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THE PROBLEM OF TOBACCO ADDICTION: META-ANALYSIS OF BEHAVIOURAL TREATMENTS IN SPAIN

Julio Sánchez Meca, José Olivares Rodriguez and Ana Isabel Rosa Alcázar
Universidad de Murcia

The problem of tobacco addiction: meta-analysis of behavioural treatments in Spain. This work presents the results of a meta-analytic study on the effectiveness of multi-component programs in the treatment of subjects addicted to smoking. An exhaustive literature search identified 16 empirical studies carried out in Spain from 1980 to 1996, providing a total of 37 independent works with data from 1,979 subjects. The effect size index was defined as the standardised mean difference between pretest and posttest means in one-group designs, whereas in two-group designs it was defined as the difference between pretest-posttest mean changes in treated and control groups. The results showed a clear global effectiveness of behavioural treatments (d_+=1.450), although this was reduced by half after 18 months of follow-up (d_+=0.637). Self-control techniques were the most effective (d_+=1.810). The influence of other moderating variables is also analysed, and a predictive model of effectiveness proposed. Finally, the theoretical and clinical implications of the results are discussed.

En este trabajo se presentan los resultados de un estudio meta-analítico sobre la efectividad de los programas multicomponentes en el tratamiento de sujetos con adicción al tabaco. Una búsqueda exhaustiva de la literatura nos permitió identificar 16 trabajos empíricos realizados en España entre 1980 y 1996, dando lugar a un total de 37 estudios independientes que recogían datos de 1.979 sujetos. Se definió como índice del tamaño del efecto la diferencia media tipificada entre el pretest y el postest en los diseños de un solo grupo, mientras que en los diseños de dos grupos se definió como la diferencia entre los cambios medios del pretest al postest entre el grupo tratado y el de control. Los resultados mostraron una clara efectividad global de las intervenciones conductuales (d_+ = 1.450), aunque se reduce a la mitad tras 18 meses de seguimiento (d_+ = 0.637). Las técnicas de autocontrol fueron las más efectivas (d_+ = 1.810). Se analiza la influencia de otras variables moderadoras de los resultados y se propone un modelo predictivo de la efectividad. Finalmente, se discuten las implicaciones teóricas y clínicas de los resultados.

The consumption of tobacco is one of the principal sources of health risk and of premature mortality in Spain and in western countries in general (Becoña, 1995). For the Spanish population as a whole, the proportion of smokers is around 40% (Bayot, 1996). Given this serious problem, and the lack of a single model to explain smoking, an enormous quantity of research has been generated with the aim of finding effective treatment techniques for its elimination or control (Froján, 1995). A distinction should be made between two main types of therapy, non-behavioural and behavioural. Important among the first type are "medical advice", "drugs", "hypnosis" and "acupuncture"; within the framework of behavioural therapy there have been various tendencies. Thus, in the 1960s and 70s behaviour modification techniques began to be used in the treatment of smokers whose main objective was abstinence. These techniques (e.g., rapid smoking, satiation) were highly successful in the short term, but did not sustain this success in the long term. The 1980s saw the introduction of cognitive and psychosocial factors, and today multi-component programs have been developed, based on the systematic combination of certain control strategies focused not only on abstention, but also on the prevention of relapses. There is currently a general consensus that these programs constitute the most effective approach (Becoña, 1993; Lichtenstein and Glasgow, 1992; Schwartz, 1987). They are organised around three main kinds of treatment: (1) Aversion techniques (smoke retention or rapid smoking), (2) gradual reduction of nicotine and tar and prevention of relapses, and (3) self-control strategies (Froján and Santacreu, 1993).

Some authors working in Spain (Becoña, 1986, 1987, 1990; Becoña, Galego and Lorenzo, 1988; Becoña, Rodríguez and Salazar, 1995; Vázquez and Becoña,

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Correspondence concerning this article should be addressed to Julio Sánchez Meca. Facultad de Psicología. Campus de Espinardo. 30100 Murcia. Spain. E-mail: jsmeca@fcu.um.es

1996), reviewing these procedures, have examined their effectiveness, arriving at the conclusion that there is great variability in abstinence rates of some groups with respect to others, even when the same techniques are used and the studies are carried out by the same research team. Given this conclusion, it is considered that the use of a more powerful methodology could explain the heterogeneous results of the empirical research. This methodology is meta-analysis, which consists in applying statistical methods to the quantitative integration of results from studies on a single topic (Hedges and Olkin, 1985; Sánchez and Ato, 1989).

