracts have been successfully used in the past to increase the likelihood that self-reports are done (Follick, Fowler, & Brown, 1984; Paxton, 1980).

Finally, using standard forms for self-observation could also improve the ease with which subjects note smoking and related variables and, thus, might improve the reliability and validity of the assessments.

Changing Topography

Research on topography suggests that it is susceptible to control by instructions, that it can be modified across behaviors, and that results are favorable for generalization and at follow-up (Frederiksen, Miller, & Peterson, 1977; Frederiksen & Simon, 1979; Mellis et al., 1985). It is noteworthy that as well as having been
used successfully to modify topography, instructions have also been used to initiate brand switching and improve generalization (Frederiksen & Simon, 1978), as well as modifying puff size and volume (Zacny & Stitzer, 1986) and location (Jason & Liotta, 1982).

**Taste Aversions**

Four types of taste aversion punishment techniques (rapid smoking, smoke holding, satiation, and rapid puffing) have been used clinically along with behavioral cessation instructions.

The first technique, "rapid smoking" has been attained by therapist-mediated coaching (Lichtenstein & Glasgow, 1977). Coached "rapid smoking" involved drawing on a lit cigarette, inhaling more deeply at rates much faster, and retaining smoke within the subject's lungs for much longer periods than a particular subject's typical baseline rate. Under rapid smoking conditions subjects have been instructed to take a "large" puff and inhale about every 6 seconds. For comparison, the "standardized" smoking machine performance is a 2.5 second puff every 60 seconds, with a volume of about 35 ml (Kozlowski et al., 1982).

Subjects typically presmoked one cigarette at their own pace, followed by an episode of rapid smoking, followed by a five minute no-smoking period, followed by
several repetitions of rapid smoking and no-smoking. This continued for thirty minutes or until the subject refused twice or became nauseated (Lichtenstein & Glasgow, 1977). As with other taste aversion techniques, the effectiveness of rapid smoking was enhanced when it was used in conjunction with other treatment approaches. Initial success rates have been fairly high but tended to drop off over time (Poole et al., 1981). Other researchers have found this group of tactics to be not as effective when compared to the outcomes reported by earlier reports (Lichtenstein & Danaher, 1976).

Reviews of later, less successful studies of rapid smoking suggest that they did not follow Lichtenstein's earlier protocol (Danaher, 1977a). The important parts of the earlier protocol seem to be regular private or small group sessions, clinic-based treatment, continuous treatment to "time" and/or "refusal" criteria (Lichtenstein & Brown, 1983; Lichtenstein & Danaher, 1976).

Another problem seems to have been that the earlier studies failed to classify smokers by their respective initial baseline nicotine ingestion rates. It might be expected that those ingesting greater amounts of nicotine over relatively greater periods, and over more varied conditions would have behavior occurring at greater strength, under more varied stimulus conditions, and have
greater resistance to response reduction techniques, if the nicotine-as-reinforcement model holds.

The second tactic, nicotine satiation, less often used, involved having the subject continue smoking at a normal rate but required to smoke another cigarette upon completion of the previous cigarette. In common language, subjects were required to "chain smoke" for several hours at a time. Some "marathon" sessions have continued up to 18 hours (Hall et al., 1984; Lichtenstein & Glasgow, 1977).

A third tactic, smoke-holding, though not often reported in the literature, has been the source of impressive results (Kopel et al., 1979; Lando & McGovern, 1985; Tori, 1978). Smoke-holding was thought to derive its effectiveness from the conditioning of taste aversions, which are said to be very resistant to extinction (Baker, Cannon, Tiffany, & Gino, 1984; Logue, Logue, & Strauss, 1983).

Treatment by smoke holding involved having subjects hold smoke in their mouths without inhaling for 30 to 60 seconds. They were coached to hold the smoke before exhaling. Within 10 seconds they were required to take more smoke into their mouths. Finally, after several minutes they expelled the stale, smokey air from their mouths. Obviously, this technique would not work well with subjects who have been unable to breathe air through
their noses. Regardless of this, the results of smoke-holding, when used in conjunction with other tactics has yielded cessation rates of 44% at 12 months (Lando & McGovern, 1985) to 66% at 6 months (Tori, 1978).

A fourth variant, rapid puffing, has recently been reported in the literature (Erickson et al., 1983). Rapid puffing is the practice of having the subjects draw very frequently on the lit cigarette without actually inhaling the smoke. In that research trial subjects were exposed to either rapid smoking, rapid puffing, or behavioral counselling. Though rapid smoking produced the greatest improvements, the results reported for rapid puffing were also favorable.

Recent research suggests taste-aversion learning as a possible mechanism for the reduction in drug ingestion, and avoidance of nicotine consummatory behavior in cigarette smokers (Baker et al., 1984; Erickson et al., 1983; Logue et al., 1983). All four of the described variants have in common that they have involved the application of taste aversion training to eliminate cigarette smoking with variable success, depending on the application processes. The advantage of all of these aversives has been their contiguity with smoking responses. Presumably, this contiguity could increase the effectiveness of smoking cessation efforts.
The major disadvantage of the first two tactics, rapid smoking and nicotine satiation, is that they could lead to nicotine poisoning. Being no small threat due to the relative toxicity of nicotine, researchers have suggested various tactics to ensure the safety of subjects. The fear has been that some subjects might develop cardiac arrhythmias from exposure to excessive nicotine levels during the rapid smoking procedure (Lichtenstein & Danaher, 1976). For this reason rapid smoking has not been considered as an alternative in this study.

