A Meta-analysis of Psychotherapeutic Interventions for the Cessation and Reduction of Smoking

by

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A thesis
presented to the University of Manitoba
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy
in
the Department of Psychology

Winnipeg, Manitoba, 1984

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ABSTRACT

The modification of habitual cigarette smoking has become the focus of considerable research activity in the past 20 years. Recent reviews of this literature appear to concur on a number of points. These are: that methodological weakness has flawed much of the research; that relatively few effective treatment strategies have been developed; and that aversive and multicomponent techniques, although apparently less effective than self-initiated cessation, are demonstrably more effective than most other psychotherapeutic strategies. Otherwise, the intensive investigation in this area has produced only an often conflicting and highly variable body of findings.

Recently, a number of authors have questioned traditional reviewing strategies, arguing that quantitative reviews produce more highly specific and often more accurate conclusions particularily with a large body of studies where conflicting findings are present. The present study is a quantitative integration of the smoking cessation literature based directly on outcome measure. Although virtually all researchers in the area of smoking modification have employed similar outcome measures (what percentage of subjects are still smoking and at what rate), highly variable and of-

ten inadequate follow-up periods are endemic to the literature. This variability in time of measurement, in conjunction with a typically marked decay of treatment effects over time, make any direct comparison across studies exceedingly difficult. Comparison was facilitated, however, by deviating individual outcomes from the predicted decay curves for smoking and abstinence rates.

Using this technique it was found that, on average, the smoking cessation programs reviewed were modestly successful at inducing abstinence, yet quite unsuccessful at decreasing smoking rate among non-abstainers. The strategies and psychotherapeutic conditions found to be most conducive to successful cessation were, in order of importance: the use of booster sessions, satiation (increased baseline smoking), rapid or regularly paced aversive smoking, continued therapist contact during treatment, the use of cognitive strategies, and hypnosis. Other behavioral and self-control techniques, the use of corroborative evidence, and the year of publication were all found to be unrelated to reported abstinence.

ACKNOWLEDGEMENTS

I would like to thank my advisor, John Schallow, both for the initial suggestion which led to this analysis, and for his continued support of my work. I would also like to thank John Lind, whom I relied heavily upon for his knowledge in multivariate analysis. In addition, I would like to extend my thanks to the other members of my committee; John Conway, John Adair and Joe Kuypers, as well as my oral proposal "shadow"; Terry Hogan for their helpful criticism.

Finally, and perhaps most importantly, I would like to thank Lynne Feehan for her continuing patience and understanding.

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INTRODUCTION

Habitual cigarette smoking has, in the past 20 years, become the focus of considerable research activity (see Lando, 1980; Lichtenstein & Brown, 1982). The largest share of this research has concerned itself with treatment strategies which are designed to aid those individuals who desire to quit (McFall, 1978). The relative prominence of this area of concern appears primarily attributable to three interrelated factors. The first of these factors is the widespread occurrence of smoking and almost equally widespread desire to quit smoking. In Canada, approximately 40% of adults smoke daily. Of these smokers, approximately one-third made some attempt to quit or reduce consumption during 1978 or 1979 (Statistics Canada, 1981). In terms of population then, well over two million Canadians attempted to reduce their habit at sometime during these years, yet are still smoking.

The second factor encouraging research is obviously interrelated with the first. Smoking poses a serious risk to health. Epidemiological and experimental evidence clearly implicate tobacco consumption as a factor in the development of a host of diseases including but not limited to cardiovascular disease, chronic bronchitis, emphysema, and carcinoma (Bernstein & McAlister, 1976).

Finally, smoking appears to lend itself quite readily to empirical investigation. The act of smoking itself is an easily definable and readily observable behavior (Paxton, 1980) that typically occurs at high levels of frequency (Lichtenstein & Danaher, 1976). Additionally, the problem is not usually highly interrelated with other behavioral or psychological difficulties (Paxton, 1980). These attributes, in addition to the easy identification of the smoking population, greatly facilitate the target behavior research strategy that has previously proven effective in behavioral research (Lichtenstein & Danaher, 1976).

Unfortunately, despite intensive investigation, relatively few effective treatment strategies have been identified. Although a variety of approaches have achieved significant initial reductions in smoking, these reductions have not typically been well maintained over time (Bornstein, Carmody, Relinger, Zohn, Devine & Bugge, 1977; Lando, 1978). This is particularly true of much of the earlier research. Hunt and Matarazzo (1970, 1973), upon reviewing a substantial number of studies, concluded that the relapse rate for those who had quit smoking was relatively independent of treatment mode. While two-thirds of all those treated resumed smoking within three months, only a small residue of nonsmokers remained permanently abstinent. Similarly, Winett (1973) reported that most studies he reviewed achieved abstinence rates of less than 13%.

Half a decade later, Rogers, Deckner, and Mewborn (1978) reported upon a similar situation. They concluded that: (1) there are no differential effects between various treatments, (2) all treatments have only short-term therapeutic effect, and (3) all treatments relapse to pretreatment levels within one year.

Explanations for this high level of relapse generally fall into one of two categories: (1) the nature of the behavior being acted upon, and (2) the nature of the research itself. Hunt and Matarazzo (1970) suggest that the "extinction" of nonsmoking is largely a product of the considerable extent to which smoking behavior is established. They argue that smoking is overlearned to the point where it becomes automatic. That is, it is marked by decreasing awareness and a dependency on secondary, rather than primary reinforcement. As such, smoking itself is highly resistant to extinction. Similarly, Bernstein (1970) points out that smoking occurs under such an array of stimulus conditions and in conjunction with so many secondary reinforcers that it is difficult to specify or control most of the relevant operants.

In addition to its behavioral complexity, cigarette smoking is confounded by physiological variables. Pharmacological evidence strongly implicates nicotine as a primary physiological reinforcer (see Dunn, 1974). Not only is this pharmacological reinforcement powerful, but it acts within

only a brief period (approximately 7.5 seconds) of the smoking behavior (Paxton, 1980). Perhaps, as Paxton (1980) has pointed out, the apparent attractiveness of smoking as a target behavior in research is somewhat deceptive. Smoking does not appear to be the uncomplicated behavior that had initially attracted so many researchers to the area.

The complexity of the behavior is not, unfortunately, the sole reason for the generally disappointing research findings in the area. A number of resarchers have also commented on the generally poor methodology which has marked much of the literature. This is particularly true of the earliest research. In 1969, Bernstein concluded, "[t]he design and methodology employed in most smoking-modification research is so poor that the data generated are not meaningful" (p. 418).

A chief failing of much of the research lies in the inadequate attention focused on long-term maintenance. As Lando (1978) points out, considering the "refractory nature" of smoking behavior, it is unlikely interventions which concentrate on limited treatment elements will ever result in long-term success. He argues that exclusive reliance should no longer be placed on short-term interventions designed merely to eliminate smoking. Unless nonsmoking can be maintained, the clinical utility of any stop-smoking program is greatly limited.

In the last decade, a few treatment packages have been designed which hold out some promise of response maintenance. Bernstein and McAlister (1976) have described two general strategies which appear to have resulted in relative success. That is, they have generally resulted in an elimination or reduction in cigarette smoking for the majority of subjects treated, and have demonstrated improvements in abstinence rates over previously available interventions. The strategies are: "(a) rapid smoking within a positive social treatment context" and "(b) multicomponent interventions which more specifically program the teaching/reinforcement of nonsmoking behaviors along with smoking suppression tactics" (p. 98).

Rapid smoking is a general term applied to a variety of procedures all of which require the subject to smoke a number of cigarettes in rapid succession, inhaling repeatedly at short intervals. One of the most successful of the earlier applications of rapid smoking was the Lichtenstein and Penner (1977) study. Their procedure resulted in an abstinence rate of 54% during short-term follow-up and 36% in a long term follow-up of 2 to 6 years.

Multicomponent strategies are considerably more diverse, but the best of these have produced results comparable to the above rapid smoking procedure. Pomerleau, Adkins and Pertschuk (1978) achieved 61% abstinence at the end of treatment and 32% abstinence at one-year follow-up with a

procedure involving a self-help book, self-monitoring, stimulus control techniques, covert conditioning and intensive follow-up.

According to a recent comprehensive review of the smoking-cessation literature conducted by Peckacek (1979), the above two studies appear to be generally representative of the most successful findings. Although studies such as Lichtenstein and Penner (1977) and Pomerleau et al. (1978) represent a substantial improvement over previous findings, as Pomerleau (1979) points out, 50% recidivism with only 33% long-term abstinenence leaves considerable room for improvement (p. 17). This is especially true given the substantial number of people who appear able to quit successfully on their own (see Peckacek, 1979). As of 1979, fully 22.5% of adult Canadians are ex-smokers. This is nearly 40% of all individuals who have ever smoked. Relatively few of those individuals could have participated in formal cessation clinics.

Schachter (1982), in fact, argues that the rates for successful self-cure of cigarette smoking are considerably higher than any rates yet reported in the therapeutic literature. He bases this conclusion on two studies completed by himself on nontherapeutic populations. He surveyed complete populations from two diverse groups: the staff of a relatively large psychology department, and the residents of a small New England town. He reports successful abstinence

rates among those who attempted to quit of 65.8% and 61.5% for the two groups respectively. In his discussion of these findings, he proposes two possible explanations for the discrepancies between therapeutic populations and his two populations. Firstly, and most probably, those who seek help in quitting are a distinct group from those who do not seek help. Less likely, although not outside of the realm of possibility, smoking-cessation programs may act to prevent or retard successful abstinence. Such a process may occur through reductions in perceived control or perceived self-efficacy by help-seeking smokers.

In some sense, Schachter's (1982) findings should be of encouragement to researchers in smoking cessation. They underline the point that smoking is not an intractible behavior. People have, and do quit. Unfortunately, despite intensive research, satisfactory methods for aiding individuals in the quitting process appear to still elude researchers in the area.

Review of Recent Literature

In the four years since the publication of Peckacek's (1979) review, well over 100 studies have been reported in the literature which have attempted to improve upon previous cessation and maintenance. As no comprehensive overview of this research is available in this literature, I have provided a review of most of these studies below. For an over-

view of earlier studies, I refer the reader to the excellent reviews completed by Lando (1980), Lichtenstein and Brown (1982) and Peckacek (1979).

Research has been conducted on a variety of social, pharmacological, and psychotherapeutic strategies for reducing or eliminating cigarette consumption. In this review, I have been exclusively concerned with psychotherapy programs. I have not dealt with pharmacological strategies nor have I reviewed advertising and education programs. Both these latter have a literature quite distinct from the psychotherapy literature.

Most of the therapeutic strategies I review are behavioral, however, social psychological strategies (e.g., altering subjects' attributions) and hypnotherapy are also represented. I have, for the purposes of organization, divided the review into eleven, somewhat arbitrary, sections.

Hypnosis

Peckacek (1979), in his recent review, described the hypnotherapy literature as chaotic. He found little empirical evidence to support the often high cessation and abstinence rates claimed by some authors, as most of the literature was seriously flawed by methodological weaknesses. The few well controlled studies that had been conducted generally show only minimal long-term abstinence. Consequently, Peckacek supported the notion, first advanced by Orne (1977), that

hypnosis can probably best be categorized as a placebo effect.

Little which has been reported in the literature since Peckacek's review would contradict this conclusion. In general, there has been little improvement in methodological sophistication. In particular, three design flaws appear to reoccur in much of this recent literature. Briefly, these are: (1) failure to use either a control group or a suitable quasi-experimental design, (2) failure to obtain corroborative evidence of subject report, and (3) inadequately brief follow-up periods.

Five studies (Berkowitz, Ross-Townsend & Kohberger, 1979; Javel, 1980; Perry, Gelfant & Marcovitch, 1979; Powell, 1980; and Stanton, 1978) investigated the effectiveness of a single-session hypnotic induction. In varying degrees, each of these studies replicate an earlier study by Spiegel (1970). Spiegel utilized a single session involving formal hyupnotic induction and the provision of three hypnotic suggestions intended for use in later self-hypnosis.

Two of the five studies (Berkowitz, Ross-Townsend & Kohberger, 1979; Stanton, 1978) employ what can only be described as uncontrolled case studies. Stanton (1978) reports upon 75 patients he had treated over a two-year period. After one session, 60% ceased smoking, with 45% of the total group still abstinent at 6 months. The hypnotic technique used by Berkowitz et al., however, was considera-

bly less elaborate than that employed by Stanton. For both of these studies,control conditions were not used, and no attempt was made to corroborate subject reports either through natural environment informants or biochemical tests. Finally, follow-up does not appear to have been conducted on an in-person basis for either of their two studies.

A third study (Powell, 1980) suffers from many of the same methodological weaknesses. Powell investigated the efficacy of a combined program of hypnosis and flooding. Unfortunately, no control group was used, and no corroboration was obtained. The reported abstinence at 6 to 9 months, though, is a disappointing 30%.

Javel (1980) in a somewhat more controlled study conducted a component analysis of hypnotherapy. One-third of his subjects were assigned to a no-treatment control, one-third received a formal hypnotic induction plus suggestions, and the final third received suggestions alone. For the two treatment groups, 60% and 40%, respectively were still abstinent at 3 months. Again, however, follow-up information was obtained by phone with no corroborating evidence. Further, no long-term follow-up was ever conducted.

Three further studies utilized single-session hypnosis. Pederson, Schrimgeour and Lefcoe (1979) followed four non-smoking groups over a 6-month period. The groups were: (1) live hypnosis plus counseling, (2) videotape hypnosis plus counseling, (3) relaxation-hypnosis plus counseling, and (4)

counseling alone. The abstinence rates at 6 months were 53%, 19%, 19% and 13% respectively. The only major limitation to this study appears to be the lack of corrobortative evidence of subject report.

Perry, Gelfand and Marcovitch (1979) reported upon two studies. In the first, single-session hypnosis was contrasted with rapid smoking. In the second, subjects were treated by a combined rapid smoking and hypnosis technique. For hypnosis alone, less than 4% were still abstinent; for rapid smoking, 25% were still abstinent, and for the combined treatment, 24% were still abstinent, all at 3 months. Again, the follow-up period is extremely brief, follow-up was not conducted in person (except for the combined condition) and corroborative evidence was not collected. This final oversight is particularly important as monetary deposits refundable after follow-up were collected.

The only other study to utilize hypnosis was conducted by Glad (1978). He compared group rapid smoking, a self-control "package", an education and support group and a multidimensional program including hypnosis. All conditions utilized multiple sessions and later booster sessions. Of the individuals treated with the hypnotic procedure, 35.5% were still abstinent at 6 months. Unfortunately, follow-up was again conducted over the phone or by mail and corroborative evidence was not collected.

Due to often serious methodological and design oversights, these studies as a whole, add little to the smoking-cessation resaerch. While some of these studies approach the minimal criteria for well controlled resarch, particularly Pederson et al. (1979) and Glad (1978), the majority provide little supporting evidence for the efficacy of hypnotherapy. Even Pederson et al. (1979) and Glad (1978) are somewhat flawed; both use relatively short follow-up periods, and both fail to collect corroborative evidence of subject report. It would appear that Pechacek's (1979) summary of the hypnotherapy literature is equally as descriptive of present research as it was of earlier resarch.

Self-Monitoring

Overall, the methodology of recent learning-based research represents a considerable improvement over hypnotic research (Peckacek, 1979). The strategy of self-monitoring has proved, however, somewhat disappointing. Self-monitoring refers simply to a subject's record-keeping of, usually, cigarettes consumed, or in some cases, "urges conquered." Peckacek (1979) reports that this procedure has rarely produced lasting treatment effects.

A few of the studies that have employed self-monitoring have been published since Peckacek's review. The most recent application of this procedure has been as a no-treatment control condtion. O'Connor and Stravynski (1981), for

instance, employed self-monitoring in this capacity. They report that subjects in this condition continued to smoke at baseline for the entire 8-month period of follow-up.

A few authors have continued to examine self-monitoring as a treatment strategy. Largely, their results have been disappointing. Kilmann, Wagner, and Sotile (1977), for instance, report no significant change in smoking behavior across 89 subjects after four weeks of monitoring.

Chase and Ladouceur (1980) looked at the temporal order of monitoring. They found no significant difference between groups who recorded their consumption before, during, or after the smoking of the cigarette. The follow-up occurred at only one month, yet subjects were smoking at an average of between 69% and 88% of baseline.

Kantorowitz, Walters and Pezdek (1978) looked at positive (number of urges resisted) versus negative (number of cigarettes smoked) self-monitoring, and found no difference in overall success. Unlike the above studies, however, they report what appears to be a substantial decrease in smoking. Smoking at the unspecified follow-up was 40% and 49% of baseline, for the two self-monitoring groups. As no time period was affixed to the follow-up measurement, it is difficult to ascertain whether these results are clinically significant or not.

Schinke, Blythe and Doneck (1978) also examined the self-monitoring of conquered urges. They examined three

subjects, all who had ceased smoking at the termination of treatment. The follow-up indicated that all three subjects were again smoking at one year post-treatment.

Abrams and Wilson (1979) report on the self-monitoring of either cigarette or nicotine, alone or in combination with the provision of health hazard information. The two cigarette monitoring groups reduced to around 70% of baseline. The nicotine monitoring groups achieved far better results with 49% and 38% of baseline smoking for these two groups. Unfortunately, no follow-up appears to have been conducted.