Using this procedure, reviews have been carried out of research covering both preventive (Bruvold, 1993; Rooney and Murray, 1996) and treatment programs, the aim of which has been to analyse the effectiveness of the different procedures and of the moderating variables intervening in that effectiveness (Baillie, Mattick and Hall, 1995; Baillie, Mattick, Hall and Webster, 1994; Becoña, 1993, 1995; Cepeda-Benito, 1994; Covey and Glassman, 1991; Garrido, Castillo and Colomer, 1995; Lichtenstein, Glasgow, Lando, Klein and Boles, 1996; Viswesvaran and Schmidt, 1992).

OBJECTIVES OF THE STUDY

The present work has applied the methodology of meta-analysis to the study of the effectiveness of one of the principal behavioural approaches used in the treatment of tobacco addiction in Spain: multi-component programs. We believe this meta-analytic review to constitute a new approach for four reasons: (a) no quantitative review exists that focuses exclusively on the effectiveness of behavioural treatments, and specifically on procedures that tend to form part of multi-component programs; (b) no previous meta-analysis has been made in this field with regard to the Spanish population, in which, as mentioned above, the proportion of smokers is around 40% (Bayot, 1996), a figure for concern if we bear in mind the large number of smoking-related illnesses; (c) abstinence rate is not the only measure used for analysing the changes observed in subjects after treatment: other indicators are included, such as number of cigarettes smoked, nicotine reduction, motivation, etc.; (d) we present a predictive model which, using a small number of variables, explains most of the variability of the effect sizes.

The *objectives* of the present study were: (a) to make a quantitative analysis of the results of the principal behavioural treatments, specifically the multi-component programs, in the treatment of smoking addiction; (b) to analyze the characteristics of the studies that may moderate the results; (c) to look for an explanatory model of the variability of effect sizes; (d) to draw up action proposals and consider future perspectives on the basis of the results found.

From the literature on this topic, we proposed several hypotheses. Firstly, the technique used is an influential variable with regard to the magnitude of effect sizes; that is, different techniques obtain different results, the most effective being those of gradual reduction of nicotine and tar (Becoña, 1987, 1990, 1993) and self-control (Ferraro, 1973; Newman and Bloom, 1981).

Secondly, following the research of García and Becoña (July, 1994), intensity and duration of treatment present a negative relationship to the results. It is to be expected that these variables are related to smokers' level of addiction (number of cigarettes smoked and years as smoker), since the stronger the addiction the more time is needed to learn properly all of the treatment strategies (Schachter, 1977).

In third place, following the results of Kottke, Battistta, DeFriese and Brekke (1988), we found that mixed treatments (individual and group) obtained better results than treatments that were only individual or only group-based.

In fourth place, since motivation is considered an essential variable in the treatment of tobacco addiction, we can assume that those programs that either control subjects' motivation or require monetary deposits will attain greater effect sizes than those that do not include such conditions.

Furthermore, the effectiveness of the programs may be conditioned by time and type of measure used; specifically, we started out from the hypothesis that self-recording attained better results than those of other measurement instruments, due to the well-known problem of reactivity (Froján, 1995). Similarly, as with other addictive behaviours, in the months following the treatment there will be relapses, though we hypothesised that these would be fewer in groups whose treatment program involved techniques that favoured the maintenance of changes.

Another hypothesis is that the type of design will influence effect sizes; specifically, it is postulated that single-group pretest-posttest designs will obtain better results than between-group designs. Also, and still with regard to methodological variables, we postulate that attrition will correlate positively with the magnitude of effect sizes due to the dropping out of those subjects least motivated to see the program through.

METHOD

Literature search

The information search was based on the following *sources*: (a) Database search (ISOC (CSIC), MEDLINE and ERIC) made in June, 1996, and dating back to 1980. The descriptors used were *smoking*, *tobacco* and *nicotine*, matched with *multi-component programs*, *nicotine reduction*, *aversion techniques* and *self-control techniques*; (b) direct review of specialized journals, books, monographs and abstracts (*Psychological Abstracts* and *Current Contents*: *Social and Behavioural Sciences*), covering the period 1980-1996; and (c) consultation with expert researchers in the area.