Though arrhythmias have never actually been reported for rapid smoking (nor for smoke holding), a variety of precautions have been suggested for studies using such procedures. Recent studies have suggested a simple screening that has been found to be useful with this problem (Dawley & Dillenkoffer, 1975; Lichtenstein & Glasgow, 1977), while others have provided reassurance that the rapid smoking has risks and benefits even for cardiac patients given appropriate precautions (Hall et al., 1984; Poole et al., 1980).

The end result of these exclusionary factors is that a large group of people with these problems has been excluded from treatment research, though probably not from treatment with rapid smoking. The disadvantage of rapid smoking and nicotine satiation--tremendous increases in
noxious stimulation resulting in arrhythmias and fainting—has been overcome by the use of smoke-holding and rapid puffing since nicotine is not inhaled into the lungs (the major site of transport). Since relatively smaller amounts of nicotine are transported orally, the likelihood of nicotinic poisoning is diminished.

Treatment Complexity

Reports of success and failures have been mixed across the applications of both single treatment strategies and the application of multicomponent packages, though multiple component treatment packages have exhibited a definite edge in cessation and relapse rates.

The trend in recent reports seems to be towards the application of multiple treatment packages (Foxx & Axelroth, 1983; Lando & McGovern, 1985). Given the continuing high relapse rates, the need for the development of effective treatment continues to take precedence over the need to find specific mechanisms involved in each component found in such packages (Yates, 1975).

A second concern leading to an increased use of multicomponent packages has been expressed by Foxx and Axelroth (1983), admonishing therapists to provide alternatives and choices to patients rather than simply applying aversion therapy. A hierarchical approach, using
a "least restrictive treatment" model may help ensure that patients receive only the treatments necessary.

Purpose of the Study

The primary purpose of the present study was to evaluate the effects on smoking of combining behavioral counselling with smoke holding and nicotine fading in patients with potentially high-risk medical factors.
Subjects

Nine adult smokers (5 females: SK, MI, TO, JW, and PW; 4 males: VS, FM, JM, and RM) were enlisted through a clinic newsletter circulated to present and former patients, and hospitals and physicians throughout the metropolitan Detroit, Michigan area of over 4 million residents. The enlistment information included a brief discussion of health problems associated with smoking, the difficulties inherent in smoking cessation, and requesting participation by subjects who had previously had difficulty in attempts at cessation. Due to time constraints the first 9 subjects meeting research requirements were selected for participation and medical histories were taken by a registered nurse.

Subjects could have been screened out on the basis of whether they could attend 12 weekly group sessions and could respond to follow-up inquiries, though none actually were excluded for this reason. Others were screened out if any history was found of recent unstable medical conditions such as a recent heart attack,
carcinoma, or advanced chronic obstructive pulmonary disease (COPD) was evident.

A final screen out was done on the session following the presentation of the informed consent. Subjects could have been dropped from the study based on a total absence of self-collected records during baseline. Lack of records during this period has been found to be a potential indicator of poor compliance (Stalonas, Johnson, & Christ, 1978).

Subjects ranged from 39 years to 64 years of age. All were employed, except one laid-off quality control technician (subject FM), with several owning their own businesses (subject JM, SK, RM, and MI). All subjects were judged to be middle to upper middle class by a combination of income and education.

Subjects FM, PW and SK were morbidly obese, with FM having sleep apnea and SK having severe cardiac arrhythmias. Subject TO had been diagnosed as having Buerger’s disease, an obliterative disease characterized by inflammatory changes in small and medium-sized arteries and veins which is seen most often in smokers. This condition often leads to the rapid development of gangrene. VS indicated that some loss of breath had been recently noted during mild activity. Other subjects appeared to be asymptomatic for smoking related problems.
Subjects were randomly assigned to separate groups prior to orientation and requested not to communicate with members of alternative groups. Interview with subjects suggested that they were unaware of members in the other groups which met on a schedule of alternate days and times.

For inclusion subjects were to be smoking 10 or more cigarettes per day for more than 1 year. The reported range was from 15 to 55 years and 20 to 80 cigarettes smoked per day.

Subjects were assessed, though not excluded based on a five factors questionnaire offered by Dawley and Dillenkoffer (1975). These authors have suggested the following criteria be met by subjects: be in good physical health, not be significantly overweight, have no past nor present cardiovascular disease, blood pressure should be within normal limits, and they should be less than 40 years of age. Assigning a 1-point value to each of these factors yields subject scores as follows: SK, PW, and TO = 0; FM, RM, and JM = 1; VS and MI = 3; and JW = 5. Since the major thrust of the present study was the treatment of resistant, higher medical risk subjects, failing to meet the 5-point minimal requirements suggested by Dawley and Dillenkoffer (1975) led to inclusion rather than exclusion, except where medically necessary.
Additional safeguards were positioned. Each subject had a medical history and vital signs taken by a registered nurse experienced in smoking cessation. They also had a three lead electrocardiogram administered by a clinic technician, which was then read by a cardiologist. Other safeguards included the use of an EKG screening by a cardiologist, session-by-session questioning (i.e., anecdotal information, and two mood surveys which will be described later), vital signs (BP, HR, plus respiratory carbon monoxide), and having a physician on-call 24-hours per day, and a 1/2 hour "cool off" after smoke holding. These were done as to help reduce possible health problems associated with smoking cessation.