Foxx and Brown (1979) examined four groups which use either or both of nicotine fading and self-monitoring. Nicotine fading is a self-control procedure in which subjects reduce amounts of nicotine smoked according to prearranged increments. Typically, this is done through brand switching. Consistent with previous findings, self-monitoring alone proved incapable of aiding cigarette cessation. In this group, no subject actually quit smoking, nor were there substantial reductions in nicotine consumption.

The combined group (involving both nicotine fading and self-monitoring) was successful. In fact, it was significantly more successful than nicotine fading alone. The authors argue that nicotine reductions were reinforced by the self- recording, thereby increasing those reductions.

In a 30-month follow-up of this study, Foxx, Brown and Katz (1981) report that 50% of the subjects in the combined

group were still abstinent. The remaining 50% were all smoking a cigarette brand with less nicotine than baseline. For a study utilizing long-term follow-ups and reliabiltiy checks of subject report, this condition achieved impressive results. Perhaps further study into combined nicotine fading and self-monitoring is warranted.

Stimulus Control

Stimulus control is a procedure which involves increasing a subject's awareness of both the target behavior and controlling stimuli, and then providing the subject with individualized self-management skills designed to control the target behavior (Peckacek, 1979, p. 20). Because the nature of this approach is gradual rather than abrupt, total cessation is only infrequently reached. A variety of researchers have reported that most subjects are unable to continue gradual cessation below a certain point--usually 10 to 12 cigarettes a day (see Flaxman, 1978). It has been suggested that perhaps at this level of consumption, individual cigarettes increase in reinforcement value to the point where they severely disrupt any cessation strategy (see Peckacek, 1979). Unfortunately, many individuals who fail to achieve total abstinence rapidly return to baseline levels of smoking after treatment has ceased (Peckacek, 1979). Despite these limitations however, Peckacek considered stimulus control to be at least moderately encouraging. A few studies

which rely primarily on stimulus control techniques have been reported since Peckacek's review. Colletti and Kopel (1979) obtained quite good results for a strategy involving a stimulus control treatment program, and a self-monitoring follow-up. Smoking was at only 35% of baseline at one year follow-up. It is possible these results are partly due to a program of regular phone contact between therapist and subject for the entire follow-up period.

Despite the usually rapid return to baseline of most smokers who fail to achieve complete abstinence, some investigators have discussed the possibility of controlled smoking. Two such investigators, Frederikson and Simon (1978) attempted to systematically modify smoking topography (puff frequency, puff duration) nicotine content, and smoking rate in a single heavy smoker. In a sense, their attempt to achieve controlled smoking failed as the smoker quit smoking completely a few weeks after treatment. Prior to abstinence however, significant changes in the targeted behaviors had occurred. Most stimulus control procedures reported in the last three years were merely one part of larger, more comprehensive programs. These studies will, therefore, be discussed in later sections of this paper.

Contingency Contracting

Some authors have utilized self-control procedures (self-monitoring and stimulus control) in conjunction with deposit contracts. In such studies, the subject is required to submit a set sum of money which is refundable upon successful completion of the program. Success is defined variously. Some authors have refunded money to all those who continue to submit records of smoking behavior, regardless of whether they have reduced consumption. Other authors set total abstinence as the sole criterion for refund.

Lindsay (1978) examined a multicomponent procedure involving group support, self-control strategies and contingency contracting. At the termination of treatment, 90% of his subjects were abstinent. Fourteen weeks later, 54% remained abstinent. However, because of the brief follow-up period and absence of information on follow-up procedures, this study is merely suggestive.

Another study which utilized both contracting and self-control procedures did collect long-term follow-up data. Unfortunately, these data were not encouraging. Although smoking had dropped to 30% of baseline at end of treatment, by the one-year follow-up, smoking had returned to 81% of baseline. What makes this study by Brockway, Kleinman, Edleson and Grunewald (1977) of particular importance is the methodological thoroughness. In-person follow-ups, accompanied by corroborating physiological evidence occurred at 3,

6, and 12 months. Glad (1978) also found deposit contracting to be quite ineffective. In fact, at six-month follow-up, hypnosis produced significantly better results than either contracting or self-control. As neither follow-up procedure nor actual figures are given, the reliability of this study is open to question.

A variety of authors have obtained more encouraging reults. Bornstein, Carmody, Relinger, Zohn, Devine and Bugge (1977), for instance, report on a multivariate treatment package which relies primarily upon self-monitoring and contingency contracting. At one-year follow-up, their 8 subjects were smoking an average of 54% of baseline. Paxton (1980, 1981) obtained excellent results in two studies which utilized rapid smoking (an aversive procedure) and deposit contracts. However, the length of the deposit did not substantially alter success rates (Paxton, 1981) and he found no difference between a deposit group and a no-deposit group both employing rapid smoking (Paxton, 1980). The relative effectiveness of Paxton's procedures is most likely due to rapid smoking, and not deposit contracts.

Murray and Hobbs (1981, see also Murray, 1976) examined two types of contract deposits. In the first, subjects were allowed to reward themselves (from monies set aside by themselves at the beginning of the experiment) for each day in which they were successfully abstinent. In the other condition, subjects forfeited money when unsuccessful. A third

group combined these two procedures. Although self-punishment was more successful than self-reward, the combined group proved most successful with a maintained reduction of 10.7 cigarettes per day after 3 months and 16.9 after 3 years.

Two studies have investigated token economies. I include these in this section of the paper due to the theoretical and practical similarities between the two procedures. Barton and Barton (1978) instituted a token economy procedure with a single male smoker, who achieved complete abstinence,and maintained that abstinence over the two-month follow-up. Using a somewhat more methodologically sound procedure, Bermann, Burnett, Maide and Zinik (1980) achieved a 10% abstinence rate at treatment termination. However, reduced consumption and not total abstinence was the intended goal. At the end of treatment subjects were smoking only 35% of baseline, and smoking reductions were apparently maintained over the one-year of follow-up. Unfortunately, neither exact figures nor follow-up procedures were explicitly stated.

Overall, research examining the efficacy of contracting has produced equivocal results. Many of the studies I have reviewed are not methodologically sound, and of the ones that were, conflicting results were obtained.

Aversive Smoking

The results of reseach utilizing rapid smoking have generally been superior from results to any techniques discussed thus far. Rapid smoking is an aversive procedure in which subjects are required to inhale rapidly at very short intervals for a specified number of cigarettes or period of time.

Peckacek (1979) reports that initial research with this procedure produced highly satisfactory results. Although subsequent research produced more qualified successes, rapid smoking still appeared quite promising, particularly when certain conditions were met. Danaher (1977) concluded, upon reviewing the data up to the mid-1970's, that rapid smoking was most effective when a personal relationship between client and therapist was developed, when social reinforcement and positive expectations accompanied the procedure, and where treatment scheduling is individualized or flexible.

In the past three years, rapid smoking and focused or regularly-paced aversive smoking have been well represented in the smoking-cessation literature. Focussed or regularly-paced aversive smoking are both strategies which utilize normal inhalation rates but are otherwise modeled after rapid smoking. Results for both of these strategies have continued to be mixed. At six months, the percentage of subjects still abstinent varies across studies from a low of

17% to a high of 75%. By far the most successful aversive smoking study is that conducted by Lando and McCullough (1978). In what was essentially a replication of an earlier study by Lando (1977), they achieved an abstinence rate of 75%. This finding is consistent with the 76% figure obtained in the earlier study. Both of these investigations employed a broad-spectrum behavioral approach, consisting of focused smoking, increased baseline smoking, contingency contracting, and group maintenance sessions. Increased baseline smoking is a procedure in which a client is asked to smoke usually twice baseline for a period of a few weeks before quitting.

A third study by Lando (1978) failed to replicate these earlier successes. This study was intended as a partial component analysis of the 1977 study. Here, however, an additional preparation phase was added, and booster sessions reduced. Six month abstinence was only 28%. In order to clarify these earlier findings, Lando (1982) also conducted a more elaborate study investigating a variety of factors intrinsic to his multicomponent treatment including the effects of subject preparation, experimenter contact, and a maintained reduction alternative. This later study also overcame some of the methodological limitations of the earlier studies. The first two studies employed only a relatively small number of subjects (34 and 16 respectively) and none of the earlier studies examined abstinence after six months.

As the maintained reduction condition was not successfully implemented, the Lando (1981) study was essentially a 2 x 2 design examining subject preparation and therapist contact. With preparation, minimal contact appeared to produce better results. Abstinence for this group was 71.9%, 52.1% and 29.9% at one week, six months and one year respectively. Intensive contact with preparation resulted in abstinence of 82.1%, 27.2% and 18.4% for the same three periods. These results are somewhat poorer than abstinence rates obtained without subject preparation. With minimal contact, these rates were 63.2%, 30.2% and 29.1%, while for intensive contact, abstinence was 93.1%, 58.5% and 56.3%.

This final condition was essentially similar to Lando's first two studies (Lando, 1977; Lando and McCullough, 1978). Clearly, this is the superior approach. Although it is not surprising that intensive contact facilitates maintenance of nonsmoking, it is not clear why subject preparation has the opposite effect. Perhaps, as Lando (1978) speculates, preparation makes the procedure unnecessarily complex.

To other studies published in the period following Peckacek's (1979) review also employ follow-ups of longer than the conventional 3, 5, or 9 month period. Poole, Sanson-Fisher and German (1981) investigated rapid smoking both as sole treatment, and in conjunction with relaxation and contingency contracting. Abstinence rates for rapid smoking are 52.6%, 26.3% and 25.0% for one week, 6 months and one

year. When combined with relaxation, abstinence is relatively unchanged at 57.1%, 28.6% and 25.0% for the same three periods. Rapid smoking, contingency contracting and relaxation result in similar abstinence rates of 66.7%, 33.3%, and 22.2%. The final group, contingent rapid smoking achieved higher initial abstinence but greater decline. The rates were 82.4%, 17.6%, and 14.3%. Overall, Poole et al. (1981) did not reproduce the strongly encouraging results obtained by Lando (Lando, 1977, 1981; Lando & McCullough, 1978). The difference in general results between the two studies appears reducible to two factors. Firstly, Poole et al. (1981) achieved far lower initial abstinence. Second, one condition of Lando's (1981) study (minimal preparation, intensive contact) produced much greater long-term abstinence than any other conditions in either study, all of which were otherwise approximately equal.

The differences in initial abstinence can probably be explained on the basis of procedural differences. Between rapid smoking sessions, subjects in the Poole et al. (1981) study were encouraged to refrain from smoking, whereas those in all of the Lando studies were encouraged to smoke at least twice baseline. Clearly, the experiences of the two subject groups would have differed significantly prior to initial abstinence.

That Poole et al.'s (1981) data are more consistent with Lando's minimal contact conditions than with his intensive

contact conditions is also not surprising. In the Poole et al. (1981) study, the follow-up period for three of the four conditions was essentially "minimal contact." The sole exception, contingent rapid smoking, involved a great deal of contact initially, but after two months, this too dropped to a low level of contact. It is interesting that abstinence in this group was initially high, but dropped rapidly after three months.

In another study utilizing long-term follow-up, Russell and Raw (1980) achieved poorer results. One of their three conditions employed rapid smoking, the other two utilized cue exposure and simple support respectively. Cue exposure involves exposing subjects to smoking-eliciting stimuli while having them refrain from smoking. Only one of 20 subjects in the rapid smoking condition was still abstinent at 3 months and one year. These extremely poor results may be a product of the low number of subjects who achieved abstinence. Only 19% of the rapid smoking subjects ever reached this stage.

Paxton's (1980) study, published in the same volume, used a remarkably similar procedure, yet obtained quite different results. Paxton (1980, 1981) achieved six-month abstinence rates of between 35% and 45% for a variety of conditions employing rapid smoking and deposit contracts of varying lengths. In the one condition in which rapid smoking was used without a deposit contract (Paxton, 1980) abstinence at

six months was achieved by slightly more than 45% of the subjects. As with Lando's (1981) most successful condition, contact was fairly high during follow-up, with regular meetings throughout the period.

Best, Owen and Trentadue (1978) contrasted rapid smoking and satiation. The satiation condition paralleled Lando's (1981) aversive smoking procedures in that subjects were encouraged to smoke at least twice baseline. Rapid smoking occurred both under supervision and at home on designated dates. The overall abstinence rate at termination was 67%. At six months, this had dropped to 47%. Unfortunately, follow-up was neither in-person nor accompanied by corroborating evidence. Hackett and Horan (1979) conducted a partial component analysis of a comprehensive smoking program. They found focused smoking to be as effective as a combined program of focused smoking, peer and family contracting, thought-stopping, cognitive restructuring and cue-controlled relaxation, and superior to the entire program without focused smoking. With focused smoking alone, 40% of the subjects were still abstinent at 6 to 9 months. They achieved identical results for the entire comprehensive program. Contact during follow-up appears to have been minimal. Hence, this study is somewhat equivalent to Lando's minimal preparation, minimal contact condition which obtained somewhat poorer results (30.2% abstinence at six months, and 30.0% abstinence at nine months).

Four other aversive smoking studies collected abstinence data of sufficient length to be considered somewhat reliable. Saterfield (1978) utilized three follow-up strategies (self-instructions, self-distractions and a discussion control group) in conjunction with a rapid smoking treatment procedure. The follow-up strategies did not produce appreciably different results at the six month follow-up. Smoking at six months was 65%, 56% and 55% of baseline for the three groups, respectively.

Dawley and Sardenga (1977) investigated an aversive smoking procedure that consisted of rapid smoking, warm smokey air, and handling cigarette ashes. At nine month follow-up, only approximately 17% of their subjects were still abstinent.

Danaher, Jeffery, Zimmerman and Nelson (1980) achieved eight-month abstinence rates of 37.5% and 28.6% for a rapid smoking and a regular-paced aversive smoking procedure, respectively. Their entire procedure was multidimensional, that is; relaxation, personal contracting, stimulus control and alteration of self-statements were all also components of the program. The aversive procedure was presented solely by means of audiotape. The overall results are somewhat disappointing especially given that the follow-up figures did not differ significantly from abstinence rates of a no-treatment control (11.8%).

Merbaum, Avimer and Goldberg (1979) reported upon a study which looked at two levels of aversiveness. In the strong aversive condition, rapid smoking took place with a group in small, closed rooms and was followed by covert sensitization. The procedure for the mild aversion group was a relatively typical rapid smoking format. In the strong aversion conditions, 38% were abstinent at six months, while only 17% were abstinent for this same time period in the mild aversion group. As an aside, vomiting during aversive training was found to be related to lowered smoking consumption.

DiClemente (1981) in a condition involving satiation, rapid smoking, and mild electric shock achieved a continued abstinence in 71% of his subjects over a 5-month follow-up period. Poole, Dunn, Sanson-Fisher and German (1982) examined the relationship between subject characteristics on two personality scales and success in quitting smoking. The procedure used was rapid smoking. At six months only 29% of their subjects were abstinent.

Eight other studies published during this period also investigated rapid smoking. In each of these studies, unfortunately, either follow-up was inadequately brief or no follow-up data was provided at all. Those studies that fall into the latter category were primarily found in Dissertation Abstracts International and hence, full data was not available.

Studies that provided follow-up data of only 3 months (Gordon, 1958; Miller, 1978; Poole and Stumbles, 1979) achieved mixed results. Abstinence rates of only 21.4% (Poole & Stumbles, 1980) and 25% (Miller, 1978) resulted from two of the studies. The third (Gordon, 1978) reports 68% of baseline smoking after three months. None of the remaining rapid smoking studies provide quantitative follow-up data.

One other study (Lichstein & Stalgatis, 1980) utilized smoke aversion, but in quite a different way. Couples, both attempting to quit smoking, were utilized for this study. When one member of the dyad smoked, the other member was then required to smoke. The method was termed reciprocal aversion. By six month follow-up, 50% were abstinent.

Other Aversive Techniques

A number of studies have used aversive procedures other than smoke aversion. Lichstein and Sellis (1981) evaluated four different covert sensitization procedures on six subjects in a multiple baseline procedure. All subjects were smoking at the six-month follow-up. Three other studies (Alevy, 1977; Bier, 1978; Emmelkamp and Walter, 1978) all evaluate the efficacy of covert sensitization but fail to provide medium or long-term follow-up data.

Berecz (1979) reports upon a program of wrist-band aversion therapy. Of those who actually used the wrist-band

(only half of the number actually assigned to the treatment group) 57% were still abstinent at one year. However, when all subjects in the aversion group are considered together regardless of whether they had complied, one year abstinenence drops to 39%. Even using the latter figure, these results are impressive. Unfortunately, follow-up was conducted only by phone and no corroborative measure appears to have been used.

Two studies (Lamontagne, Gagnon, & Gandette, 1978; Lamontagne, Gagnon, Trudel & Boisvert, 1978) have investigated the effectiveness of thought-stopping as a smoking cessation technique. In the two studies, thought-stopping resulted in, respectively, 72.7% and 62.5% of baseline smoking at six-month follow-up. This compares to a non-treated control in the first study which was smoking 87% of baseline at six months.

Relaxation Procedures

Because of an accumulation of evidence linking anxiety with smoking behavior (for instance, Schacter, 1976) a number of authors have explored the possibility of including relaxation or anxiety reduction procedures in a comprehensive treatment package. As with many of the techniques described above, the results are somewhat equivocal. Beaver, Brown and Lichtenstein (1981) examined a combined program of nicotine fading and anxiety management. Anxiety management

consisted of two components: relaxation training and covert rehearsal. Although abstinence was not high, 27% in the nicotine fading group and 7% in the combined nicotine fading/ anxiety management group, abstinence was not the central goal of the program. At six months, both groups were consuming less than 50% of baseline nicotine.