From this information we used for the meta-analysis that which fulfilled the following *selection criteria*: (1) studies must have been carried out in Spain, with a Spanish population, between 1980 and 1996; (2) group designs must have been used, studies where N=l being discarded, (3) data presented must have been sufficient for finding effect sizes; and (4) studies must deal with the treatment of tobacco addiction behaviour whose main procedure, with a multi-component program, was any of the following: rapid smoking, smoke retention, gradual reduction of nicotine and tar and cognitive techniques (especially self-control). The search process allowed us to select a total of 16 projects that produced 37 independent studies.

Codification of the studies

The characteristics of the studies were grouped in three categories (Lipsey, 1994): Substantive variables (treatment, subject and context variables), methodological variables and extrinsic variables.

The *treatment characteristics* codified were: (a) technique (gradual reduction of nicotine and tar, aversion techniques, cognitive techniques and combinations of these); (b) duration (in months); (c) mean intensity (weekly hours received by each subject); (d) total intensity (total hours received by each subject); (e) format (group, individual or mixed); (f) use (or not) of a contract; (g) type of training (direct, delayed or mixed); (h) training method (oral, written or mixed); (i) use (or not) of a monetary deposit; (j) use (or not) of a maintenance program; other variables, such as educational background, experience and sex of the experimenter.

The *subject characteristics* codified for the samples of each study were as follows: (a) mean age of sample (in years), (b) sex of the sample (percentage of males), (c) educational level (high, medium, low or mixed), (d) mean number of years as a smoker; (e) mean number of cigarettes smoked per day. Only one *context characteristic* was codified: the environment or location in which the training was carried out.

The following *methodological characteristics* were codified: (a) sample size; (b) attrition (percentage of subjects that gave up the treatment); (c) quality of the study (on a scale of 0 = minimum quality to 10 = maximum quality); (d) subject source (volunteer, experimenter, referred and random); (e) design (within-group and inter-group); (f) control group type (no treatment and other treatments).

Lastly, the *extrinsic characteristics* codified were: (a) date of report (year); (b) publication (published versus unpublished); (c) researcher's theoretical preference (reduction of nicotine and tar or self-control).

The codification of some characteristics required the use of complex judgements. With the aim of confirming the appropriateness of these judgements, a reliability study of the codification was carried out, in which two researchers codified independently a sample of the studies (20% of the total). The level of agreement reached, on average, in all of the variables codified was highly satisfactory, being around 99.8%. Inconsistencies between codifiers were resolved by consensus.

Calculation and analysis of effect sizes

Calculation of effect sizes. The effect size index used was standardised mean difference, *d* (Hedges and Olkin, 1985), taking into account the following definitions according to the type of design: (1) For the one-group pretest-posttest designs, the index *d* was defined as the difference between pretest mean and posttest mean divided by the overall within-group standard deviation; and (2) for the between-group designs with pretest-posttest measures, the standardised mean difference, *d*, was defined as $d = d^E - d^C$, with d^E and d^C being, respectively, the standardised mean differences between pretest and posttest of experimental (or treated) group and control group. In the pretest-posttest designs, positive values of *d* reflected an improvement in posttest with respect to pretest. In the between-group designs, positive values of *d* indicated that the improvement from pretest to posttest in the treated group was superior to that of the control group.

When a study presented the results of several dependent variables, all the values of *d* were averaged out to avoid problems of dependence. These calculations were made by considering various points of the data-collection process: directly after the treatment (posttest), and 6, 12 and 18 or more months after the end of the treatment (follow-ups).

To determine the reliability of the calculation of the *d*

values, two independent researchers analysed, in accordance with the criteria specified in the codification manual, a random sample of the studies (20%), finding excellent reliability (r = 0.96). Inconsistencies were resolved by consensus.