Though subjects were fully informed about the treatments and side effects, they were not informed about the intent to study their cigarette ingestion patterns during nicotine fading. Informed consent was obtained following two 1-hour orientation meetings, which were segregated by treatment groups. During that period subjects reviewed American Lung Association literature (Hyde et al., 1986), were instructed in the intended procedures, had the procedures modeled, and had all of their nonmedical questions answered by the author. Following this a 24-hour "cooling off" period was done to reduce pressures to participate. Other procedural safeguards included having their own physician release
them for participation in the study, and obtaining permission to use the present protocol from the human subject review committees of both William Beaumont Hospital in Royal Oak, Michigan and Western Michigan University in Kalamazoo prior to initiating the treatments.

Setting

All instructional sessions were held in a group meeting room within the Clinics of Nutritional and Preventive Medicine, William Beaumont Hospital. Due to restrictions imposed by clinic policy the conduct of videotaped smoking sessions was restricted to a ventilated stairwell (dubbed the "stairwellness lounge").

Research Design

Subjects were initially divided into two concurrent groups, both groups receiving similar treatment in the same order, but on a staggered time schedule. The "multiple-baseline across groups" design (Hersen & Barlow, 1976; Kelly, 1980) has also been called a "time lagged control group" design (Campbell & Stanley, 1966). Within this design one group of subjects receives treatment while the second group serves as a control. The intent was that after the first group received treatment, the second group was to receive treatment similar to, but delayed from that
provided to the other group. However, due to illnesses, unscheduled business trips, and "subject mortality" the design was modified to a multiple baseline across subjects. In this design all subjects received all treatments. Another modification to the design was made by having the subjects adhere to a changing criterion requiring incremental reductions of nicotine (Hartman & Hall, 1976; Hersen & Barlow, 1976).

Procedure

Within the present study subjects observed the following protocol. All subjects had their personal physicians sign and return a form indicating active consent for their patient to participate in the smoke holding treatment. This added step was taken though the health risks of this technique were thought to be extremely low in comparison with other taste aversion techniques.

A constructional approach to treatment was taken to guide the development of the treatment regimen (Delprato, 1981; Goldiamond, 1974). Initially, subjects were asked a series of questions to help develop an individualized program. For example, subjects were asked to describe what would be successful outcomes for each of them. They were asked why they were interested in starting now and what strengths on which they could build. They were also
asked to consider the types of changes they had been able to make in the past. They were asked to consider any problems which had been mastered in the past and whether these improvements had been maintained at the time of the session. They were also asked to describe how their problem may have been a source of reinforcement for each of them.

Typical responses suggested that the cost in dollars and some anticipated health problems were the reasons for cessation. Except for VS, no subject linked a current health problem to the reason for quitting at that time, despite some very real smoking-related health problems observed in some of the other subjects. Other subjects indicated a perceived loss of control or the insistence of some significant other as the impetus to change (e.g., physician, spouse, co-workers). All subjects indicated having short periods of success in the past with smoking cessation, but an inability to design an environment supportive of maintained cessation. Another issue evoked from this discussion involved the anger and hostility which each subject experienced while cigarette-free for short periods of time. All subjects indicated that, while smoking was itself reinforcing, escape from difficult, monotonous, or boring situations was equally important and probably reinforcing. Curiously, only one of the subjects, JM, described physical activity or any other
activity (e.g., hobbies) as a regular part of his life. Most described their work as their major outlet.

Subjects were taught to develop a set of personalized, self-described goals from the previous assessment (Locke, Shaw, Saari, & Latham, 1981). Typical goals included the improved stress handling and coping with problem situations, more free cash, develop alternative responses and activities (e.g., walking, reading books at the library, swimming). Some subjects indicated a desire to lower blood pressure, maintain weight, and improve breathing. These goals were then reviewed and feedback was given to help the subjects make each of their goals more measurable. For example, a subject indicating that she would like to feel better in the morning, might then indicate that she would like to get up without having to clear her throat and sinuses of sputum. A subject indicating that he would like to be able to walk up stairs without being out of breath, would have to indicate, incrementally, how many steps would be climbed and when each improvement would occur.

Within the present self control model the study population learned over 6-7 weekly sessions to apply a "problem solving model" and to collect specific, relevant data. To assist them in taking the desired steps a memory device or mnemonic was used to help them remember and apply the steps. Each of the letters in the mnemonic,
"SCIENCE", stand for a specific step: "S" suggests that the subject was to "specify the problem," "C" was to "collect the data," "I" was to "identify patterns," "E" was to "examine possible solutions," "N" was to "narrow options and experiment," "C" was to "compare and contrast current and past data," and, finally, "E" was to "expand and revise." This was presented to them in a lecture and discussion format, with the experimenter initially providing examples and vignettes for role-playing and skill development.