Flaxman (1979) utilized a multiicomponent strategy involving self-control and affect management in two separate studies. He reports abstinence rates of 23% and 32% at six months follow-up. Hyner (1979), in what was essentially a case study, reports the attainment of completed abstinence for the single subject he examined. The principal treatment was relaxation.

One of the treatment strategies investigated by O'Connor and Stravynski (1982) involved relaxation, emotional coping and distraction activities. At an eight-month follow-up this procedure had resulted in 18% and 40% of baseline smoking for the two groups examined. The large discrepancy between the groups was predicted by the authors and is apparently based on the personality differences, which marked the two groups. O'Connor and Stravynski had examined high activity and low activity smokers separately. It was the high activity smokers who had evidenced the most dramatic decrease in smoking.

Cognitive Approaches

O'Connor and Stravynski also examined a coverant procedure, in which subjcts were encouraged to examine the relationship between beliefs about the effects of smoking and craving. They were then encouraged to challenge the irrational assumptions underlying the belief and generate alternate hypotheses about coping, which did not involve smoking. This strategy was considerably less successful than the relaxation and distraction procedure. Percentage of baseline smoking at eight months was 87% for high activity smokers and 78% for low activity smokers. On the basis of the labels applied by O'Connor and Stravynski, behavioral intervention (relaxation, distraction) appears vastly superior to coverant intervention (examination and rejection of irrational assumptions). Both of these techniques, however, are clearly cognitive in import.

An increasing number of authors have explored strategies, in an attempt to facilitate long-term maintenance. Below I have listed three such studies. Again, results are somewhat equivocal. Blittner, Goldberg and Merbaum (1978) compared a therapeutic approach which included a cognitive stage designed to establish and reinforce a self-control belief system with a simple stimulus control program. Although they only completed a three-month follow-up, the condition which included the cognitive component appears to have resulted in a considerably higher reduction in smoking. Subjects in

this condition were smoking only 33% of baseline at three months, while simple stimulus control subjects were smoking an average of 65% of baseline. It is interesting that subjects who had completed the cognitive treatment program evidenced a significant increase in internal orientation as measured by Rotter's (1966) internal-external control measure.

Miller (1978) reports upon a program of cognitive restructuring which resulted in a similar outcome to each of three other groups. In all of the groups, success was limited, with around 25% of all subjects abstinent at three months. Garson (1978) reports success, however, with the application of positive imagery, and performance rehearsal of nonsmoking. Sixty-one percent of subjects in this condition were abstinent after three months.

Social Psychological Approaches

Some researchers have applied findings from the social psychology literature to smoking-cessation programs. A number of these studies have attempted to alter subjects' attributions (perceptions of the causes of their behavior). Colletti and Kopel (1979) for instance, found some support for their hypothesis that better maintenance would be achieved by those subjects with a high degree of self-attribution. These results, however, are merely correlational, as degree of self-attribution was an organismic rather than experimentally manipulated variable.

Chambliss and Murray (1979) attempted to maniplate subject attribution in order to see whether maintenance would be affected. In the first of two studies, subjects were led to attribute their withdrawal symptoms to a placebo pill rather than smoking reduction. This manipulation resulted in no significant effect on smoking reduction. In the second study, however, when subjects were encouraged to attribute their successes to themselves, rather than a placebo pill, greater smoking reduction ensued. These results are consistent with Colletti and Kopel's (1979) findings. Kaplan and Cowles (1978) also report having found that individuals who held internally-oriented health locus of control beliefs were more successful than others in maintaining reduced smoking levels.

Similarly, DiClemente (1981) found that individuals who scored relatively high on a measure of self-efficacy were considerably more successful in maintaining abstinence than individuals who had not. Self-efficacy is the perception that one can cope effectively with a particular situation (see Bandura, 1977). This finding, that high self-efficacy is correlated with successful abstinence was supported across three different treatment programs, aversion therapy (satiation, rapid smoking), behavioral management (multicomponent) and self-quitting.

Condiotte and Lichtenstein (1981) similarly found that high self-efficacy was correlated with successful mainte-

nance. They also found that situations in which a subject normally reported low self-efficacy corresponded highly with those situations in which they actually relapsed.

Personality and Situational Correlates of Smoking Cessation

Self-efficacy and perceived control appear to be important components of successful quitting. As measured in the majority of the above studies, these variables constitute organismic variables. A large number of authors have investigated other organismic variables that might possibly interact with success in smoking reduction or cessation. Daughton, Fix, Kass and Patil (1980) examined differences in socioeconomic indicators, psychosocial assets and smoking histories between individuals who had successfully quit smoking and those who had not. All of their subjects had chronic obstructive pulminary disease, a life-limiting lung disorder typically brought on, or seriously excacerbated, by smoking. This study was intended as a replication and extension of an earlier study completed by Dudley, Aickin and Martin (1977). Like Dudley et al. (1977), Daughton et al. (1980) found that pyschosocial assets and smoking history correlated significantly with success in quitting. Unlike the earlier study, however, Daughton et al. did not feel they could support the conclusion that psychosocial assets are the primary factors underlying the ability to quit. In fact, they found no measurement that was able to separate smokers from ex-smokers beyond base rate expectations.

Abramson and Sequest (1978) examined 10 independent variables they believed potentially capable of predicting success in a smoking control program. Although none of the predictor variables were independently capable of predicting success, a regression equation based on the five best predictors accurately predicted direction of change of smoking rate 87% of the time. The variables were, in order of importance; number of driving accidents reported, internal-external control, coffee consumption, ego-strength, and self-acceptance.

Shipley (1981) looked at the effect of follow-up letters as a product of three variables: smoking motivation, muscle tension and health locus of control. Although letters produced no main effect, they did correlate with reduced smoking among those with low smoking motivation, high muscle tension or an external health locus of control. For other groups, smoking actually increased with letter receipt.

Alevy (1977) investigated the relationship between suggestibility and success in quitting smoking. He reports that highly suggestible subjects smoked less than non-suggestible subjects at follow-up. This difference was statistically significant. Similar findings were reported by Perry, Gelfand and Marcovitch (1979).

Although it is difficult to base definite conclusions on so few, diverse studies, it does appear that some organismic and situational variables do interact with success in quit-

ting smoking. This general conclusion is similar to that arrived at by Peckacek (1979) four years ago.

Aspects of Follow-up

Some authors have recently investigated follow-up strategies, often quite independent of the treatment program. Accumulating evidence suggests that both therapist contact and degree of involvement in the follow-up program affect maintenance levels.

Colletti and Kopel (1979, see also Colletti, 1977) investigated three maintenance strategies in their smoking cessation program. In one condition (Modeling) previous subjects were required to act as models for new subjects during a series of group meetings. In the participant-observed condition, previous subjects were asked to participate in these groups but not required to act as models. The final group merely continued to self-monitor cigarette consumption, and were in regular phone contact with the therapist. Surprisingly, at one-year post-treatment self-monitoring subjects were actually smoking less than subjects in either of the other two conditions. Self-monitoring subjects were smoking an average of approximately 35% of baseline, participant observer subjects were smoking 47% of baseline, and modeling subjects were smoking at 56% of baseline.

In a two-year follow-up of this study, Colletti and Stern (1980) found similar results. Self-monitoring and continued

phone contact, with 38% of baseline smoking, appears superior to both modeling and participant observing which were at 67% and 46%, respectively.

In another study, Colletti and Supnick (1980) investigated the role therapist contact plays in continued abstinence. After receiving identical treatment packages, subjects were randomly assigned to either a minimal contact maintenance strategy or a no-maintenance control. Although minimal contact subjects were smoking less at six months, these differences largely seemed to dissipate by the end of one year. Minimal contact subjects were smoking at 44% of baseline, while no contact subjects were smoking at 56% of baseline.

Therapist Contact

The findings of the above studies complement three studies which have investigated amount of therapist contact during initial treatment. Lando (1981) found minimal contact to be inferior to intensive contact for his highly successful two-stage program. The two stages are an aversive smoking treatment package, with a seven-session maintenance program for intensive contact subjects, and a reduced aversive smoking program with only one maintenance session for minimal contact subjects.

Hamilton and Bornstein (1979) also investigated the effect of various maintenance strategies. Those subjects who received treatment were later assigned to one of three main-

tenance procedures: either, no contract, a social support group or a social support group and paraprofessional training. At six months, significant differences existed between these groups. No contact subjects were smoking at 87% of baseline, with 9% abstinent. Social support subjects were smoking at 54% of baseline with 27% abstiennt and social support-paraprofessional training subjects were smoking at 40% of baseline with 36% abstinent. Unlike the Colletti studies, maintenance appears to have improved as the maintenance strategy became more elaborate. Unfortunately, Hamilton and Bornstein (1979) did not conduct a one-year follow-up, so long-term results are unavailable.

Jaffin (1977) reports that when follow-up plans were announced, maintenance was significantly better over four months than when follow-up came as a surprise. He concludes that the mere expectation of follow-up influences outcome. Unfortunately, Jaffin (1977) did not collect data after four months.

Glasgow, Schafer and O'Neill (1981) compared self-administration and therapist-administration of three comprehensive smoking-cessation programs. Over the three programs, there was no significant difference in abstinence on the basis of administration. Although the exact relationship is not clear, amount of contact during the abstinence period appears to facilitate maintained abstinence. Amount of contact during initial quitting does not appear to be as important.

Summary of Recent Literature

Much of the recent research continues to be compromised by the methodological weaknesses that have plagued earlier research. Less than 40% of the studies published since 1976 utilize any sort of corroborative evidence to support subject report. In addition, a large number of studies employ unacceptably brief time periods for follow-up. Yet, an increasing number of methodologically sophisticated studies have begun to appear. I believe that the results of these latter studies have begun to reach some concensus.

Aversive smoking has been demonstrated to be a highly efficacious strategy. Both rapid smoking and increased baseline smoking appear capable of resulting in complete abstinence for a significant proportion of participating subjects. In addition, there is at least tentative evidence that deposit contracts, relaxation therapy, and cognitive interventions may also facilitiate long-term maintenance. Each of these strategies appear most effective when combined in multicomponent interventions. Health information, social support and continued contact as well as the self-monitoring of cigarettes are integral components of most of the more successful strategies. Few encouraging results were produced by use of self-control procedures and quality research on hypnotherapy was simply unavailable.

Although these general conclusions are based solely on research unavailable to previous reviewers, they are largely

in concensus with their conclusions. Peckacek (1979) emphasizes the encouraging results obtained through multicomponent interventions. Although he partially depreciates aversive smoking by suggesting its efficacy may be due to its association with multicomponent techniques, he does note the relative successes in this area. Peckacek also decries the methodological crudity of much of the hypnosis literature, and expresses disappointment in most of the stimulus-control based treatments. Lando (1980), like Peckacek (1979) and myself, describe multicomponent and aversive-smoking techniques as quite promising.

In general terms then, there is some consistency across reviews. This consistency, however, is accompanied by a loss of information. The reviews themselves arrive at their conclusions through strategies of distillation and partial omission. Such a process is necessary because the area, like any large area in psychology, is represented by often highly variable outcomes, and frequently conflicting findings.

Cross Study Data Integration

The results of a study which has employed a novel paradigm, or explored a new content area may be considered to be strongly suggestive of a particular conclusion, but without further substantive evidence would rarely, if ever, be considered as absolute or definitive. Rather, such results us-

ually act to stimulate further research of a similar nature. A definitive conclusion, if reached, would then be based on the emergent findings of the entire body of studies. When knowledge advances in this fashion--on the basis of bodies of literature rather than single studies--how the literature is synthesized becomes at least as important as how the individual results are achieved. Although there have been important advances in the interpretation of individual results (more sophisticated experimental designs, more powerful statistical tools) assessment of research domain has, unfortunately remained largely an art form. Light and Smith (1971) describe the three steps typically involved in traditional research integration. First, relevant studies are gathered together. Next, methodologically inadequate studies are identified and discarded. Finally, the conclusions of remaining studies are subjectively compared in an effort to uncover basic consistencies or trends in the literature.

There are a host of problems associated with such an approach. Firstly, the procedure involves the loss of the majority of available information (Light, 1978). This occurs both through the discarding of studies and through the simplification of potential information in the remaining studies. Secondly, by searching for consistency, inter-study variation is often treated as error, arising out of inadequate methodology rather than, as Light (1978) believes, out of differing circumstances for observation. This has at

least two important consequences. Firstly, by disregarding variation,valuable, perhaps critical information is lost. Secondly, when contradiction is seen as error, contradiction among even the "best" studies (a not uncommon occurrence) acts to erode confidence in the entire area. Light and Smith (1971), as well as Light (1978) quote Mark Twain on this phenomena:

> The thirteenth stroke of a clock is not only false of itself, but casts grave doubts on the credibility of the preceding twelve.
> Twain, Autobiography

A third difficulty associated with the traditional review concerns the subjective manner in which the remaining data is integrated. Recent research has highlighted the difficulties inherent in attempting to subjectively integrate large volumes of information. Elstein and Bordage (1980) argue that reasoning is bounded by the relatively small capacity of working memory. This forces an individual making a decision to select data carefully, process that data serially, and to represent problems in simplified ways. Over the past thirty years, various authors, most notably Meehl (1954) in his seminal work, Clinical Versus Statistical Prediction, have noted that, in fact, people, including experts, are generally not good at integrating large bodies of information. Both Fishoff (1976) and Ross (1976), for instance, in reviewing research investigating common errors made in combining information, report that most individuals underestimate the value of base rate information when new conflicting information is made available.

The final difficulty associated with traditional reviews is a lack of either specific guidelines or commonly understood strategies for conducting a review. "Unlike the standard prescriptions for the researcher, there are no consensually accepted rules for the scholar seeking to determine the convergences and disagreements within the literature" (Fiske, 1983, p. 65). Since procedures for reviewing are rarely articulated, the assumptions and critical decisions upon which the review is based are often unavailable to the reader or even to the reviewer him/herself.

In an attempt to circumvent some of these difficulties, a number of researchers have attempted to use statistical procedures for integrating cross-study data. Although most of these attempts have been quite recent, statistical techniques for summarizing research have been available since the 1930's (Rosenthal, 1980). The most primitive of these procedures is perhaps the "voting" method: subtracting the number of studies that disconfirm the hypothesis from the number that confirm it. Although once common, this procedure is no longer widely in use. Rosenthal (1978) has described a variety of more sophisticated techniques, including combining $\underline{Z}$ scores, $\underline{t}$ scores and/or probability levels. Most recently, many of the published quantitative reviews have utilized some common scale (which defines the relative outcome of each study or condition with a single real number) as the dependent variable in a regression equation developed

from the characteristics of the individual studies (Glass, 1978). Glass (1976) has dubbed this procedure, "meta-analysis", as essentially what is being done is the analysis of analyses. Presently, the combination of effect sizes, along with the combination of significance levels are the most commonly employed meta-analytic procedures (Stuebe & Hartman, 1983).

The goals of both traditional and quantitative reviews are essentially identical: the reduction and interpretation of an abundance of information. The advantages of successful employment of a quantitative strategy are simply that the methodology of review is better articulated and less intuitive, and the amount of information that can be adequately and accurately considered is greatly increased. A well articulated methodology has a number of advantages. Decisions are less likely to be made without awareness that a decision has been made, or more likely, without awareness of the implications of the decision. Since the decision is explicit, the reader can re-evaluate that decision him/herself. Future reviewers have both guidelines and perhaps better insight into potential pitfalls. Finally, the types of information that are particularly useful are highlighted for future researchers. This final advantage is not trivial. Glass and Kliegl (1983) argue that the documented literature often fails to allow for between-study comparison, due to a failure to report much of the critical information.

Equally as important as the above advantages is the increased capacity to deal with information. A quantitative review makes it possible for more studies to be closely examined (rather than simply catalogued or ignored) and a consideration of more than just the general issues and outcomes of each study. A reviewer could consider, in a standardized fashion, each of, say, 30 different factors over 300 different studies. Such attention to detail is beyond the scope of most traditional reviews. It is this increased precision that is often cited as the most important advantage of a quantitative review.

The quantitative review, or meta-analysis, is not however, a panacea for all the weaknesses of traditional reviewing. The quantitative reviewer must still employ judgement in choosing and operationalizing variables to be considered, and in utilizing statistical tools perhaps not intended for this sort of population. As Stube and Hartman (1983) point out, quantitative review involves both the problems of a more traditional review, and a unique set of statistically-based problems. Inferential statistics were designed for use on representative samples. There is some question about the "representativeness" of published studies. Research producing non-significant results tends not to be published, as does research that contradicts or debunks current scientific thought (cf. Stube & Hartman, 1983).

As important is the issue of completeness and accuracy of reported results. Procedures as well as results are often imprecisely reported[1]. Meta-analysis, as with any statistical technique produces precise numbers. Such precision may be unjustified when the original data fails to even approach the same level of accuracy.