Statistical analysis of effect sizes. After making a descriptive analysis of the characteristics of the studies, the average effect size obtained in the posttest and in several follow-ups was calculated. Subsequently, homogeneity of the effect sizes was found and, if it was significant, the possible moderating variables of this variability were analysed, applying techniques of variance analysis and simple regression analysis. These analyses were carried out giving a weight to each effect size according to the inverse of its variance. Lastly, based on the overall effect size index in the posttest, we proposed an explanatory model of the variability of effect sizes with the aim of identifying the set of moderating variables most relevant and influential in the results. To this end, we applied weighted hierarchical regression analysis (Hedges and Olkin, 1985).

RESULTS

Descriptive analysis of study characteristics

Of the three behavioural techniques, the most frequent was that of gradual reduction of nicotine and tar (41.66%), followed by cognitive techniques (36.11%). There were also four studies that combined aversion techniques with either reduction (Becoña and Gómez-Durán, 1993) or cognitive techniques (Becoña and Vázquez, 1996a; Tortella, 1991). The majority of the treatments were made in group format. On average, duration of treatment was approximately six weeks, total number of hours received per subject was around 8, and each received 1.5 hours of treatment per week. Finally, treatment most frequently took place in an artificial environment (especially in universities).

With regard to subjects, the average profile for the samples reviewed (which included a higher percentage of males than females) was of a subject 32 years old, with high educational level, almost 13 years a smoker, and smoking an average of 24 cigarettes per day.

As far as methodological characteristics are concerned, we found a high level of heterogeneity in the sample sizes of the studies (between 4 and 473 subjects), with a mean of 56 subjects. The most frequent type of study was pretest-posttest with a single group; most subjects were recruited as volunteers, and attrition, on average, was not very high, around 4%. Finally, mean quality of the studies was 7.5 points, on a scale of 0 to 10.

As for extrinsic characteristics, the studies in our meta-analysis were mainly published articles, with psychology being the discipline most often represented by the first author. Most of the studies (86.1%) were carried out in the 1990s.

Mean effect size

The fundamental measure of the effectiveness of the treatments in our meta-analysis was effect size (defined as the standardised mean difference) obtained in the posttest; that is, after the conclusion of treatment. Nevertheless, effect sizes were also calculated at the 6-, 12- and 18-or-more- month follow-up points in those studies that incorporated such measures (Table 1).

Of the 37 studies in our meta-analysis, 36 provided posttest measures. Table 1 presents the basic descriptive statistics of these effect sizes. In the first place, it is important to point out that the effect sizes in the posttest are based on a total of 1,979 subjects, of which 1,871 were subjects on some kind of program for giving up smoking and the remaining 158 were members of control groups. The low number of controls in relation to that of treated subjects is due to the fact that, of the 36 studies, only 14 included a control group.

All of the effect sizes obtained were positive, that is, in favour of the treatment, and the overall average level of effectiveness, in terms of weighted mean, was 1,450, a very high value if we bear in mind that a standardised mean difference of 0.80 is considered to be a large effect size (Cohen, 1988). The confidence interval obtained for effect size shows that, in general, the behavioural treatment of the smoking habit is successful. As can be observed in Table 1, effectiveness diminishes with time, becoming reduced by half by the 18-month follow-up point (d_+ = 0.637). Nevertheless, the effectiveness of behavioural treatment continues to be significant, though there are very few (only 4) studies that provide follow-up data of 18 months or more.

With regard to abstinence rates, Table 2 shows the

Table 1
Basic descriptive statistics of effect size

		FOLLOW-UP (in months)		
Statistics	**Posttest**	**6**	**12**	**≤18**
k	36	24	25	4
Weighted mean	1.450	0.915	0.846	0.637
Confidence interval at 95%	1.37; 1.53	0.85; 0.98	0.78; 0.93	0.44; 0.84
Homogeneity test	389.790**	148.209**	40.563*	1.023
Proportion of positive ESs	36/36 = 1.0	24/24 = 1 .0	25/25 = 1.0	4/4 = 1 .0

k: Number of studies. *p < .05. ** p <.01. *ES*: Effect size

results obtained when including those studies that provided data on this variable in the posttest, after 6, 12 and 18 or more months. In the posttest, the abstinence rate achieved by the groups of treated subjects was 51.6%, as against 5.6% for the control subjects. This clear effectiveness decreases with time, falling by approximately half (to 23.6%) by the 18-month follow-up point.