To strengthen subjects' behavior change, relapse prevention training was done by providing vignettes, and following these with relevant modeling and role-reversals (Marlatt & Gordon, 1979). For example, the group might be given the following vignette and asked to demonstrate an alternative coping strategy: "your boss, who never asks you into her office, does so and asks you to have a cigarette (which she also usually never does)." The subject demonstrated a coping method and then received praise and feedback from the experimenter and the group members.

Alternative responses and stimulus control management were developed for each person based on analysis of their records, as were self-reinforcement and self-talk. For example, subjects indicating that certain television shows with cigarette smoking characters caused them to want a
cigarette would learn to avoid the show, go for a walk, or read the newspaper at that time. Some care was taken so as to not eliminate reinforcing events from each of the subjects' lifestyles without substituting other reinforcing events.

Assertion and the relaxation response were described in lecture format, then modeled and practiced. Each of the subjects were given individual feedback and reinforcement for improvements in acceptable examples of assertion. The full relaxation response protocol was practiced during the first part of two sessions, while shortened versions of the relaxation response were practiced at the beginning of each session (Benson, Greenwood, & Klemchuk, 1975). Subjects were also encouraged to begin a walking program based on recommendations provided by Franklin and Rubenfire (1980), emphasizing relatively slower repetitive exercises carried out over a relatively longer duration about 3-4 times per day.

To improve compliance to the self-control model, which emphasized strengthening each subject's "self-controlling repertoire," a refundable deposit of $50 was obtained. These were collected in the form of five $10 checks made out to an agency or individual least desired by the payor (e.g., an ex-husband). Checks were voided based on performance of pre-specified target responses
(e.g., record keeping, coming to groups, doing homework, switching brands). Failure to meet contract requirements resulted in the deposit being sent to the recipient specified on the check. Subjects were notified in advance that the deposit's return was not based on successful smoking cessation. All counselling groups after the sixth session dealt with identifying and solving continuing problems.

They were also instructed to apply nicotine fading techniques so that their estimated nicotine intake decreased roughly in three steps of about 30% (i.e., 30%, 60%, 90%) while each subject's cigarette count remained about the same following recommendations by Foxx and Axelroth (1983). Nicotine fading was accomplished by a combination of cigarette brand-switching and adding ventilation holes. Brands were assigned based on estimates provided by the Federal Trade Commission (1981). Subjects were given a choice of any brand that fell within their self-assigned nicotine range. At the point at which nicotine could no longer be conveniently decremented, subjects were instructed in the use of a pinhole "ventilation" technique.

On the first day on which ventilation took place subjects continued to use their latest brand. At that time they used a standard seamstress' pin to puncture their cigarette three times near the base of the cigarette.
where the filter and the tobacco join. Holes were added until the nicotine fading objectives had been achieved.

During this period subjects were instructed about problems with behavioral compensation and specific tactics to use to control for this tendency. For example, on how to use Kozlowski’s (1981) filter inspection method to assess their smoking intensity and how to decompensate for filter patterns indicating "oversmoking" (e.g., put the cigarette down between puffs; not covering the holes; noticing increased heat with oversmoking).

After completing nicotine fading, each subject was exposed to taste aversion training consisting of three consecutive daily sessions of one-half hour exposure to smoke holding conditions. The first day of smoke holding was also designated as the "quit day."

**Phases**

Each subject was exposed to four phases.

**Baseline Phase**

The first phase was baseline which was one week duration for subjects initially assigned to group one. Baseline was about four weeks duration for those initially assigned to group two. During this phase subjects received general information about smoking, discussed
their smoking experiences, and had videotaped observations made of their smoking behaviors and related data.

An electrocardiogram was scheduled at a time convenient to subjects and staff. Orientation information, copies of the informed consent and release documents were distributed and discussed during the first session. Subjects were requested to not smoke for 60 minutes prior to arriving for any of the following sessions. They were also taught to keep records using the antecedent-behavior-consequence format using a preprinted form.

Subjects wrote individualized deposit-return contracts which specified the return of records and samples of smoked cigarettes and empty cigarette packets, completion of assignments, and prompt attendance. The $50 deposit was required the following week in the form of five $10 checks made out to an undesired group or individual.

All subsequent sessions began with assessment of vital signs. That is, weight, heart rate, and blood pressure, collection of expired respiratory carbon monoxide, and blood samples for nicotine/cotinine assessment were taken. This was followed by a 20-minute videotaping of smoking behavior. Following this, vital signs and expired respiratory carbon monoxide were done again. Alveolar carbon monoxide was assessed using the
method suggested in the manual provided with the carbon monoxide breath analyzer (see below).

Following that time a "cooling off" period of about 20 minutes was scheduled prior to any scheduled departure; this was done to reduce potential problems with balance and nausea. From that point on subjects also completed two surveys to assess possible changes in self-observed private events.

Nicotine Fading Phase

The second phase used a combination behavioral education, counselling and problem solving to modify smoking. These were done along with the main treatment of nicotine fading. Subjects were taught to develop short-term goals, identify and develop alternative responses, identify environmental controls (stimulus control) and develop coping strategies, identify stressors and counter-strategies. Additionally, subjects developed a group "quit day" with special emphasis placed on the importance of fulfilling this commitment.