A further criticism that has been directed at meta-analytic research concerns what is perceived as an overly general, insufficiently flexible orientation. In what is perhaps the most influential quantitative review to date, Smith and Glass (1977) conducted a meta-analysis of psychotherapy outcome studies by combining effect sizes in order to compare different types of therapy. Rachman and Wilson (1980) argue that the type of information this study has produced (for instance, the average effect sizes of four general "types" of therapy) is far too general to be of use in evaluating therapeutic efficacy. They reiterate Paul's (1967) call for research evaluating specific treatments, for specific problems, in specific populations. In many ways, however, Rachman and Wilson's (1980) criticisms are specific to the particular publication they address; that is Smith and Glass (1977). In a later publication, Smith, Glass and

[1] A difficult dilemma is posed when a study reports simply that "no significant difference was found on the three outcome measures between confrontive and noncontrontive psychotherapy", when both the p level and nature of the confrontive/nonconfrontive dichotomy is left undefined. To assume that "non-significant" means p=.50 is merely a guess, yet to discard the study further biases the representativeness of the sample.

Miller (1980) provide much more highly specific information including, for instance, the relationship between various measures of methodological sophistication and outcome success. That information which they failed to provide was generally unavailable in the literature. Even here, Smith et al. (1980) act to pinpoint those specific areas in which more research should be conducted, or more information should be recorded.

A further criticism of Smith and Glass' (1977) study is concerned with their use of all available studies regardless of quality. This policy of throwing all studies into one big stew, regardless of methodological sophistication, has been criticized quite vigorously (see, for instance, Eysenck, 1978; Frank, 1979). Glass and Smith (1977) have defended their research primarily on two grounds: (1) there is a low correlation between overall effect size and degree of internal validity, and (2) eliminating weak studies also eliminates a large portion of the total information available. Landman and Dawes (1982) have reconducted Smith and Glass' (1978) analysis on a subsample of the original body of studies, including only those studies judged to be appropriately controlled. They conclude that their re-analysis consistently supports the conclusions drawn by the original authors, Smith and Glass. Glass and Kliegl (1983) also point out that by eliminating some studies a priori, a researcher loses the opportunity to empirically study the ef-

fect of design flaws--rather than just debate them. If design flaws are critical they will correlate with study outcome, and can therefore be dealt with statistically.

Meta-analytic strategies appear to present a number of advantages over traditional reviews, particularly where a large number of studies are to be considered. Although there are difficulties inherent in the use of such an approach, these difficulties are generally well articulated and are therefore probably more avoidable or controllable than would be the case with a traditional review.

Meta-Analysis and Smoking Cessation

Given the quantity of recent research in the area, the smoking cessation literature appears to be an ideal candidate for a quantitative review. In fact, the smoking cessation area is in many ways better suited for meta-analysis than is the more diverse and considerably more variable psychotherapy literature evaluated by Smith and Glass (1977). The vast majority of studies in the smoking cessation literature use the identical outcome measure (is the person smoking, and if so, at what rate). The strategies used are generally well defined and finite, and finally a number of recent, extensive traditional reviews (Lando, 1980; Lichtenstein & Brown, 1982; Peckacek, 1979) are available for comparison purposes.

Because of the existence of a common dependent measure original data may be used. This allows a somewhat more direct comparison of individual conditions than does the effect size technique. This is particularly important when various treatment strategies are directly compared without reference to either a placebo or control group. In fact, most researchers in the area use this technique. Lando (1981), for instance, compares four quite elaborate treatment strategies in order to investigate the effects of subject preparation, and experimenter contact. With Smith and Glass' technique, this excellent study would have to be discarded.

Unfortunately, although virtually every researcher has reported either follow-up smoking rate in comparison to initial smoking rate, the percentage of individuals smoking at follow-up, or both pieces of information, they have done so over greatly variable time periods. Many studies report results only for the end of treatment and a brief follow-up (say, three months) while others report results that only begin at six or 12 months follow-up. Given the deteriorating curves typically found over time in abstinence and percentage of baseline smoking measures, it is obviously impossible to directly compare outcome measures based on differing time periods. To select only studies reporting information at certain time periods would result in a massive loss of information.

Fortunately, measurements taken at different time periods can be compared by calculating their average deviation from the average or expected results for each time period. In order to make such calculations, I have developed a non-linear regression model describing the average percentage of baseline smoking over time for all treatment groups. A similar model was developed for percentage of subjects abstinent. The models which were eventually employed were those that had the smallest mean square residual. The average outcome for treated subjects rather than all subjects was utilized to construct the regression lines so that one would be able to readily to differentiate those studies which produced better than average results from those that produced poorer than average results without having to conduct further data transformation. Regression models for control conditions were also developed for comparison purposes.

For the purposes of developing these models, as well as for all later analyses, individual conditions were weighted by the number of subjects who participated in that condition. This was necessary as the number of subjects per condition varied from one to well over 100 in the sample I utilized. Although this procedure violates the assumption of independence of observation, this violation is less extensive than similar violations allowed by Smith and Glass (1977). In fact, Landman and Dawes (1982) list five distinct types of violation of independence committed by Smith

and Glass. Landman and Dawes (1982) re-examined Smith and Glass' data controlling for violations of independence. They obtained results complementary to the original analyses, and therefore argue that the type of analyses conducted are relatively robust in respect to such violations. Despite the reassurances of Landman and Dawes (1982), any comparisons between treatment strategies were interpreted carefully in light of the partial violation of independence between conditions.

For the next step of the analysis, each condition was individually compared to the regression lines developed on the treatment conditions and an average residual or average distance from the line was calculated. This produced two real numbers describing the relative success of each study. The first number reflects the relative reduction in baseline smoking; the second reflects the relative percentage of abstinent subjects. Next, these two common scales were checked to determine whether homogeneity of variance existed across time periods. The common scales were then used to calculate the correlation, and partial correlation of each independent measure (e.g., type of treatment, amount of contact) with the relative efficacy of a condition.

Because of the controversy over the use of quality versus all data (see Eysenck, 1978; Glass & Smith, 1978), individual studies were coded for methodological sophistication. Stube and Hartman (1983) discuss three types of validity

that should be considered when evaluating the quality of an individual study to be included in a meta-analyses. These are conceptual, methodological and statistical validity. The concern with conceptual validity is related to the fact that similarily labelled treatments or programs may not test the same underlying process (Stube and Hartman, 1983). Fortunately, as I have restricted myself to a highly specific content area, I was able to use more numerous and exact categories than would otherwise be possible. I will be contrasting, for instance, nicotine monitoring and cigarette monitoring rather than behavior therapy and client-centred therapy. As a result, conceptual validity is probably less of a concern than with many of the earlier meta-analyses. Unfortunately, the more specific and perhaps more valuable information, of personality, social, and topographical differences in smoking were not included in this analysis. Although I agree with previous researchers (see Peckacek, 1979) that these variables are important, too few studies have considered them. I cannot review what has not been researched. I would hope, however, that if in five or ten years a similar review is being proposed, a central concern will be client-specific and situation-specific variables.

The major methodological variables of concern in the present meta-analyses are: length of follow-up, use of appropriate control and placebo groups and the use of adequate measures to cross-validate subject report. Essentially, the

first two of these three concerns are controlled by the nature of my analysis. Rather than utilize individual treatment-control comparisons, I have combined all control groups which will then serve as a basis for comparison. If an individual study has failed to utilize a control group, the outcomes of this study are still usable. The strategy I have previously described for controlling for length of follow-up effects has enabled direct comparison of studies with markedly divergent follow-up periods. The final methodological concern, use of corroborative evidence, was coded as an independent variable across all studies. In this way, the effect of failing to include such a measure was directly examined. Because I have not considered either probabilty levels or various inferentially derived statistics, the statistical validity of individual studies is of lesser concern than would otherwise be the case. Due to concerns with the non-representative and non-independent data I am utilizing, virtually all analysis will be of a descriptive rather than inferential nature.

My study is primarily exploratory -- descriptive rather than inferential. Consequently, the development of hypotheses was in many ways inappropriate. However, I hypothesized that there would be a clear, clinically-significant difference in the relative outcomes of control and treated conditions. I also anticipated that corroborative evidence would be a relatively unimportant variable but that other-

wise the general thrust of my findings would be consistent with prior qualitative reviews.

METHOD

Procedure

All studies listed under the subject heading: 'Tobacco smoking' in Psychological Abstracts for the five-year period from July, 1977 to July 1982, inclusive, comprised the initial data source for this analysis. The initial boundary date of this analysis was based upon two considerations. In 1979, Peckacek conducted an exhaustive review of the literature in this area. However, since the publication of the most recent article in Peckacek's review a large number of further studies have been published. Initially, it was my intention to analyze only these, more recent studies. Unfortunately, only approximately 50 studies met my inclusion criteria. Consequently I expanded my analysis to include a further year of studies. I did not continue with even earlier studies than this as much of the early research in this area failed to produce any reliable procedures for aiding in cessation or reduction (see Hunt & Matarazzo, 1973). This failure was despite relatively intensive investigation in the area. It was my fear that if twenty years of studies were included together in this analysis that the recent, successful studies would be obscured by the earlier research, despite the fact that the early research has proba-

bly been made irrelevant by recent advances in the field. For this reason, I wished to contain my review to only the most recent years. At the same time, however, I wished to secure a sufficient sample size to adequately contrast the varying techniques. July,1977 proved to be an acceptable compromise.

Every study that met each of three basic requirements were included in the final data analyses. These requirements are: (1) utilization of a psychotherapeutic approach to aid smoking reduction or cessation; (2) adequate description of the intervention to enable an evaluation of the procedure used, and (3) quantitative data of either percent of subjects abstinent, average percentage of baseline smoking, or data that can be transformed into one of these two measures for either treatment termination or any follow-up period after termination.

A coding scheme was then applied to each condition of every study that met the above requirements. That is, every eligible condition was coded on twenty independent variables and up to twenty-two dependent variables. The independent variables consist of: the number of subjects completing treatment; whether corroborative evidence was used; the year in which the study was published; thirteen specific cessation strategies; two measures of therapist contact; and three subject variables. As the coding of some of these variables rely partly on judgement, a reliability check of

the coding was conducted. All coding was initially done by myself according to the detailed coding scheme contained in Appendix A. Next, for all variables in which judgement was necessary (number of subjects, the treatment of variables, and the therapist contact variables), a subset consisting of 25% of all conditions was selected for recording by another individual. For each condition then, a measure of relationship between the original coding and the recoding was determined. For the categorical variables Cohen's Kappa was used, while for the sole continuous variable (number of subjects) a Pearson's product-moment coefficient was calculated.

The first measure, number of subjects entering treatment, often differs from both the number of subjects completing treatment and the number of subjects completing follow-up. I used this particular measure as it is, unlike the other two measures, universally reported and is probably also the most accurate representation of the number of subjects contributing to the data for the initial few months of follow-up--the most critical period in terms of relapse. The measure of corroborative evidence is meant to discriminate between data that has some level of assured accuracy and data that does not. Studies that used some form of corroborative evidence in determining smoking levels at follow-up were coded as 1. Studies that did not report having utilized any such evidence were coded as 0. The thirteen treatment strategies coded were: (1) hypnosis, (2) rapid or

focused smoking, (3) satiation, (4) other aversive techniques, (5) cigarette monitoring, (6) nicotine monitoring, (7) monitoring of "conquered urges", (8) stimulus control, (9) deposit contracts contingent on successful reduction or abstinence, (10) relaxation therapy, (11) cognitive therapy, (12) provision of information on the benefits of not smoking or risks associated with smoking, and (13) token economy. If the particular strategy was employed, that cell was coded as a 1, if not, the cell was coded as a 0.

Therapist contact was coded separately for the treatment and the follow-up periods. For the treatment period, the total absence of therapist contact (i.e., waiting list control, or self-help book) was coded as 0. Those treatments in which the therapist met with clients on only a single occasion to give instructions was coded as 1. If there were ongoing meetings of any sort, a code of 2 was assigned. For the follow-up period, information-gathering follow-ups not expected by clients were coded as 0. Follow-ups which were expected, yet were only intended to gather information, or provide simple encouragment, were coded as 1. Those studies in which ongoing therapeutic intervention, or booster sessions were part of follow-up were coded as 2. More specific information on the coding criteria for each of the above variables is included in Appendix A.

Two distinct types of dependent measures were recorded. These were the average percentage of baseline smoking for

the entire condition, and the percentage of total subjects who were abstinent. Each of these measures were recorded for as many time periods as were available. The potential time periods were: treatment termination, each of the periods from one month through to six month follow-up inclusive, and follow-up periods of seven to nine months, 12 months, 18 months, and 24 months. Thus, for each condition, 17 independent and one to 22 dependent variables were utilized. In later analyses only, three other independent variables were also considered. These were: average age of subjects in group, average number of cigarettes smoked per day, and average length of time smoking.

Data Analysis

Defining a Regression Model. For the initial stages of analysis, all conditions were divided into one of two groups: control and experimental. Membership in the experimental group was based on the use of any of the following treatment strategies: hypnosis, any aversive technique, nicotine or "urge" monitoring, relaxation, cognitive intervention, stimulus control techniques, deposit contracts contingent on outcome, or a token economy. Conditions in which no intervention was taken or in which either or both of cigarette monitoring and the provision of health-related information were the only interventions taken, were classified as control conditions. I did not consider cigarette monitoring

or the provision of health related information as treatment strategies for two reasons. Firstly, a variety of studies suggest that these two techniques have little to no therapeutic effect. Secondly, particularly in recent studies, when either or both of these techniques are presented in the absence of other treatment strategies, they were generally intended by the researcher to serve as control conditions.

Next, the mean percentage of baseline smoking, weighted for number of subjects per condition, was calculated for each of the eleven time periods. This was done for the control and experimental groups separately. Similar statistics were calculated for percentage of subjects abstinent.

When graphed, this information would have produced four separate curves representing mean percentage of baseline smoking and mean percentage of subjects abstinent for both the control and the experimental group. For each of these four curves, a curvilinear regression model was calculated. Several types of models were considered. Those models which yielded the smallest mean square residual were retained.

Defining a Common Metric. The regression lines defined by the model generated from all experimental conditions were then used to establish a common scale. The outcome data from each condition, independent of its prior classification as control or experimental, was compared to the appropriate regression line for treated conditions. At each time point for which outcome data was available, the distance between

the predicted outcome and obtained outcome was calculated. This distance was then averaged across all time points, for percentage of baseline smoking and percent abstinent separately. If, for instance, one study yielded no information in regards to the percent abstinent, yet provides the average percentage of baseline smoking at three and six months, then two residuals would be determined. Each of these residuals would reflect the distance between actual and predicted outcome. When averaged, these residuals then provide the average distance between expected and actual outcome. If a number obtained by these calculations was, say, +4.93 this would indicate that, on the average, this study yielded percent of baseline smoking measures 4.93 percent above the average of all treatment conditions. This procedure produced up to two real numbers for each condition. The first reflects the relative success of the study in terms of percentage of baseline smoking. The second reflects the relative success of the study in terms of percent of subjects abstinent.

Utilizing the Common Metric. A variety of techniques were utilized to determine the correspondence between the independent variables and the common scales for the two types of measures. Initially a Pearson's product-moment coefficient was calculated between each independent and each dependent variable. Next, these coefficients were recalculated partialing out the effect of all other independent

variables. These analyses, like the original calculation of the regression lines, were weighted by the number of subjects per condition. Following this, a canonical correlation was performed, with all the independent variables comprising the first set, and all the dependent variables comprising the second set.

Next, in order to develop a predictive model capable of predicting the dependent variables in the basis of the independent variables, two regression models were developed. The first was used to predict percentage of baseline smoking. The second was used to predict relative success in percentage of subjects abstinent. Most of the independent variables used in these regressions are not only dichotomous, but also have highly unequal distributions. Token economies for instance only appear in an extremely small number of studies. Conversely, cigarette monitoring occurs in most studies. Because this data violated some underlying assumptions of the model, simple linear regression could not be used. Consequently, logistic regression which is unaffected by unequally distributed dichotomous variables was used. Unfortunately, logistic regression requires a dichotomous dependent variable. Consequently, dependent variables were recorded as 1 and 0 depending upon whether they reflected scores better or worse than the mean for experimental conditions. Dichotomizing the dependent variables, unfortunately, results in a considerable loss of informa-

tion. Thus, there was some cost in using this particular strategy.

Cross-validation was initially accomplished by a "jack-knife" strategy, where each separate condition was used to test a model developed with all but that condition. Following this, all studies published after the most recent study in the initial analysis, and available at the time of my reanalysis, were coded in the same manner as the initial studies. The two logistic models were then applied to this new sample in order to test the predictive validity of the models.

Next, the new studies were included in the total data group and all previous analyses were repeated, except the logistic regression. Also, a number of additional analyses were conducted. For all conditions in which such data was available; the average age, average level of baseline smoking, and average number of cigarettes smoked per day was recorded. The correlation between these three new independent variables and the two scales was then computed. Following this the correlations were recalculated partialing out the effects of all other independent variables.

Finally, a further three analyses were conducted on the original 17 independent variables in order to determine which procedures were generally used in conjunction. The first of these three analyses was a group means cluster analysis with an algorithm designed for use with categorical

data. Next, a correlation matrix of the independent variables was calculated. Finally, a principal component analysis with varimax rotation was completed on the original 17 independent variables.

RESULTS

Selection of Initial Data Group

All studies listed under the heading of "Tobacco Smoking" in Psychological Abstracts between July 1977 and July 1982, inclusive, were considered for these analyses. Those studies which eventually comprised the initial data group all fulfilled each of three predetermined criteria. These criteria were: that the study involve a specific procedure designed to aid in the reduction or cessation of smoking, that the procedure not be essentially medical or pharmacological, and that some quantitative data on treatment outcome be provided. Those smoking cessation studies that did not fulfill these criteria and hence were not included in the analyses, all fell into at least one of three categories: mass-media or educational programs, pharmacological strategies, and studies providing no specific outcome information. Included in this latter group were: (1) a number of unpublished, and largely unsuccessful dissertations, and (2) a variety of studies only incidently concerned with smoking reduction or cessation.