Returning to the values of effect size, *d*, another important result is the great heterogeneity among the effect sizes of the studies (Table 1). It is in the posttest where data from the highest number of studies is available, and where the greatest heterogeneity was obtained. Let us therefore move on to an exploration of the characteristics of the studies that might explain the variability observed.

Analysis of moderating variables

The heterogeneity found among the effect sizes of the studies can be explained by their different characteristics. In order to analyse the influence of moderating variables we started out from a conceptual model, according to which the effect sizes of the studies is a function of characteristics related to treatment, to subjects and to the treatment context, and also of methodological and extrinsic characteristics.

To see whether the three types of behavioural treatment most frequently applied to the problem of tobacco addiction in Spain presented differential effectiveness, we carried out two complementary analyses. In the first place, of the 36 studies with a posttest, we selected the 31 that had applied only one of the three techniques (gradual reduction of nicotine and tar, aversion techniques and self-control) and we carried out a weighted analysis of variance. Although all three techniques showed a clearly significant effectiveness, the variance analysis indicates differences between them [$Q_B(2)$ = 11.963; p = .002], self-control techniques being the most effective (d_+ = 1.810), followed by those of gradual nicotine and tar reduction (d_+ = 1.395) and aversion techniques (d_+ = 1.281). Secondly, and to allow the inclusion of the four studies that combined aversion techniques with one of the other two, we applied a weighted multiple regression analysis to the 36 studies, taking as predictor variables the three behavioural techniques and using the fictitious codification system (1, technique present; 0, technique absent). The results corroborate those of the previous analysis of variance, showing that the degree of effectiveness of the three techniques is different [$Q_R(3)$ = 15.637;p = .001], with the self-control techniques again being superior. Nevertheless, both analyses also showed that there is still a great deal of effect size variability to be explained.

Tables 3 and 4 present the results of the variance and regression analyses (both weighted), respectively, for other characteristics of the studies. Continuing with the variables related to the implementation of the programs, it should be underlined that the duration of the treatment presented a negative relationship to effectiveness [$Q_R(1)$ = 11.322; p = .001]; thus, the longer the duration of the treatment, the less effective are the results. Another variable, considered to be less important to the treatment, but nonetheless relevant, is 'type of training', which has a significant influence on the results (p = .000), with the mixed category (d_+ = 2.200) standing out. The variable 'type of training' affects the results (see Table 2) in that greater effect sizes are attained with groups trained directly by the therapist orally (d_+ = 2.182). With regard to the variable 'monetary deposit', it can be observed that the requirement of a deposit as a means of controlling subjects' attendance at treatment sessions increases effectiveness (p = .000). Finally, the variable 'prevention', that is, the use, as part of the program, of sessions or means for preventing relapses or maintaining the effects, also marginally improves effectiveness (p = .069).

As for the characteristics of subjects, our results show

Table 2
Abstinence rates of treated and control subjects

		FOLLOW-UP (in months)		
Statistics	**Posttest**	**6**	**12**	**≤18**
No. of treated subjects	*1779 (30)*	*1921 (24)*	*1578 (22)*	*72 (1)*
No. of control subjects	286 (14)	258 (13)	208 (9)	-
% abstinence treated	51.6 %	28,7 %	27 %	23.6 %
% abstinence control	5.6 %	2.7 %	3.4 %	-

Note: Number of studies in brackets.

Table 3
ANOVAs on qualitative variables in the posttest

Type of variable	Variable	k	Q_B	DF	p
Treatment variables	Technique	32	11.963	2	.002
	Type	36	26.633	2	.000
	Train 1	31	137.024	1	.000
	Train 2	31	162.030	2	.000
	Deposit	36	48.452	1	.000
	Prevention	36	3.304	1	.069
Subject variables	Educational level	23	14.933	2	000
Methodological variables	Design	36	6.037	1	.014
Extrinsic variables	Theoretical preference	32	44.586	1	.000

k: Number of studies. Q_B: between-group homogeneity test. DF: Degrees of Freedom. *p*: Probability level.

that large effect sizes correspond to samples with older subjects [$Q_R(1) = 26.255$; $p = .000$] and to male subjects [$Q_R(1) = 35.421$; p = .000]. These two variables, age and sex, present the highest percentages of explained variance of all the variables considered (11.44% and 15.34%, respectively). Similarly, the greatest effect sizes are obtained when subjects have a high educational level [$Q_B(2) = 14.933$; $p = .000$]. However, there is no evidence that number of years as a smoker and mean number of cigarettes smoked per day before beginning the treatment affect the results (see Table 4).