Nicotine fading steps of 30%, 60%, and 90% were planned based on estimated nicotine intake per cigarette. Subjects whose cigarette brand's nicotine levels were too low to allow for another brand switch were instructed to perforate the cigarette three times near the point at which the tobacco joined the filter. Subjects were
requested to make the first cut on the first week of the current phase, with additional cuts requested at about two week intervals thereafter.

They also had portions of the $50 deposit returned in five steps. Each of the four checks were returned while they completed the nicotine fading steps and the last check was returned during taste aversion training.

**Taste Aversion Phase**

In the taste aversion treatment phase, subjects began "smoke holding" on the final day of the nicotine fading. Three consecutive days of smoke holding were done. Subjects were provided paced instruction to draw and hold cigarette smoke in their mouths for up to thirty seconds without inhaling, but were not required to redraw every 10 seconds. They then were allowed 30 to 60 seconds between puffs. This continued until 30 minutes had passed or the subject was unable to continue. Subjects who quit smoking during this period were required to finish all three sessions of smoke holding. All subjects received the instruction "stop smoking and do not smoke between sessions."

**Maintenance Phase**

The maintenance phase lasted 3 consecutive weeks followed by one monthly meeting. During each of these in-
house sessions, all subjects attending received behavioral counselling relevant to abstaining from cigarette smoking. The active experiment was considered finished when all subjects had all treatments and attended at least one follow-up session.

Follow-Up Phase

Follow-up telephone contacts were made at about 2-years 3-months after maintenance had ended. Subjects were questioned as to their smoking habits, health, and to obtain feedback about the treatment they received and the residual effects of treatment, if any.

Dependent Variables

Dependent variables in this study were categorized as: smoking responses; health responses; and survey responses.

Smoking Responses

Self-Reported Smoking Frequency

Daily records of smoking events were collapsed into weekly frequencies for each subject.
Cotinine and Nicotine

Blood serum cotinine and nicotine were taken on several occasions, though the cost was high at about $25 per sample. Blood samples were drawn by certified laboratory technicians, who then spun down and extracted the serum. Serum samples were then sent to Toxicology Laboratory Center, 5836 Executive Drive, Lansing, MI, 48911, phone 614-889-5091 for photospectrometric analysis.

Videotaped Smoking Frequency

Each inhalation and exhalation of smoke from a lit cigarette was counted as one puff.

Compliance

Compliance was rated negative when subjects failed to turn in or show proof of completion of homework, nicotine fading steps, empty packs and smoked butts, or record keeping.

Health Responses

Body Weight

Body weight was obtained in pounds on an electronic medical scale capable of accurately measuring up to 1000 pounds.
Alveolar Carbon Monoxide

Expired respiratory carbon monoxide was taken at the beginning and end of smoking sessions following the procedure described by the manufacturer, using a Mini-CO Breath Analyzer (available through Catalyst Research, 3706 Crondall Lane, Owings Mills, Maryland, 21117; 1-800-851-4500). Initially subjects were instructed to exhale then inhale and hold their breath for 8 seconds. Following this, they expelled about one-half of their remaining air. Subjects used the remaining breath to then inflate a balloon attached to the monitor. Carbon monoxide was then analyzed by the monitor.

Heart Rate

Heart rate was taken as the wrist pulse rate per minute which was counted for one full minute.

Mean Average Pressure

Following a recommendation by Yates (1980, pp.179-182) the mean average blood pressure was computed using the formula $MAP = DAP + (.33 \times (SAP - DAP))$, where $DAP$ is diastolic blood pressure and $SAP$ is the systolic blood pressure. This $MAP$ approximates the average blood pressure at all times between the Korotkoff sounds.
Profile of Mood States

The Profile of Mood States (McNair, Lorr, & Droppleman, 1971) is a 65-item key-word survey with responses made on a Likert-type scale (see Appendix A). It appears to assess changes in subjects' verbal behavior, specifically assessing tacts or observations which subjects make about their internal states. The assumption underlining the survey is that, generally, the subject is thought to be reporting greater mood disturbance as the total score increases. It is divided into six factors: tension-anxiety, depression-dejection, anger-hostility, vigor, fatigue, and confusion-bewilderment. The POMS was applied on several occasions during baseline and during treatment by having the subjects score each item as it applied to them over the previous week. Following recommendations provided by McNair et al. (1971, p.9) a "Total Mood Score" was computed by simply summing across all six factors, weighting "vigor" negatively. Scores were used only to assess possible changes within subjects; no attempt was made to compare these to the standard scores since the "norms" were based on inpatient psychiatric populations.
Shiffman Withdrawal Questionnaire

The Shiffman Withdrawal Questionnaire (Shiffman & Jarvik, 1976) is a 15 item questionnaire (see Appendix B), which the author has implied can predict successful withdrawal from overused substances (Shiffman, 1982, 1984, 1986; Shiffman & Jarvik, 1976; Shiffman, Read, & Jarvik, 1985). Since claims of this type are in dispute at this time no attempts were made to predict subjects' cessation (Hughes & Hatsukami, 1986; Kozlowski & Wilkenson, 1987; Lombardo, Hughes, & Fross, 1988). Rather, the survey was repeatedly administered to assess changes within subjects. As with the POMS, relatively higher total scores on the Shiffman Withdrawal Questionnaire (Shiffman & Jarvik, 1976) suggest more problems with staying away from cigarettes.