In all, 88 independent studies were judged to have fulfilled all criteria for inclusion in the initial analysis. These studies were derived, however, from more than 88 pub-

lications or abstracts as often multiple publications arose out of a single investigation. Largely, this was attributable to extended follow-ups or journal publications which expanded upon prior dissertation abstracts. All publications used in the analyses are listed, in alphabetical order, in Appendix B. While publication dates of these studies range over each of the eight years from 1975 to 1982, approximately 70% were published in 1977,1978 or 1979. Taken together these studies utilized a total of 3896 subjects in 202 separate conditions. Approximately 15% (597) of these subjects participated in one of the 38 no-treatment control conditions. Based on common usage, I defined a no-treatment control group as any condition in which no treatment intervention, other than cigarette monitoring, or the simple provision of health information was used. The remaining 3299 subjects participated in one of the 164 treatment conditions.

The presence or absence of 13 treatment strategies were noted for each of the 202 conditions. The most commonly employed intervention strategies were as follows: cigarette monitoring (64.1% of all subjects), rapid or focused smoking (39.9% of all subjects), stimulus control techniques (34.6%), and the provision of health-related information (32.9%). The remaining strategies were less frequently employed: relaxation (18.7%), cognitive interventions (17.4%), hypnosis (14.7%), aversive techniques not involving ciga-

rette smoke (9.7%), deposit contracts (7.6%), increased baseline smoking (6.3%), nicotine monitoring (1.9%), urge monitoring (1.8%), and token economy (1.3%). Corroborative evidence was employed in 80 of the 202 conditions, including 1434 subjects (36.8% of all subjects).

In order to examine the reliability of the coding for independent variables, a sample representing approximately one-quarter (51) of all conditions was selected for recording by a second scorer. These 51 conditions were coded on all 13 treatment variables, both contact variables and the number of subjects per condition. The subject number was considered to be a variable involving judgement as some decision-making was involved where there was a high attrition rate. The overall interscorer agreement rate for the variables with discrete categories (treatment and contact levels) was 0.949. As these variables involved categorical variables the Kappa measure of inter-rater reliability was calculated. These Kappa coeffients, and the overall interscorer agreement rates are contained in Table 1. A Pearson's correlation of 0.996 was calculated for the only continuous variable: number of subjects.

Insert Table 1 Here

Next, each of the dependent measures were correlated with year of publication, in order to examine increases or de-

Table 1

Measures of Interscorer Reliability -- Kappa Coefficients

Variable	Coefficient
Hypnosis	1.00
Rapid/Focussed Smoking	0.95
Increased Baseline Smoking	1.00
Other Aversive	0.95
Cigarette Monitoring	0.72
Nicotine Monitoring	1.00
Urge Monitoring	1.00
Stimulus Control	0.93
Deposit Contracts	1.00
Relaxation	0.83
Cognitive Strategies	0.65
Information	0.63
Token economy	1.00
Contact/Treatment	0.42
Contact/Follow-up	0.90

creases in relative usage. Rapid or focused smoking, cigarette monitoring, deposit contracts, relaxation techniques and nicotine monitoring are all significantly positively correlated with year of publication. These correlations are most marked with rapid smoking ($r=0.20$, $p<0.01$), and cigarette monitoring ($r=0.17$, $p<0.01$). The use of corroborative evidence is not significantly correlated with year of publication.

The first of the two sets of dependent variables, percentage of baseline smoking was recorded for 2218 of the subjects and 146 of the conditions (57% and 72%, respectively) at some time following treatment. All of the possible treatment and follow-up variables were represented within this group. The second of the two sets of dependent variables, percentage of subjects abstinent was recorded at sometime following treatment cessation in 145 (72%) of the conditions. Again, all of the possible treatment and follow-up variables were represented.

Development of Descriptive Regression Models

The average outcome for each of the eleven time periods was calculated for the two types of measures (baseline and abstinence data) on each of the two global treatment categories (treatment and no-treatment control). For the baseline measure the curves describing treatment and no-treatment outcomes are highly similar with rapid increases in smoking

during the first six months post-treatment, gradually leveling off at about 12 months. Similarily the curves describing percentage of subjects abstinent show initially rapid decreases in abstinent subjects gradually leveling off, so that little or no change is evident by 12 months. These means, as well as standard deviations, and the population size for each observation are shown in Tables 2 and 3.

Insert Tables 2 and 3 Here

From the above means and observation sizes, a nonlinear regression model was described for each of the two types of measures on both treatment and contol conditions. This model was derived by means of the Gauss-Newton Algorithm (BMDP,1981 p.302) The function that best described the progressive increases in percentage of baseline smoking over time for both the treatment and control conditions was: $y=b1[\ \underline{ln}(x+1)]+b2$. For the treatment condition the parameters that best describe the actual curve are; b1=14.783 and b2=28.405. For the control condition the parameters that best describe the actual curve are; b1=9.361 and b2=70.080. The second parameter, in each case, or b2, represents the y-intercept or the predicted percentage of baseline smoking at treatment termination. There is a difference of around 40% of baseline smoking between treatment and control conditions at the initiation of follow-up. These two regression lines are represented grapically in Figure 1.

Table 2

Mean Percentage of Baseline Smoking Following Treatment-Original Five Year Sample

Group	Cessation	Time Following Treatment (Months) 1	2	3	4	5	6	7-9	12	18	24
Treatment											
M	27.8	39.1	45.1	51.2	37.4	54.3	58.0	56.9	67.7	67.9	68.4
SD	23.1	20.3	18.9	20.0	15.1	20.0	19.5	14.7	17.3	32.9	23.3
n	1569	909	482	1327	174	254	187	187	367	47	47
Control											
M	69.3	76.2	86.0	84.5	--	88.0	85.4	100.0	97.8	102.0	107.0
SD	30.0	26.5	15.9	18.3	--	0.0	18.2	0.0	18.8	0.0	0.0
n	343	236	73	256	0	20	159	8	53	11	11

Table 3

Mean Percentage of Subjects Abstinent Following Treatment-Original Five Year Sample

		Time Following Treatment (Months)									
Group	Cessation	1	2	3	4	5	6	7-9	12	18	24
Treatment											
M	62.9	50.5	54.1	40.5	46.1	27.3	39.1	26.9	25.2	16.7	30.5
SD	25.7	21.6	20.0	18.8	17.2	13.6	16.6	14.1	15.2	17.3	12.4
n	2213	1005	541	1278	246	405	1453	235	660	33	286
Control											
M	24.3	22.1	17.3	12.9	--	25.0	12.2	7.8	10.9	12.0	8.8
SD	20.6	23.5	12.5	12.2	--	0.0	6.5	5.8	6.8	0.0	1.0
n	299	57	110	178	0	20	107	26	74	74	29

The obtained regression equation is of the form y=b1[ln(1/x+1)]+b2. For the treatment studies the parameters are: b1=13.154 and b2=61.881, while for the control studies the parameters are: b1=5.817 and b2=23.886. As with the baseline measures, the difference in percentage abstinent at termination of treatment of approximately 40% is largely maintained throughout all the follow-up periods. These two regression lines are represented graphically in Figure 2.

Insert Figures 1 and 2 Here

FIGURE 1
PERCENTAGE OF BASELINE SMOKING OVER TIME - FIVE YEAR SAMPLE

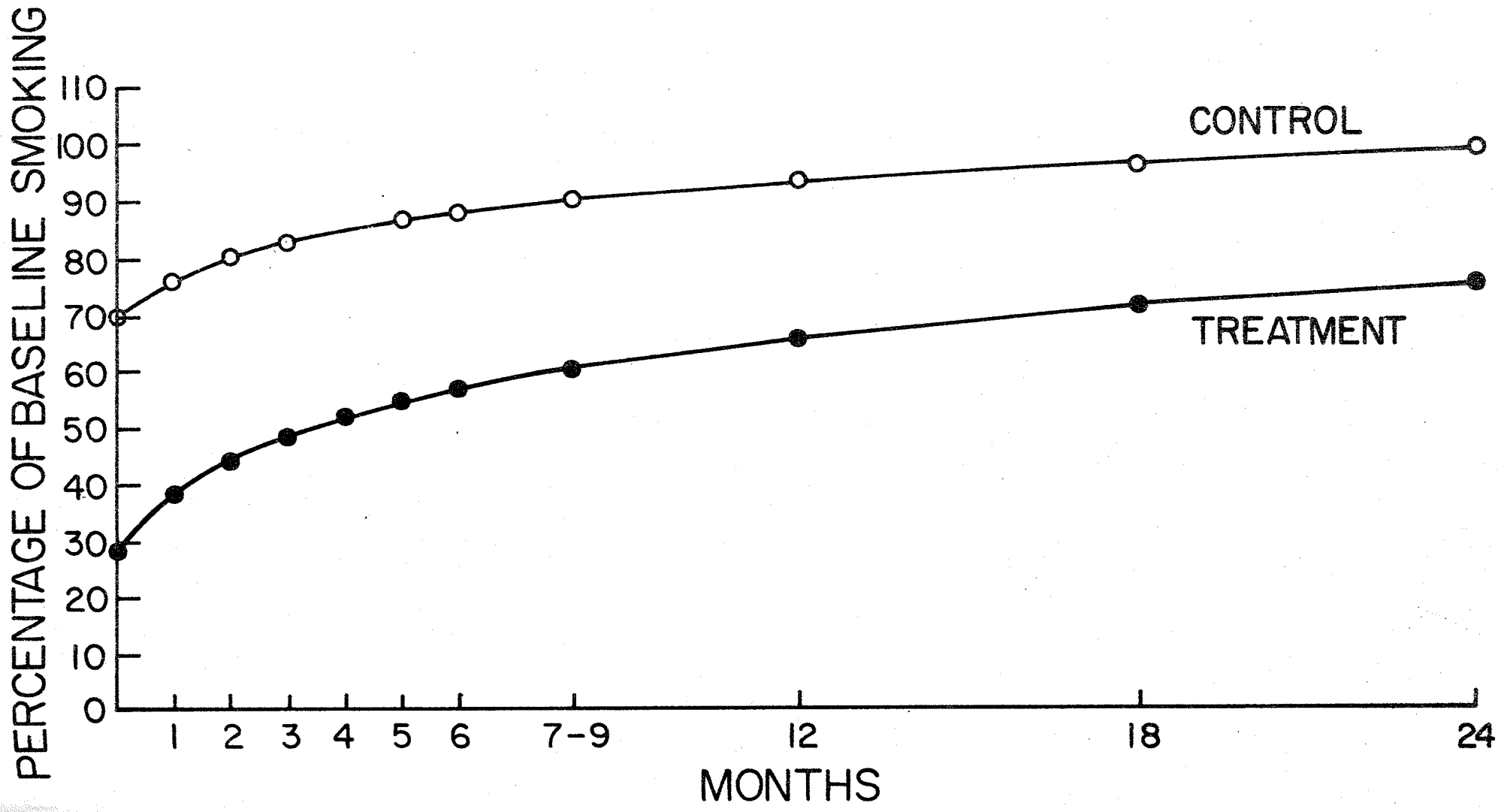
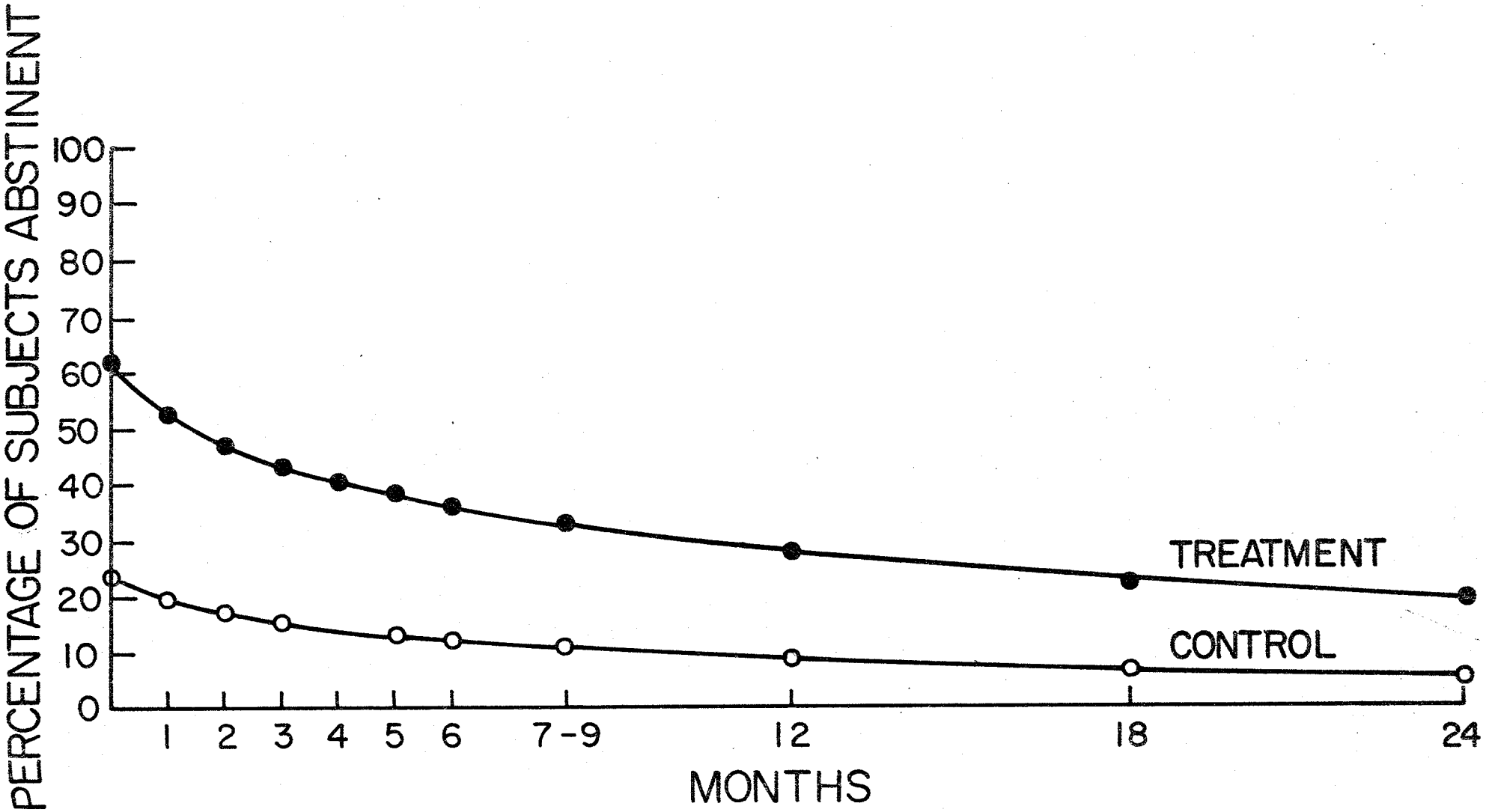


FIGURE 2
PERCENTAGE OF SUBJECTS ABSTINENT OVER TIME – FIVE YEAR SAMPLE



Calculation of a Common Metric

The actual outcome scores for each condition were subtracted from the outcome predicted by the treatment regression equation for every time interval for which there was data available. These difference scores were then used to calculate an average difference score for each condition. This procedure yielded a single number or scale for the baseline measure and another number or scale for the abstinence measure. In order to ensure the scales were not an artifact of the degree of variation at the time measurement was taken, the standard deviations were compared across the eleven time periods. Variation appears roughly equal over time, and there are no evident trends across time. These standard deviations were presented in Tables 2 and 3.

Because the majority of independent variables are only present in a relatively small number of studies, the entire set of variables undoubtedly deviates considerably from a multivariate normal distribution. For this reason, logistic regression, which has been shown to be less affected by non-normality than the linear discrimant function (Press, 1977), was the first analyses performed. Separate models were derived for the baseline and abstinence scales. The coefficients and standardized coefficients for each independent variable are reported in Table 4.

Insert Table 4

Table 4

Coefficients for Logistic Regression
of Baseline and Abstinence Metric

Variable	Baseline Metric	Abstinence Metric
Hypnosis	-1.33	0.19
Rapid/Focused Smoking	-0.56	0.94
Increased Baseline	-0.66	0.28
Other Aversive	0.50	-0.29
Cigarette Monitoring	0.59	--
Nicotine Monitoring	0.77	0.31
Urge Monitoring	--	0.72
Deposit Contracts	-0.40	--
Stimulus Control	1.15	-0.16
Relaxation	-0.11	--
Cognitive	--	0.48
Information	-0.41	0.23
Token Economy	0.80	0.40
Contact at Follow-up		
Level 1	3.94	4.13
Level 2	1.98	1.68
Corroborative Evidence	0.11	--

Next, the individual correlations between each independent and each dependent variable were calculated. Pearson's product-moment correlations were used since they differed negligibly (<.03), from robust estimates of the population correlations provided by Spearman rank order correlations. Next, another Pearson's correlation was employed, with the effect of all independent variables not involved in the correlation partialled out. Three of the independent variables had highly significant negative partial correlations with the baseline scale, that is, they were associated with relatively low levels of smoking. These were, in order of strength of relationship: therapist contact during treatment,rapid or focused smoking and relaxation. Cigarette monitoring was actually reliably associated with higher levels of smoking. Two variables had highly significant positive partial correlations with the abstinence scale. That is; they were associated with high levels of abstinence. These were: therapist contact during treatment and increased baseline smoking. No variables had significant negative correlations. The correlation between the two dependent variables, the baseline scale and the abstinence scale, was surprisingly modest(r=-0.342,p<0.01). The simple and partial Pearson's correlations are reported in Table 5.