Reliability

Survey Scoring Reliability

Survey reliability was assessed by allowing one of the observers to randomly draw several completed surveys from each subject's file and then having them rescored by one of two volunteer reliability observers. One of the observers was a masters-degreed, practicing behavioral psychologist and the other a school principal possessing a juris doctorate. Reliability observers were shown the
method of scoring each of the items on the surveys and then allowed to score surveys without conversing with the author. A total reliability score was computed simply by dividing the smaller total by the larger and multiplying by 100%. The range of scores were 99% to 100%, with 27 of the 28 surveys rescored at 100%.

Smoking Sessions Reliability

Five videotaped smoking sessions were scored for puff frequency and session duration by the trained behavioral psychologist. Tapes were selected at random by "fast forwarding" the videotape and stopping when the observer indicated to stop. Each session was scored for reliability, resulting in a range of 84% to 97%.
CHAPTER IV

RESULTS

The overall results of the present study are straightforward. Of the 9 subjects initiating treatment, two dropped out before treatment commenced while 6 completed all phases of treatment and two subjects were cigarette free at the end of the maintenance period. The fine grained physiological changes and results at the second year, though encouraging are more complex and are reviewed at a later point in the present paper.

Three subjects dropped at various stages in the study. The initial drop out was due to subject PW’s schedule conflicts regarding the times for group assignment. A second subject, SK, dropped before treatment was initiated based on findings of medical problems and advice of her physician to quit smoking immediately.

The third subject dropping from treatment, FM, did so after completion of the first session of smoke holding due to reported resumption of sleep apnea. Earlier written commentary by this subject indicated reluctance to continue cessation efforts and growing conflicts with
his wife; he had also indicated that he had joined treatment at his wife's behest.

Subject VS provided an unpredicted response pattern: he stopped smoking at the point in time which he had agreed to join the study. After what he described as a 55 year history of heavy smoking he stopped completely without actively participating in the nicotine fading nor smoke holding, though he was present and actively participated during all behavior therapy groups.

Visual inspection of the graphically presented data for subject VS suggest an orderly though small reduction in health parameters, with the exception of measured levels of alveolar carbon monoxide which dropped so low that these became unreadable (see Figure 1).

VS reported no negative emotions and only minimal "withdrawal" effects, which also seem to be confirmed by his performance on the POMS and Shiffman Withdrawal Questionnaire (see Figure 2). Interestingly, he remained cigarette free throughout the rest of the study as measured by the blood levels of nicotine and cotinine, alveolar carbon monoxide.

At the second year follow-up VS indicated that though he had not had to use the nicotine fading and smoke holding, the behavior therapy program had helped him to remain cigarette free during the critical period.
Figure 1. Changes in Health Measures for Subject VS.
Figure 2. Changes in Mood and Withdrawal Survey Scores for Subject VS.

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Of the remaining five subjects only one subject (20%) finished treatment showing orderly reductions in all measures of smoking behavior.

Visual inspection of JW's data (Figure 3) suggests close compliance with all parts of the program producing orderly reductions in nicotine, cotinine, and alveolar carbon monoxide. Comparisons of Figures 3 and 4 suggest variability in mean average blood pressure and heart rate may be occurring in relation to titration. Increasing body weight appears also to have been reactive to reductions in nicotine and cotinine. This subject's self-reports of difficulties during the nicotine fading and prior to the smoke holding, also measured by the POMS and Shiffman surveys were also indicative of some reactivity to reductions in smoking and possibly to reductions in nicotine (see Figure 5).

At two months post-treatment blood testing indicated that JW continued to remain cigarette free and she also indicated feeling emotionally stablized.

At the second year follow-up JW indicated having returned to smoking during a period when her mother was undergoing a heart bypass. Interestingly, JW reported that the three-day smoke holding has had residual effects in that she no longer smoked high nicotine cigarettes and became nauseated whenever higher nicotine cigarettes were
Figure 3. Changes in Smoking Responses for Subject JW.
Figure 4. Changes in Health Measures for Subject JW.
Figure 5. Changes in Mood and Withdrawal Survey Scores for Subject JW.
smoked. She also indicated that she would be reducing and eliminating cigarettes with a fixed target date.

Results for the other five subjects were less straightforward as pertains to their participation and resulting attempts at cessation. While the male subjects FM, JM, and RM all showed orderly decreases in nicotine, cotinine, and alveolar carbon monoxide during nicotine fading none was deemed to be totally compliant to the record keeping requirements while fading nicotine. Interestingly, all kept adequate records during their respective baselines followed by major disruptions during nicotine fading.

Visual inspection of JM’s data suggest several interesting relationships relative to the effects of nicotine fading. Figure 6 suggests that as nicotine and cotinine reduced so did the reported frequency of smoking. Interview with JM suggested that his records were accurate when they were being turned in, including five weeks of full baseline recording. Subject JM had cut the number of cigarettes smoked by about two-thirds, contrary to instructions to not cut the number of cigarettes. It should also be noted that he apparently began downward titration during baseline but did not meet the criterion for reducing estimated nicotine levels. Alveolar carbon monoxide was drastically reduced during nicotine fading.
Figure 6. Changes in Smoking Responses for Subject JM.
Figure 7. Changes in Health Measures for Subject JM.
Figure 8. Changes in Mood and Withdrawal Survey Scores for Subject JM.
while MAP increased somewhat then decreased during fading. Heart rate showed a similar pattern (see Figure 7). Figure 8 data suggest that JM was also reporting some related problems with stress in relation to cessation efforts.

At second year follow-up, JM indicated that he had stopped smoking on several occasions during the previous two years but had always resumed smoking within 2 weeks. A lasting effect which he noted was the nauseating taste of higher nicotine cigarettes and his continued use of lower nicotine cigarettes.

The experience of RM was only slightly different than that of JM in that RM's treatment by nicotine fading was interrupted by a three week hiatus due to an unplanned business trip. During this period RM did not keep records though he indicated that he had continued to use reduced nicotine cigarettes and to take care not to smoke "too hard." Figure 9 lends support to his self-reports of maintained reductions in nicotine levels while away.

Other than dramatic decreases in alveolar carbon monoxide few changes were noted in other physical measures of weight, heart rate, or mean average blood pressure (see Figure 10). Interestingly, POMS and Shiffman scores suggested that RM was having fewer problems with "moods" but more problems with self-observations of "withdrawal" as nicotine fading proceeded (see Figure 11).
Figure 9. Changes in Smoking Responses for Subject RM.
Figure 10. Changes in Health Measures for Subject RM.
Figure 11. Changes in Mood and Withdrawal Survey Scores for Subject RM.
Two year follow-up with this subject also indicated several intervening attempts to stop smoking and a strong residual effect of the three-days of the smoke holding procedure. That is, RM also reported some distaste with smoking higher nicotine cigarettes, choosing rather to continue to smoke lower nicotine cigarettes.

Inspection of FM’s graphically presented data suggest a similar pattern as observed with JM and RM, though data presented in Figure 12 suggest an early decline in smoking frequency followed by a rapid increase in frequency not paralleled by cotinine levels. Decreases in alveolar carbon monoxide were also observed to coincide with reductions in cotinine, while heart rate and mean average pulse pressure were somewhat variable and divergent from each other (see Figure 13). Weight remained relatively stable. Figure 14 data suggest self-statements of mood and "withdrawal" from cigarettes were changing. These observations happened to coincide with self-reports of increasing emotional distress, culminating in termination of treatment after the first smoke holding session (which also included the instruction to quit smoking).

At second year follow-up FM indicated having made no attempts to stop smoking during the intervening period and to continuing to smoke the higher nicotine cigarettes without problems.

Visual inspection of the data derived for subject MI
Figure 12. Changes in Smoking Responses for Subject FM.

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Figure 13. Changes in Health Measures for Subject FM.
Figure 14. Changes in Mood and Withdrawal Survey Scores for Subject FM.
suggests some divergence in physiological measures. Comparison of Figures 15 and 16 suggests that as nicotine and cotinine levels increased alveolar carbon monoxide first increased then decreased, with mean average blood pressure and heart rate showing a marked decrease followed by a rapid increase and decrease. Body weight also rapidly increased as nicotine fading progressed. This subject reported a great deal of stress while undertaking the nicotine fading program, which may be partially reflected in rapid increases in POMS scores during that portion of the program as seen in Figure 17.

Though rapid decreases in reported frequency and estimated nicotine content of reported brands coincide with each other, these are not easily reconciled with the observed increases in blood levels of cotinine (see Figures 15 and 16). Follow-up with MI at the second year resulted in her indicating that she had been accurately reporting her smoking frequency and estimated nicotine levels, suggesting either that she may have been smoking the cigarettes more intensely or may have not been reporting her smoking accurately. This subject also reported repeated attempts at cessation during the intervening two-year period without success. She also indicated no effects from the smoke holding procedures. In other words, she was smoking exactly as she had prior to joining treatment.
Figure 15. Changes in Smoking Responses for Subject MI.
Figure 16. Changes in Health Measures for Subject MI.
Figure 17. Changes in Mood and Withdrawal Survey Scores for Subject MI.
The absence of nicotine and cotinine data for the period following the initiation of nicotine fading limits some of the findings for subject TO as does the absence of brand types and smoking frequency, though some data suggest a partial effect of the program (see Figure 18). Inspection of Figure 19 suggests increasing problems with self-observations of mood states and some variability in the data derived from the "withdrawal" survey. Substantial reductions in alveolar carbon monoxide were also noteworthy (see Figure 18). Examination of the extended baseline data suggests that this particular subject may have been noncompliant during this phase, possibly "jumping the gun" and initiating her own treatment program resulting in a rebound effect. Interestingly, at the second year follow-up this subject reported no interest in attempting smoking cessation, while also reporting her reluctance smoke higher nicotine cigarettes and choice of smoking lower nicotine cigarettes.
Figure 18. Changes in Smoking Responses for Subject TO.
Figure 19. Changes in Mood and Withdrawal Survey Scores for Subject TO.
Figure 20. Changes in Health Measures for Subject TO.
CHAPTER V

DISCUSSION

Results of this study are similar to those found in other studies. About 67% of the present population or 6 of 9 completely finished the phases including nicotine fading and smoke holding, though one of these subjects quit smoking at the time that he was asked to join the study. Of the remaining five, one subject (11% of the original sample) stopped smoking while three of the remaining subjects' physiological data indicated that subjects had been compliant with the nicotine fading portions of the program.