Insert Table 5 Here

Table 5

Correlations of Independent and Dependent Variables for Original Five Year Sample

Variable	Baseline Metric		Abstinence Metric	
	Total	Partial	Total	Partial
Year	-0.15*	-0.12*	0.03	-0.07
Hypnosis	-0.17**	-0.15*	0.08	0.11
Rapid/Focussed Smoking	-0.32**	-0.22**	0.28**	0.15*
Increased Baselind Smoking	-0.12*	-0.07	0.19**	0.17**
Other Aversive Techniques	-0.01	0.03	0.11	0.10
Cigarette Monitoring	0.11	0.20**	0.05	-0.04
Nicotine Monitoring	0.09	0.15*	-0.01	0.05
Urge Monitoring	0.04	0.07	0.03	0.07
Stimulus Control	-0.10	-0.15*	0.04	0.04
Deposit Contracts	-0.06	-0.05	0.17**	0.12*
Relaxation	-0.26**	-0.19**	0.21**	0.14*
Cognitive	-0.08	0.02	0.17**	0.11
Information	-0.13*	-0.14*	-0.03	-0.03
Token Economy	-0.00	-0.02	0.02	0.04
Contact/Treatment	-0.33**	-0.27**	0.32**	0.18**
Contact/Follow-up	-0.15*	0.01	0.10	0.16*
Corroborative Evidence	-0.19**	-0.15*	0.01	-0.02

* $p<.05$

** $p<.01$

Next a canonical correlation was completed, with the two outcome scales and the 17 independent variables constituting the two sets. On the first canonical variable, the two sets were highly significantly correlated (r=0.62, p<0.01). The second canonical variable did not result in a significant canonical correlation between the two sets. The loadings for these canonical variables are presented in Table 6.

Insert Table 6 Here

Table 6

Canonical Variates -- Five Year Sample

Variable	Coefficient
First Set	
Baseline Metric	-0.72
Abstinence Metric	0.49
Second Set	
Hypnosis	0.26
Rapid/Focussed	0.39
Increased Baseline	0.20
Other Aversive	0.04
Cigarette Monitoring	-0.24
Nicotine Monitoring	-0.11
Urge Monitoring	-0.02
Stimulus Control	0.18
Deposit Contracts	0.16
Relaxation	0.32
Cognitive	0.06
Information	0.11
Token Economy	0.06
Contact/Treatment	0.44
Contact/Follow-up	0.12
Corroborative Evidence	0.14

Predicting Outcome of Future Studies

The logistic regression model was utilized to predict the success of future smoking cessation programs. The dependent variable in logistic regression, however, must be dicohotomous, so for each study the dependent scale was categorized as either negative or positive (above or below the average treatment outcome). The model derived from the dicohotmized baseline scale successfully classified 75.57% of the 146 conditions for which baseline data was available. The model derived from the dicohotmized abstinence scale, was similiarily successful, with 80.32% of the 145 conditions correctly classified.

Cross-Validating the Predictive Model

In order to examine the ability of these logistic models to predict future outcome, data was collected from an additional nine studies, all unavailable when the original analysis was conducted. These studies are contained within the bibliography of studies in Appendix B. Six of these studies reported on percentage of baseline smoking at some time following treatment. The logistic model only correctly classified the relative success or failure of 8 of the 14 conditions contained within these six studies. The logistic model derived from the abstinence scale performed almost as poorly, correctly classifying 15 of 21 conditions contained within seven studies.

Incorporation of Recent Studies

All of the previous steps, except the logistic regression, were repeated on an enlarged data set which incorporated the studies used to test the logistic models. This final data set involves 4285 subjects in 229 separate conditions, published over a nine year period from 1975 to 1983. Approximately 14% (619) of these subjects participated in one of the 41 no-treatment conditions. The remaining 3666 subjects participated in one of the 188 treatment conditions.

The distribution of treatment strategies is not dissimiliar from the initial five year data set; with all 13 strategies maintaining their relative position in terms of percentage of total subjects receiving that treatment. With the addition of these later studies, a large number of variables have become correlated with year of publication. More recent studies utilize more cigarette monitoring (r=0.20), greater contact during follow-up (r=0.19), more deposit contracts (r=0.18), more satiation (increased baseline smoking) (r=0.16), more rapid or focused smoking (r=0.14) and more corroborative evidence. However, they utilize less non-smoking aversive techniques (r=-0.11).

Redevelopment of Descriptive Regression Models

The means and standard deviations both for percentage of subjects abstinent, and percentage of baseline smoking appear to have changed little with the addition of the nine new studies. Means and standard deviations are contained in Tables 7 and 8. As with the means, the regression curves have changed only slightly. The obtained regression equation is of the form $y=b1[\ \underline{ln}(x+1)]+b2$, with parameters of b1=14.684 and b2=28.595 for the treatment groups and b1=9.517578 and b2=70.213 for the control groups. For percentage of subjects abstinent the most accurate model is $y=b1[\ \underline{ln}(1/x+1)]+b2$ with parameters of b1=13.03, b2=62.08 and b1=5.66, b2=23.84 for treatment and control groups, respectively. In order to ascertain the suitability of each of these models the residuals (the difference between predicted and observed levels for each time period) were examined for trends. For all four regression models there is no correspondence between residuals and time of measurement. These residuals are reported in Appendix C. These models are depicted graphically in Figures 3 and 4.

Insert Tables 7 and 8 Here

Insert Figures 3 and 4 About Here

Table 7

Mean Percentage of Baseline Smoking Following Treatment - Complete Sample

Group	Cessation	Time Following Treatment (Months) 1	2	3	4	5	6	7 -9	12	18	24
Treatment											
M	27.8	40.0	46.0	50.9	36.1	20.0	58.4	56.7	67.7	67.9	68.4
SD	22.9	20.2	18.2	19.6	15.4	53.1	19.4	16.1	17.3	32.9	23.3
n	1674	970	545	1434	1434	266	1132	203	367	47	47
Control											
M	69.2	76.7	87.3	84.5	84.5	88.0	85.4	101.5	97.7	72.0	107.0
SD	30.0	26.3	15.5	18.3	18.3	0.0	18.2	1.5	18.8	0.0	0.0
n	358	243	81	246	246	20	159	16	53	11	11

Table 8

Mean Percentage of Subjects Abstinent Following Treatment Complete Sample

Group	Cessation	Time Following Treatment (Months) 1	2	3	4	5	6	7-9	12	18	24
Treatment											
M	62.7	52.9	52.3	40.8	46.1	27.3	39.4	29.2	25.9	19.7	32.2
SD	25.9	22.2	20.5	19.8	17.2	13.6	16.8	15.5	15.0	14.6	12.3
n	2354	1218	654	1551	246	405	1666	301	738	57	310
Control											
M	24.4	21.2	17.1	12.9	--	25.0	13.2	9.2	11.1	12.0	8.6
SD	20.4	22.3	12.1	11.9	--	0.0	7.5	5.7	6.5	0.0	10.0
n	306	64	117	185	0	20	114	33	81	11	29

FIGURE 3
PERCENTAGE OF BASELINE SMOKING OVER TIME – TOTAL DATA SET

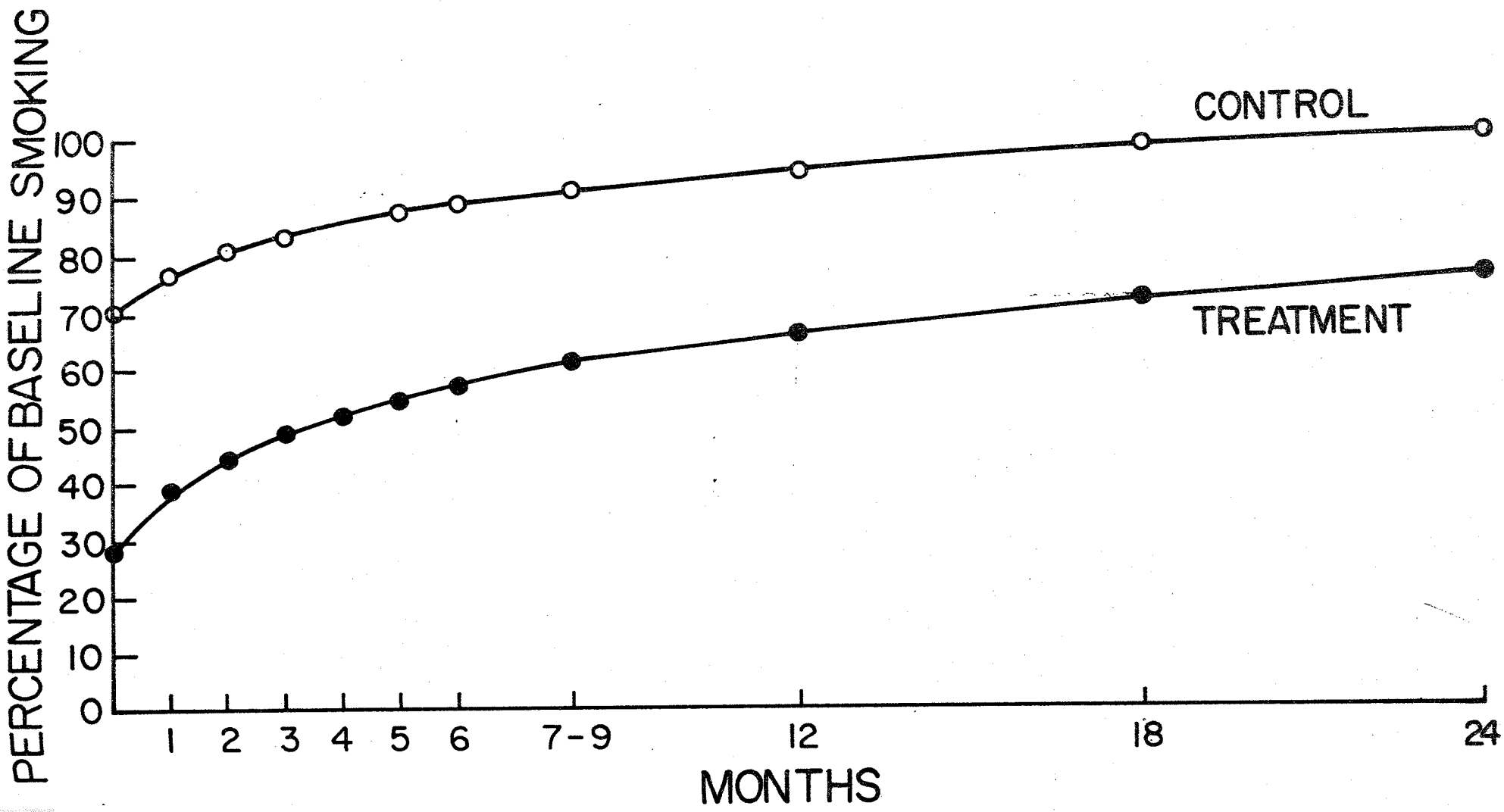
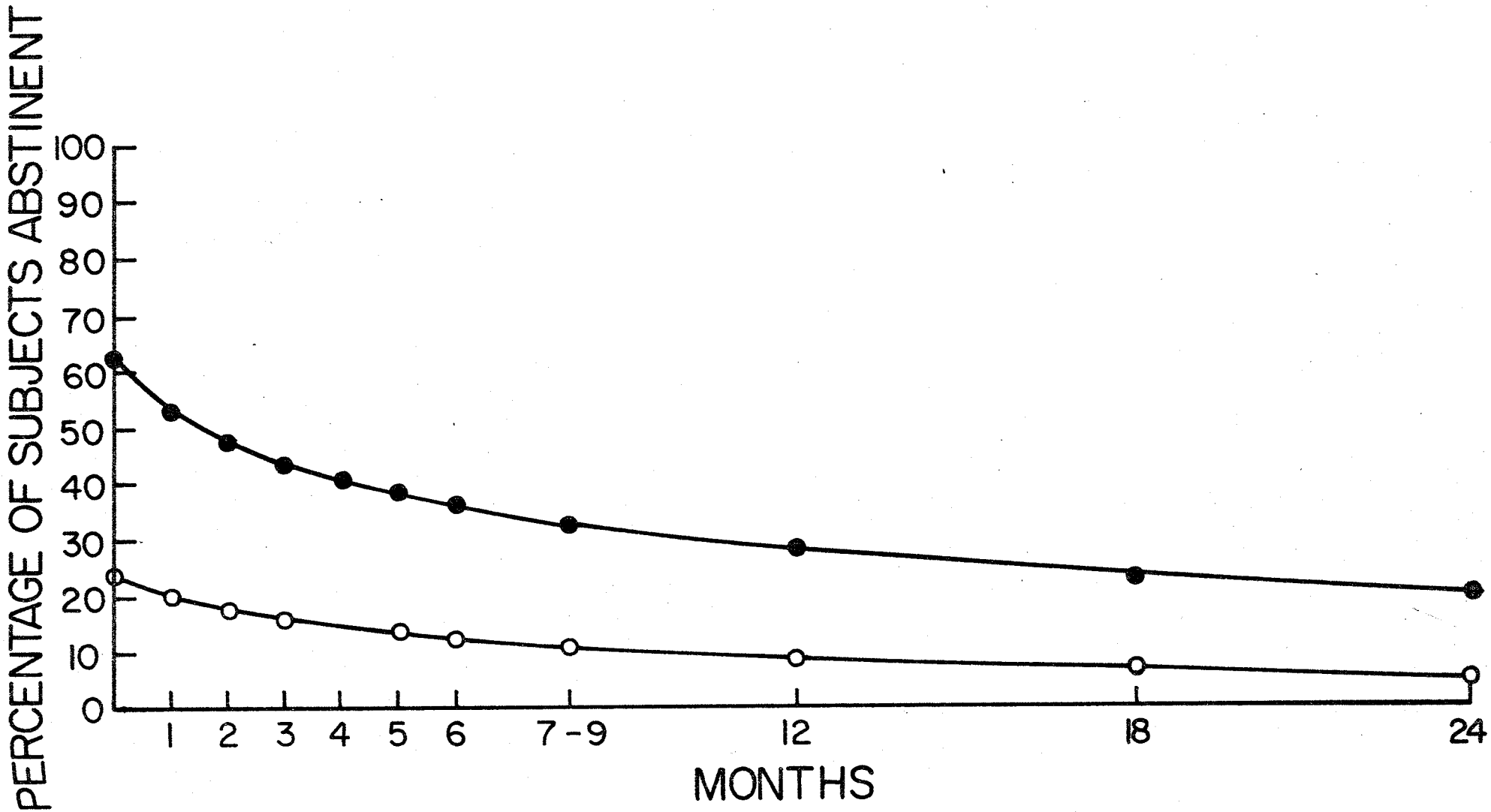


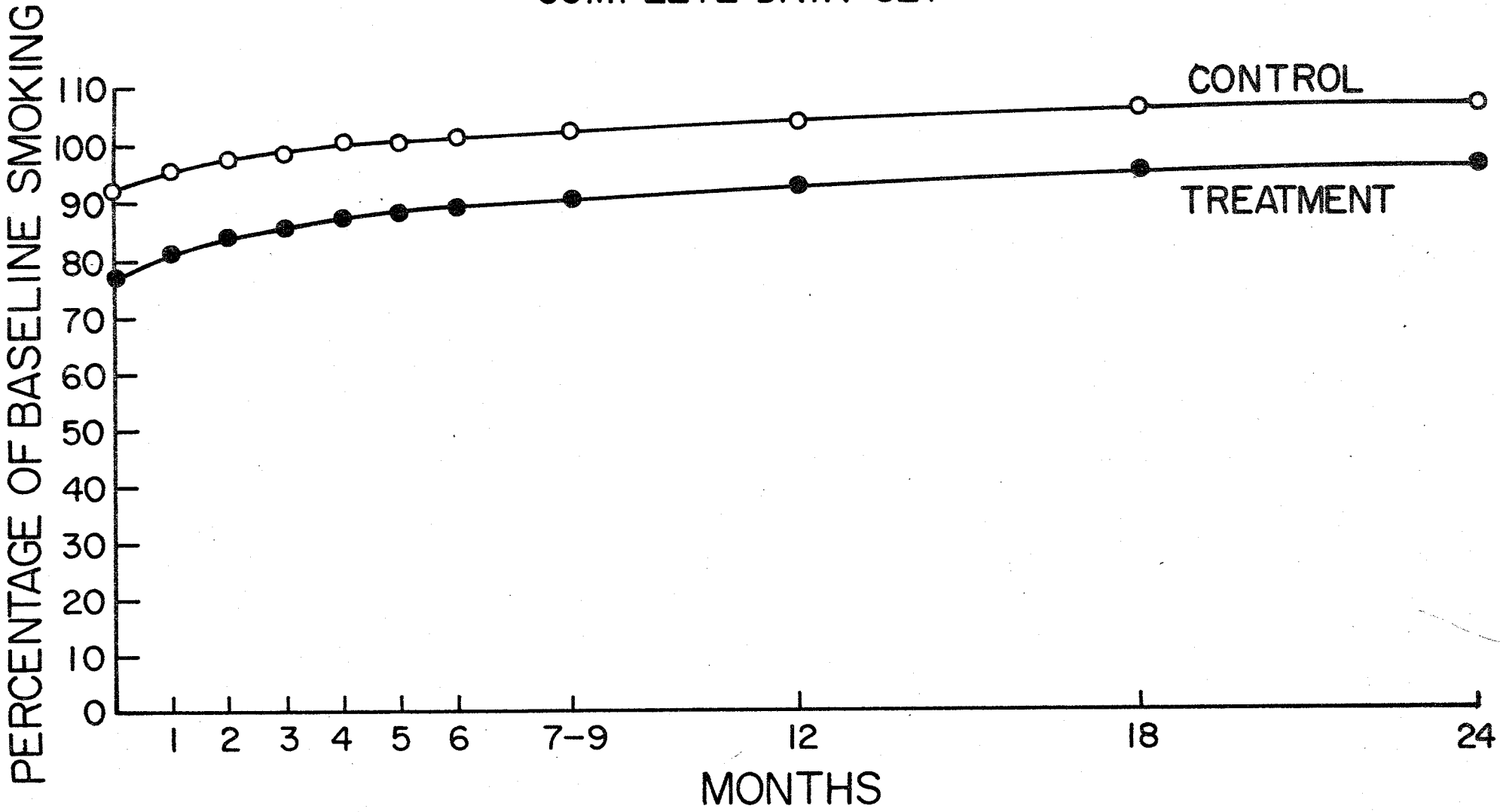
FIGURE 4
PERCENTAGE OF SUBJECTS ABSTINENT OVER TIME - TOTAL DATA SET



Because abstainers are included in percentage of baseline smoking figures, smoking rates are confounded by abstinence rates. In order to determine the rate at which non-abstainers were smoking, percentage of baseline smoking was recalculated removing abstinent subjects from the baseline regression line. This was accomplished by separating the percentage of subjects smoking at zero percent of baseline (abstinent subjects) from subjects still smoking, and recalculating the baseline scale on the remaining subjects. This resulted in a regression model for control subjects that begins (at cessation of treatment) at 93% of baseline smoking and returns to baseline levels within six months. The regression line for treated subjects is, although lower, still not encouraging. At treatment cessation the non-abstinent subjects are smoking approximately 78% of baseline. By one year this has returned to approximately 90% of baseline levels. These regression lines are graphically depicted in Figure 5.

Insert Figure 5 Here

FIGURE 5
PERCENTAGE OF BASELINE SMOKING FOR NON-ABSTAINERS OVER TIME-
COMPLETE DATA SET



Common Metric

The abstinence and baseline scales were determined in the same way as with the original five year period. Simple and partial correlations between these two scales and each of the independent variables are contained in Table 9. Five variables were inversely correlated at a highly reliable level with percentage of baseline smoking when the effects of all other variables were partialed out; that is, they were associated with lower baseline smoking. These variables are: therapist contact during treatment, rapid or focused smoking, stimulus control, relaxation and hypnosis. Although the relationship is less strong, three other variables also had significant negative partial correlations with the baseline scale: use of corroborative evidence, deposit contracts and year of publication. Two variables actually had significant positive partial correlations with the baseline scale these were: cigarette monitoring and nicotine monitoring.

Insert Table 9 Here

Two variables had highly significant positive partial correlations with the abstinence scale; that is, they were associated with high levels of abstinence. These were increased baseline smoking and therapist contact during follow-up. Four other variables also produced reliable partial

Table 9

Correlations of Independent and Dependent Variables for Complete Data Set

Variable	Baseline Metric		Abstinence Metric	
	Total	Partial	Total	Partial
Year	-0.14*	-0.13*	0.03	-0.06
Hypnosis	-0.16**	-0.17**	0.07	0.12*
Rapid/Focussed Smoking	-0.29**	-0.20**	0.30**	0.14*
Increased Baseline Smoking	-0.12*	-0.00	0.21**	0.19**
Other Aversive Techniques	-0.01	0.02	0.10	0.07
Cigarette Monitoring	0.10	0.16**	0.08	0.03
Nicotine Monitoring	0.06	0.13*	-0.01	0.05
Urge Monitoring	0.05	0.06	0.03	0.06
Stimulus Control	-0.14*	-0.18**	0.04	0.05
Deposit Contracts	-0.10	-0.13*	0.10	0.05
Relaxation	-0.23**	-0.18**	0.17**	0.11
Cognitive	-0.06	0.00	0.15**	0.13*
Information	-0.13*	-0.09	0.03	0.02
Token Economy	-0.00	-0.01	0.01	0.05
Contact/Treatment	-0.31**	-0.25**	0.30**	0.13*
Contact/Follow-up	-0.14*	0.06	0.31**	0.19**
Corroborative Evidence	-0.17**	-0.14*	0.09	-0.03

* $p<.05$

** $p<.01$

correlations with the abstinence scale. These were: rapid or focused smoking contact during treatment, cognitive interventions and hypnosis. No variable was negatively related with this scale.

For all studies for which such information was available, three further independent variables were considered. These are: the average age, the average baseline level of smoking, and the average number of years smoking, for all subjects in the experiment. The means, across all experiments for which data were available are: age, 34.3; baseline level, 27.6 cigarettes per day; and years smoking, 17.0. The number of conditions for which such information was available are 126,139 and 125 respectively. Age and number of years smoking are highly significantly correlated (r=0.96) as are age and baseline level of smoking (r=0.65), and number of years smoking and baseline level of smoking (r=0.63). Interestingly, age and number of years smoking are negatively correlated with the baseline scale. However, this is apparently just an artifact, as none of the partial correlations between these subject variables and either of the two scales even approach significance.

The canonical correlation on the full 229 cases produced two significant canonical variables. The first canonical variable has loadings of 0.693 for the baseline scale and -0.541 for the abstinence scale, and would therefore appear to be highly correlated with a successful outcome (high ab-

stinence and low smoking rates). Those variables that have high positive loadings are: contact during treatment, rapid or focused smoking, hypnosis, relaxation, stimulus control, deposit contracts, and increased baseline smoking. Cigarette monitoring loaded positively on this variable.

The second canonical variable produced high positive loadings on both the baseline and abstinence scale. Variables that load positively on this variable would be associated with high abstinence levels, yet high percentage of baseline smoking among the non-abstainers. These variables were: contact during follow-up, increased baseline smoking, cigarette monitoring, cognitive strategies and non-smoking related aversive techniques. Variables that loaded negatively on this canonical variable would be associated with low levels of baseline smoking but relatively few abstinent subjects. The variables with the highest loadings on this canonical variable are: studies using corroborative evidence, stimulus control and deposit contracts. These loadings are contained in Table 10.

Insert Table 10 Here

Next a principal component analysis of all independent and dependent variables was conducted. Seven factors had eigenvalues greater than unity. The varimax rotated factor matrix for these seven factors is reported in Appendix D The

Table 10

Canonical Variates - Complete Sample

Variables		1st Canonical Variate ($p<.01$)	2nd Canonical Variate ($p<.05$)
Set 1:	Dependent Measures		
	Baseline Metric	0.693	0.789
	Abstinence Metric	-0.541	0.900
Set 2:	Independant Measures		
	Hypnosis	-0.303	-0.138
	Rapid/Focussed Smoking	-0.383	-0.184
	Increased Baseline Smoking	-0.185	0.450
	Other Aversive	-0.039	0.286
	Cigarette Monitoring	0.149	0.413
	Stimulus Control	-0.232	-0.268
	Deposit Contracts	-0.208	-0.229
	Relaxation	-0.282	-0.084
	Cognitive Strategies	-0.118	0.316
	Information	-0.108	-0.148
	Contact/Treatment	-0.394	-0.124
	Contact/Follow-up	-0.140	0.613
	Corroborative Evidence	-0.121	-0.392

results are considerably less easily interpretable than are the results of the canonical correlation, so I will not summarize them in the text of the results section.

Finally, a variety of analyses were conducted in order to determine which independent variables normally occur in conjunction. First a simple correlation matrix was examined. None of the correlations were particularily high, however there were a number of moderate intercorrelations. These correlations are reported in Table 11.

Insert Table 11 Here

Consistent with the relatively small correlations, a block cluster analyses for categorical variables failed to produce useful clusters, with the exception of a basic control group cluster (cigarette monitoring, no corroborative evidence, contact during treatment, but only during follow-up for the purposes of collecting data). Results of the principal component analysis were somewhat more informative. The first factor of the rotated (varimax) factor matrix produced high loadings on contact during treatment, contact during follow-up and rapid or focused smoking. Even though outcome variables were not considered in this analysis this factor appears to correspond with previous findings on the utility of each independent variable. The second factor has high loadings on cognitive strategies, relaxation and non-

Table 11

Correlations Among Independant Variables

Variables	Variable															
	Hypnosis	Rapid/ Focussed	Increased Baseline	Other Variable	Cigarette Smoking	Nicotine Monitoring	Urge Monitoring	Stimulus Control	Deposit Contract	Relaxation	Cognitive	Information	Token Economy	Contract/ Treatment	Contract Follow-up	Corroborative Evidence
Hypnosis	1.00															
Rapid/Focussed	-0.02	1.00														
Increased Baseline	-0.08	0.16	1.00													
Other Aversive	-0.08	0.18	-0.04	1.00												
Cigarette Monitoring	-0.30	0.09	0.07	0.01	1.00											
Nicotine Monitoring	-0.05	-0.12	-0.07	-0.06	0.02	1.00										
Urge Monitoring	-0.04	-0.02	-0.05	0.05	-0.02	-0.03	1.00									
Stimulus Control	-0.19	-0.08	0.03	-0.06	0.17	0.18	0.05	1.00								
Deposit Contract	-0.07	0.03	0.24	-0.09	0.18	-0.06	-0.05	0.05	1.00							
Relaxation	-0.04	0.21	-0.06	0.00	-0.00	0.12	0.05	0.09	-0.11	1.00						
Cognitive	-0.11	0.09	-0.14	0.13	-0.02	-0.03	-0.08	0.00	-0.13	0.29	1.00					
Information	-0.09	-0.01	0.07	0.07	-0.12	0.01	0.12	0.10	-0.02	-0.02	0.02	1.00				
Token Economy	-0.04	-0.06	-0.05	0.06	-0.04	-0.03	-0.02	-0.04	0.07	-0.08	0.02	-0.04	1.00			
Contact/Treatment	0.09	0.25	0.11	0.10	0.12	0.07	-0.00	0.06	-0.00	0.15	0.12	0.11	0.05	1.00		
Contact/Followup	0.04	0.32	0.17	-0106	0.19	-0.16	-0.05	-0.02	0.28	-0.01	0.06	-0.06	-0.05	0.25	1.00	
Corroborative Evidence	-0.08	0.13	0.25	0.03	0.08	0.05	-0.03	0.08	0.04	0.04	0.03	0.13	-0.01	0.04	0.23	1.00

smoking related aversive techniques. It should be noted that the most common non-smoking related aversive strategy was covert aversion. The third factor had a high loading on cigarette monitoring, and moderate loadings on stimulus control and deposit contracts, all commonly employed self-control strategies. Interestingly the only non-behavioral treatment strategy considered (hypnosis), had a high negative loading on this factor. The remaining four factors with eigenvalues greater than unity are less easily interpretable. The varimax rotated factor matrix is contained in Table 12.

Insert Table 12 Here

Table 12

Principal Component Factors of the Independant Variables

Variable	Factor						
	1	2	3	4	5	6	7
hypnosis	0.233	-0.163	-0.759	-0.190	-0.014	-0.118	-0.088
rapid/focussed	0.603	0.287	0.042	0.180	-0.282	0.045	-0.092
increased baseline	0.219	-0.293	0.071	0.619	-0.047	-0.012	-0.077
other aversive	0.033	0.373	0.102	0.055	-0.342	0.300	0.413
cigarette monitoring	0.253	-0.071	0.738	-0.090	0.076	-0.104	-0.047
nicotine monitoring	-0.091	0.096	-0.043	0.018	0.767	-0.073	0.036
urge monitoring	0.050	-0.099	0.075	-0.247	-0.050	0.768	-0.162
stimulus control	-0.005	-0.024	0.377	0.084	0.582	0.194	-0.078
deposit contract	0.285	-0.522	0.330	0.114	-0.032	-0.147	0.080
relaxation	0.250	0.601	0.007	-0.064	0.260	0.010	-0.254
cognitive strategies	0.090	0.713	0.137	0.001	-0.046	-0.150	0.098
information	-0.081	0.040	-0.119	0.441	0.123	0.602	0.132
token economy	0.008	-0.097	0.003	-0.084	0.029	-0.103	0.840
contact/treatment	0.721	0.129	-0.112	-0.010	0.281	0.171	0.260
contact/followup	0.681	-0.145	0.128	0.192	-0.181	-0.171	-0.111
corroborative evidence	0.082	0.085	0.051	0.763	0.060	-0.057	-0.035

DISCUSSION

Representativeness of the Review

Although the present study is intended as a comprehensive quantitative review of the smoking cessation literature, all studies which have purported to examine strategies for reducing cigarette consumption, or inducing total abstinence have not been included in this analysis. Studies have been excluded on the basis of year of publication, specific strategy employed and/or type of data reported. However, I consider this review to be both comprehensive, and exhaustive within its frame of reference--the frame of reference is merely narrower than all smoking cessation studies. Studies published early enough to be included in the Psychological Abstracts before July, 1977 are not included in this analysis. An initial boundary date was chosen for the reasons elaborated upon in the procedure section of this paper. Journals not reviewed by Psychological Abstracts and not normally considered by research psychologists, were also not included. To investigate non-psychological journals would have entailed an enormous expansion of the scope of the investigation (to medical, dental, pharmacological, educational and sociological sources) with increasingly diminishing returns. Therefore this analysis was limited to psychologi-

cal research. Educational projects and strategies designed to utilize the mass-media were excluded both for the above reasons and because the nature of data collection in such studies is largely not comparable with the data collected in the experiments or quasi-experiments I have chosen to examine.

The formal frame of reference of my investigation is, then: recent publications of psychologically-based strategies designed to aid in the reduction or cessation of cigarette consumption. A few studies, that are encompassed within this frame of reference were also excluded because neither smoking rates, nor abstinence numbers or rates were reported within the study. These excluded studies fell into one of two categories: studies only incidently concerned with smoking--which utilized smoking cessation techniques to investigate other phenomena, and unsuccessful and unpublished dissertations. Although the exclusion of the unpublished dissertations possibly threaten the comprehensiveness of my study (for most likely, appropriate data was collected and just not reported because of unfavorable results), they represent only a small portion of the unpublished research in this area. The issue of representativeness in published research has been a major concern of many meta-analysts (cf. Stube & Hartman, 1983). As unsuccessful studies are less likely to be published then successful studies, it is probable that my entire analysis over-estimates both the average

effectiveness of smoking cessation techniques in general and the specific effectiveness of the various strategies examined. It is impossible to estimate to what degree I have erred in my analysis. Fortunately, it is probable that the relative success of the individual strategies is unchanged. Presumably, ineffective strategies are more likely to result in unsuccessful results and therefore are less likely to be published, then are the outcomes of more effective strategies. If this is in fact the case, my review not only overestimates the overall effectiveness of smoking cessation techniques, but also underestimates the differences among techniques. These conclusions are, however, although reasonable, merely speculative. The "true" effectiveness of the various strategies cannot be known.

The problem of nonrepresentativeness, effects not only meta-analyses, but all literature reviews. I have reason to believe, however, that my sample is more representative than most samples of the psychology literature. Most of the studies I review have been set up to compare more than one treatment strategy. If only one strategy happens to be unsuccessful the researcher would probably not decrease his or her chances of publication. Secondly, because there has been such an abundance of research on a relatively small number of strategies, journals are probably more likely to accept for publication studies which report negative results, since those studies probably reflect upon many other

studies, already published. In conclusion, although the "file drawer" phenomena (unsuccessful unpublished studies) undoubtedly compromises my results, this is probably less of a concern in my quantitative review, than in most meta-analyses or literature reviews.

Accuracy of Metric

Some of the Kappa coefficients, most noteably contact during treatment, are relatively low. This can be partially attributed to two factors: only a small subsample of conditions were rescored, and these conditions were not independent of each other as whole studies and not individual conditions were chosen for rescoring. In fact, with the contact during treatment condition, the two scorers only disagreed on two studies. Actual disagreement between scorers is, as a result, overestimated by the Kappa coefficient. In order to achieve a common scale I developed regression lines, both for percentage of baseline smoking and percentage of subjects abstinent from the average outcomes at the eleven time periods. As can be seen by comparing the average outcomes and the graphs of the regression lines, the simple natural logarithnic function used to develop the regression lines achieves an excellent fit. Furthermore, when residuals are examined it is apparent that the regression lines are as accurate over the final few months as over the initial few months.These residuals are reported in Appendix

C. The diminishing rate of deterioration in number of subjects abstinent that typically occurs over time appears to be a relatively simple and easily describable function. This appears to also be true of the diminishing rates of increases in smoking rate following treatment. However, smoking rate is confounded with abstinence rate, since all the abstinent subjects, who are of course still included in the data, are smoking at zero percent of baseline. When abstinent subjects are extracted from the data, the baseline regression models are still best described by a natural logarithmic function (see Figure 5). The simplicity and accuracy of the regression lines I have developed strongly suggests that these models reflect some natural underlying process. Hunt and Matarazzo (1970,1973) suggest that such a curve is typical of the forgetting or extinction curves found in the learning literature, and suggestthat what may be occurring is an extinction of the newly acquired nonsmoking behavior with a concominant reascendance of the previous smoking behavior.