Assessment of the extent to which subjects followed procedures suggested that these subjects were not compliant with portions of the data collection procedures. Other studies have found that noncompliance in self-assessments often is predictive of noncompliance with other procedures within the program.

Some loss of treatment control might be explained by the ineffectiveness of the deposit contract. Subjects indicated that the threat or loss of the deposited checks was insignificant in all subjects except JW. Quite
possibly the loss of $10 is much too small for subjects from a higher socioeconomic group. The use of a deposit indexed to the subjects' income could help to reduce this problem. On the other hand it is quite possible that a larger deposit could in fact increase the drop out rate proportionally.

Another source of problems was the length of the extended baseline and relatively longer period of time associated with stepped reductions in nicotine. A possible resolution to this in future studies would be to have more sessions within a week and reducing the nicotine reduction steps to once per week.

Another problem observed in the present study was the use of contingencies to increase compliance with a second-order operation. That is, subjects were paid to reduce an estimated amount of nicotine. Other research shows that contingencies tied to some observable event, whether it be carbon monoxide (Stitzer, Rand, Bigelow, & Mead, 1986) or exceeding a predetermined number of cigarettes (Singh & Leung, 1988), tend to be much more effective in reducing targeted physiological responses and collateral operant behavior.

Interestingly, information gathered at over two years post-treatment indicated some residual effect of smoke holding, i.e., distaste and retained brand levels with lowered levels of nicotine. Subjects indicated that they
felt good about the supportiveness of the program, though they uniformly thought it should have been extended in number of sessions. Extending the length of treatment would be beneficial in terms of providing support during follow-up treatment.

Subjects seemed to also benefit from the instructions to modify smoking parameters while in nicotine fading, and may have benefitted especially from the "butt analysis" method to assess their own intensity. Most subjects appeared to be following the instructions relative to nicotine fading, though most also seemed to rush the treatment as recommended causing some rebound problems. An alternative explanation exists for the subjects' nicotine titration: self-monitoring seems to have been closely associated with reductions. When self-monitoring deteriorated, the performance of the subjects on other treatment recommendations also tended to deteriorate. Self-recording may have caused the subjects to reduce their nicotine content in various ways and to follow the program. The stoppage of self-recording may, in turn, have caused the reversal of this treatment effect.

Future research should focus on strengthening the contingencies related to compliance by specifying reductions in first-order operations, such as carbon monoxide, though the use of estimated nicotine levels may be conceptually helpful. A study of the parametric
effects of increasing the monetary value of deposit contracts with indexing to socioeconomic status may also be in order. Studies which have relied on students have often overlooked this variable, and may have relied more on setting events for effectiveness (e.g., experimenter who is also the professor). Finally, more research needs to be conducted with medically at-risk and treatment resistant patients to develop more effective treatments for them, including extending maintenance. Extending maintenance could provide sufficient support to the process of smoking cessation to help strengthen repertoires possibly necessary for permanent cessation.
Appendix A

Profile of Mood States
Sample Words List
Profile of Mood States
Sample Words List

<table>
<thead>
<tr>
<th>POMS FACTORS</th>
<th>SAMPLE WORDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tension-Anxiety</td>
<td>Tense, Shaky, Uneasy</td>
</tr>
<tr>
<td>Depression-Dejection</td>
<td>Unhappy, Sad, Helpless</td>
</tr>
<tr>
<td>Anger-Hostility</td>
<td>Angry, Bitter, Furious</td>
</tr>
<tr>
<td>Vigor</td>
<td>Lively, Active, Alert</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Weary, Fatigued, Bushed</td>
</tr>
<tr>
<td>Confusion-Bewilderment</td>
<td>Confused, Muddled, Efficient</td>
</tr>
</tbody>
</table>

Appendix B

Shiffman Withdrawal Questionnaire

Sample Questions
Shiffman Withdrawal Questionnaire
Sample Questions

If you could smoke freely, would you like a cigarette this minute?
Are you thinking of cigarettes more than usual?
If you were permitted to smoke, would you refuse a cigarette right now?
Do you miss a cigarette?
Do you have the urge to smoke a cigarette right now?
Are your hands shaking right now?

Appendix C

Protocol Approval Letter From the Human Subjects Institutional Review Board
TO: Terry S. Bradford
    Paul Mountjoy
FROM: Ellen Page-Robin, Chair
RE: Research Protocol
DATE: July 6, 1987

This letter will serve as confirmation that your research protocol, "Running Head: An evaluation of the effects of a multiple component treatment program, using nicotine fading, behavioral counselling, and a taste aversion procedure ("smoke holding") on the modification of cigarette smoking and related behaviors in two groups of adult smokers," has been written off by the HSIRB as complete.

If you have any further questions, please contact me at 383-4917.


The effects of an incentive procedure. *Journal of Consulting and Clinical Psychology, 52*, 139-140.


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