From the regression models common scales were calculated by determining the average amount a study deviated from the predicted changes in baseline and abstinence rates. These common scales were then used to examine relationships between the various independent variables and study outcome.

Utility of Predictive Model

The initial analysis of studies was conducted partially to achieve and test the two predictive models. These models were designed to categorize all conditions on the basis of whether they would result in better than average, or worse than average percentage of baseline smoking and abstinence rates. The predictive ability of these models within the samples upon which they had been devised was promisingly high. The baseline model correctly classified slightly over 75% of 146 conditions. The abstinence model correctly classified approximately 80% of 145 conditions. This represents improvements of 25% and 30%, respectively, over chance alone. Unfortunately, these models did not predict as well when a new sample was introduced. The baseline model correctly classified approximately 57% of 14 conditions, an improvement of only 7% over chance. The abstinence model correctly classified approximately 71% of 21 conditions,an improvement of 21% over chance. These models' decreased ability to predict when applied to the new sample does not appear to be a result of the unrepresentativeness of the nine new studies. The inclusion of these new studies in the second data analysis results in virtually no changes in the regression curves used to describe the abstinence and baseline models. Rather, the reduced success of the predictive models appears attributable to the relatively small sample size (nine studies) and the relatively large amount of vari-

ation in results among all studies--even those with nearly identical procedures. The conclusion to which these findings lead is clear; although these logistic models are much better than chance at correctly predicting a large number studies they are considerably weaker at predicing a relatively small number of studies, and probably much weaker still when used in predicting a single experimental condition or therapeutic outcome.

Smoking Cessation and Reduction

There is a substantial, and clinically significant difference between the regression lines describing average treatment outcome and the regression lines describing average no-treatment control outcome. At treatment termination the regression lines indicate that 38% more treated subjects than control subjects were abstinent. Treated subjects had percentage of baseline smoking levels 42% lower than control subjects. At one year, the differences are still considerable. The regression lines show 19% more treated subjects than control subjects abstinent, and that the average treated subject had a percentage of baseline smoking rate 28% lower. However, the percentage of baseline smoking rates are confounded by the abstinence rates since an abstinent subject is smoking at 0% of baseline smoking. When percentage of baseline smoking rates were recalculated eliminating abstinent subjects from the total, it became apparent that

control subjects who do not quit reduce their smoking levels only slightly (around 93% of baseline) and quickly return to baseline levels. Treated subjects who do not quit fare only slightly better. At treatment cessation, non-abstinent treated subjects are smoking at around 78% of baseline. By one year they are smoking an average of around 90% baseline. For an individual smoking a "pack-a-day" this works out to an initial decrease (at one year) of less than three cigarettes per day. The health and economic benefits of such a drop are questionable. If an individual was required to pay $100.00 in fees for a smoking cessation program, and only reduced consumption at these predicted rates, he or she would not recoup his or her initial investment even at the end of a year, at present cigarette costs. In general then, psychologically-based smoking cessation programs appear capable of achieving clinically significant increases in the number of individuals able to achieve total abstinence, but not clinically significant decreases in the smoking rates of non-abstainers.

The strategies that are most strongly associated with successful reduction in smoking level are, in order of strength of relationship: therapist contact during treatment, rapid or focused smoking, stimulus control, relaxation and hypnosis. Other than hypnosis, these findings are consistent with the conclusions of previous reviews. Hypnosis has been frequently dismissed as an ineffective strategy,

not because successful results have not been demonstrated, but rather because they have not been demonstrated in well controlled experimental situations. By controlling for no-treatment control effects, number of observations, length of follow-up and the use of coroborative evidence this present analysis acts to overcome many of the inadequacies of hypnosis research. On the basis of the present findings I feel it is possible to tenetively conclude that hypnosis is effective in reducing smoking rates.

Two strategies, nicotine monitoring and cigarette monitoring were actually reliably associated with higher levels of smoking. It is possible that these strategies merely result in more accurate record-keeping, and that the higher levels of smoking are an artifact of this increased accuracy.

Two strategies have a highly significant correlation with percentage of subjects abstinent. These are increased baseline smoking (satiation) and high levels of therapist contact during follow-up (booster sessions). An additional four strategies are also reliably associated with higher abstinence rates. These are rapid or focused smoking therapist contact during treatment, cognitive interventions and hypnosis.

The failure of any of the subject variables (average age, average number of years smoking and average level of baseline smoking) to correlate significantly with outcome is not

surprising. The subject variables were not reported for individual subjects but rather averaged over entire studies. Consequently the differential success of, say, 20 year olds and 60 year olds, would have been obscured in a study involving individuals from each of these ages but reporting only an average age of say, 36.8 years. Highly useful information may have been obtained from an accurate comparison of these subject variables. However, as with smoking topography and personality variables, adequate information was simply unavailable in the literature. I suspect that important individual differences exist. Unfortunately, the present state of the literature prevents a quantitative examination of these differences.

The first canonical variate acts to substantiate the findings derived from the partial correlations. Both the abstinence and baseline scale have high loadings on this variable. High levels of abstinence and low levels of smoking are associated with use of rapid or focused smoking, high levels of contact during treatment, hypnosis, relaxation, deposit contacts, satiation and contact during follow-up. These results are a combination of the individual correlations of the independent strategies with the baseline scale and with the abstinence scale.

The second canonical variate is of interest as it is strongly associated with high abstinence and high levels of smoking. This then, would represent the strategies that

promote abstinence, yet if abstinence is not achieved, are associated with high smoking levels. Not surprisingly the highest loadings on this variable are contact during follow-up, cigarette monitoring and increased baseline smoking. Perhaps high levels of contact during follow-up result in more accurate data reporting, hence the higher levels of smoking for non-abstinent smokers. Presumably cigarette monitoring would act in the same manner. Corroborative evidence is not positively associated with this variable because the majority of types of corroborative measures are relatively inaccurate at distinguishing between subtle gradiations of smoking rate. Conceivably when satiation fails to result in complete abstinence the potential exists that some subjects will fail to reduce to baseline levels thereby increasing the average level of baseline smoking.

Corroborative evidence and stimulus control load negatively on this second canonical variable. Again, the first of these two loadings can be explained as an artifact of measurement, since, as mentioned previously, corroborative evidence is usually an accurate measure of abstinence and an inaccurate measure of smoking rate. The success of stimulus control in reducing baseline smoking, and its failure in promoting abstinence is not unexpected. Stimulus control techniques are generally designed to aid a smoker in slowly reducing consumption, a strategy which has been shown to be ineffective in gaining total abstinence.

It was anticipated that on average, treatment strategies would have increased in effectiveness in recent years. This has not proven to be the case. There is no reliable correlation between the percentage of subjects abstinent, and the year of publication. Although percentage of baseline smoking appears significantly lower in later studies, even here the relationship is not particularily strong (r=-0.13). There are three possible explanations for this phenomena. The first is that; researchers have risked new strategies, rather than merely reexaming established ones. This approach could result in a sufficiently high number of unsuccessful strategies to obscure the real improvement in the area. This explanation is bolstered by the seven significant correlations between year of publication and the various treatment strategies. A second explanation is that researchers have largely failed to benefit from past research. A final possibility is that researchers have reached a "ceiling" level of effectiveness. This final explanation is weakened, however, by the large variability across publication and treatment strategy. Most likely, the failure of researchers to report (on average) increasingly more encouraging results, is a consequence of the first two of the three explanations I have advanced.

The small percentage of studies which employ corroborative evidence (approximately 43%) is disappointing. However, it is interesting that the use of corroboration ap-

pears unrelated with abstinence levels, and is actually reliabily associated with lower percentage of baseline smoking (r=-0.17). This correspondance between successful reduction and the use of corroborative evidence apears to contradict the assumption that without corroboration subjects will claim lower levels of consumption than is actually the case. However, this possibility cannot be ruled out. Corroborative evidence may have merely been used more frequently in the more successful studies, or corroboration may in fact, be an effective treatment strategy in and of itself.

Although I have not directly considered the relative advantages of gradual verses abrupt cessation, my findings do indirectly corroborate the growing consensus that abrupt cessation is the only effective method of quitting. Some of the techniques I have considered would normally be used only in programs involving gradual cessation. These are; nicotine monitoring, urge monitoring, stimulus control and token economies. None of these techniques were reliably associated with successful cessation. Conversely, all three techniques which would normally involve abrupt cessation (hypnosis,rapid or focused smoking, and increased baseline smoking) were significantly correlated with high abstinence. Although this clear dichotomy - abrupt techniques work,gradual techniques don't - is possibly an artifact of the techniques themselves, it is more probable that something intrinsic to the smoking behavior makes gradual cessation unlikely.

Utility of Findings

Most of my findings complement the general conclusions of the major reviews in the area: merely reducing smoking rate is inefficient and ineffective, booster sessions are important, multicomponent strategies are most efficacious, and the aversive smoking techniques are the singularily most effective strategies. However, my findings also contradict some common review conclusions: corroborative evidence does not appear to affect reported abstinence rates, there has been little overall improvement in smoking cessation since the mid-1970's, and hypnosis appears to be a useful adjunct in aiding abstinence. Although the differences between my quantitative reviews and prior reviews may be due to the limitations of quantitative reviewing, more probably they are due to the limitations of intuitive reviewing. Qualitatively organizing the results of better than 100 publications is a difficult task, undoubtedly more subject to covert bias or error than a quantitative review. This meta-analysis, however, cannot replace subjective reviews. In order to conduct this study I was required to reduce complex programs with perhaps subtle, yet important differences into a relatively small number of discrete treatment categories. I have concluded that satiation is a viable technique for inducing abstinence. Is this true of all satiation strategies or just a particular kind? The inability of my quantitative review to address this type of question is

highlighted by the categories of non-smoking related aversive techniques, and cognitive strategies. A highly diverse collection of treatments were included within these generic categories. Perhaps wrist-band aversion is highly unsuccessful, while stimulus deprivation is highly successful. Having combined these two quite different groups I may have obscured the true efficacy of these treatments.

The correlations and regression models arising out of this study may be of direct use, both to clinicians and future researchers. A researcher should be able to compare the results he or she has obtained, with the average outcome of smoking cessation programs and to roughly predict abstinence and/or smoking rate trends if a longer follow-up period had been utilized. Perhaps more importantly, however, a researcher will be able to ascertain from the partial correlations the average costs or benefits of utilizing a particular treatment strategy or combination of strategies. The clinician can, similiarily, determine the most effective treatment combinations. Given that there are no constraints on the clinician or client, the most effective way to achieve abstinence would appear to be a combination of therapist supervised increased baseline smoking and rapid or focused smoking with booster sessions. A cognitive (say, visual imagery) or hypnotic strategy may also be employed as an adjunct to the above multicomponent program. Other techniques appear of little use in inducing abstinence. Attempt-

ing to merely reduce levels of consumption appears to be a relatively futile goal. Over the long term individuals who do not quit, typically reduce very little.

It is possible that the apparent effectiveness of satiation is almost solely the result of the research of Lando (1977, 1978, 1981, 1982, Lando & McCullough, 1978) who has achieved extremely high abstinence rates with his multicomponent strategies which centre around focused smoking and satiation. In fact, almost all of Lando's studies have in common the four variables most strongly associated with successful abstinence; satiation, rapid smoking, high levels of contact during treatment and the use of booster sessions. With variations on this general pattern Lando has achieved six months abstinence rates of as high as 76% and three year abstinence rates of greater than 40% (cf. Lando and McGovern, 1982). Taken together these represent the most successful findings presently available. I would refer any reader who is interested in specific examples of effective strategies to the Lando publications, particularily Lando (1981).

Conclusion

The area of smoking cessation has attracted considerable research attention, it is important that future reviewers and clinicians benefit to the greatest degree possible from the information contained within these studies. This quan-

titative review of the area contributes towards this end. It should not, however, be considered in isolation of traditional reviews. Meta-analyses complement but do not replace the knowledge that can be provided by more traditional forms of review.

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APPENDIX A

Coding Criteria for Independent Variables

APPENDIX A

1. Number of subjects - Record the number of subjects still in study at end of treatment.

-If this differs substantially from the number who end in follow-up, then use number of subjects at last prearranged follow-up period.

-If these numbers are unavailable, use number of subjects beginning experiment.

2. Hypnosis - Score 1 for any hypnotic technique or technique with important elements of hypnotic procedure. Otherwise score 0.

3. Rapid smoking - Score 1 for use of either rapid smoking or a regularly paced aversive smoking procedure. Otherwise score 0.

4. Increased baseline smoking - Score 1 if instructions are given to subject to increase the level of smoking on an ongoing basis. Otherwise score 0.

5. Other aversive - Score 1 for any technique which uses an aversive stimuli other than smoking or the by-products of smoking. This would include sensory isolation, wrist-band aversion therapy, and mild electric shock. Othwerwise score 0.

6. Cigarette monitoring - Score 1 for any procedure administered by the subject designed to keep accurage count of cigarettes consumed. Otherwise score 0.

7. Nicotine monitoring - Score 1 for any procedure which is administered by the subject and designed to keep track of the amount of nicotine consumed. Otherwise score 0.

8. "Urge monitoring - Score 1 for any procedure where the subject is required to deep track of either the number of times they experience "urges" to smoke or the number of times they experience "urges" and yet do not smoke. Otherwise score 0.

9. Stimulus control - Score 1 for any specifically-designed procedure which requires the subject to control the stimulus value of cigarettes by making access more difficult or by breaking smoking-environment connectins. Otherwise score 0.

10. Deposit contracts - Score 1 for any procedure in which a monetary deposit is collected and is returned contingent on successful abstinence or reduction in smoking. This does not include programs where deposits are returned upon either completion of treatment or continued participation in the program. Otherwise score 0.

11. Relaxation - Score 1 for any specifically-administered procedure in which increased relaxation or relaxation skills are a central goal. Otherwise score 0.

12. Cognitive - Score 1 for any procedure which focuses principally on altering the subjects' cognitions. This

would include, for example, thought-stopping and stress inoculation training. Otherwise score 0.

13. Information on health - Score 1 for any program which specifies that health-related information was either orally given or made available. Otherwise score 0.

14. Token economy - Score 1 for any program in which "tokens" are given or removed contingent on preset goals. Otherwise score 0.

15. Contact at treatment - Score 0 if the entire procedure is administered in written form or if no procedure was ever administered, as in a waiting list control group.

- Score 1 if the program is initially introduced by a researcher or therapist and from then on is administered solely by the subject without further therapist contact except to gather data.

- Score 2 if the treatment involved more than a single session with any of the researchers, a therapist, or a stop-smoking group.

16. Contact at follow-up - Score 0 if the follow-up was used only to collect information, and was not integral to the program, that is, it was either not preplanned or was unrelated to the initial treatment program.

- Score 1 if the follow-up was used only to collect information, yet was integral to the treatment program.

- Score 2 if the follow-up involved booster sessions or a continuation of treatment.

Note: If two publications report on only one research project, as in the case of an extended follow-up, the highest of the two scores for contract at follow-up is utilized.

APPENDIX B

Bibliography of Studies Included in Analysis

Bibliography of Studies Included in Analyses

Note - studies marked with an (*) were originally utilized to cross-validate the logistic regression models, and were only included as data in the final analysis.

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APPENDIX C

Table 13: Principal Component Factors of All Variables

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Table 13

Principal Component Factors of All Variables

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Hypnosis	0.183	-0.069	-0.697	-0.201	-0.225	-0.104	-0.179
Rapid/Focussed Smoking	0.590	0.255	0.033	0.218	0.081	-0.293	-0.052
Increased Baseline Smoking	0.154	-0.238	0.092	0.647	0.012	-0.071	-0.120
Other Aversive	0.151	0.263	0.076	-0.070	0.393	-0.270	0.439
Cigarette Monitoring	0.247	-0.100	0.737	-0.024	-0.140	0.124	-0.032
Nicotine Monitoring	-0.116	0.152	-0.060	0.031	-0.075	0.723	0.014
Urge Monitoring	-0.025	-0.051	0.180	-0.276	0.634	-0.133	-0.319
Stimulus Control	0.118	-0.069	0.283	-0.016	0.202	0.671	-0.091
Deposit Contract	0.280	-0.562	0.256	0.165	-0.125	0.027	0.097
Relaxation	0.183	0.649	0.051	0.013	-0.020	0.181	-0.223
Cognitive Strategies	0.136	0.641	0.099	0.010	-0.052	-0.012	0.226
Information	0.001	0.030	-0.114	0.244	0.646	0.153	0.035
Token Economy	-0.029	-0.090	0.038	-0.077	-0.082	-0.006	0.771
Contact Treatment	0.660	0.205	-0.012	-0.046	0.064	0.177	0.102
Contact/Following	0.665	-0.144	0.117	0.241	-0.200	-0.182	-0.114
Corroborative Evidence	0.049	0.101	0.025	0.785	0.070	0.065	0.007
Baseline Metric	0.490	-0.275	-0.456	-0.056	0.174	0.173	0.066
Abstinence Metric	-0.010	0.352	0.385	-0.187	-0.430	-0.108	-0.235