On considering the methodological characteristics of the studies, we found attrition to be positively associated with effect sizes, with 9.92% of explained variance [$Q_R(1) = 38.984$; $p = .000$]; that is, those studies that lost the most subjects before the end of the treatment attained the largest effect sizes. An uncommon result is that found on classifying the studies according to type of design, since we found a larger mean effect size in the between-group designs ($d_+ = 1.673$) than in the pretest-posttest designs ($d_+ = 1.409$) –a difference that was seen to be significant [$Q_B(1) = 6.037$;$p = .014$]. Another unusual result was the positive relationship obtained between quality of the study and effect sizes [$Q_R(1) = 30.155$;$p = .000$].

Among the extrinsic variables, 'date of publication or presentation of the study' attains statistical significance ($p = .000$) in favour of the earlier studies. Finally, the variable 'researcher's theoretical preference' was influential in the magnitude of the effects ($p = .000$), in favour of the self-control technique ($d_+ = 2.326$).

Multivariate analysis

Our final objective was to find a model that, with the smallest number of variables, explained most of the variability of effect sizes. To this end, we selected those variables that should best predict the magnitude of the effects, taking into account both conceptual criteria and the statistical results of the previously carried out analyses. From among the cluster of treatment variables, we selected the variable "technique", which, being qualitative and showing non-mutually-exclusive categories, became converted into three dichotomous variables, one per technique (reduction, aversion and cognitive). Of the cluster of subject variables, we considered as fundamental the variable "sex", understood as the percentage of males included in each sample. Finally, of the cluster of methodological variables, we selected the variable "quality" of the study, it being that which best represents the methodology of the research used in each study. The proposed model consisted, then, of five predictor variables, three from the treatment cluster, one from the subject cluster and another from the methodological cluster. Using this model as a basis, we applied a weighted hierarchical regression analysis by clusters. We first introduced the methodological variable in order to determine its influence on the magnitude of effect sizes; in second place, we introduced the subject variable, followed finally by the treatment variables. This procedure would indicate whether the variable "technique" continued to influence the magnitude of effect sizes once the rest of the variables had been controlled, specifically, quality and sex. The three clusters of variables, taken jointly, explained 27.65% of the variability. The methodological cluster, introduced first, explained 7.68%; the subject cluster, once the influence of the methodology cluster was partialised, explained 14.64%, and finally the treatment cluster, with the partialised influence of the methodological and subject factors, explained 5.33% of the results, this increment in the percentage of explained variance being significant [$Q_R(3) = 20.926$; $p = .000$]. Thus, our results show that the differential effectiveness of the three behavioural techniques used for smoking cessation is maintained once the studies are adjusted in terms of sex of the subjects treated and methodological quality.

This explanatory model may be used for making predictions, in future research, about the possible effect sizes resulting from the combination of the variables used here. The predictive regression equation was as follows:

$$d' = -2.08 + 0.23(Quality) + 0.05(Sex) - 0.02(Reduction) - 0.55(Aversion) + 0.36(Cognitive)$$

The negative sign of the regression coefficient indicates

Table 4

Simple regression analyses on quantitative variables

Cluster: variable	k	RC	Q_R (DF)	p	R^2
Treatment variables					
Duration	28	-0.396	11.322 (1)	.001	.0415
Total intensity	28	-0.014	0,309 (1)	.578	.0012
Mean intensity	28	-0.006	0.008 (1)	.929	.0000
Subject variables					
Age:	28	0.023	26.255 (1)	.000	.1144
Sex:	32	0.028	35.421 (1)	.000	.1534
Yrs. as smoker:	14	-0.000	0.000 (1)	.998	.0000
No. of cigarettes:	19	0.029	0.442 (1)	.506	.0036
Methodological variables					
Exptl. mortality	36	0.037	38.984 (1)	.000	.0992
Quality	36	0.161	30.155 (1)	.000	.0768
Extrinsic variables					
Date	36	-0.084	25.436 (1)	.000	.0658

k: Number of studies. *RC*: Regression coefficient. Q_R: Weighted sum of squares due to regression. *DF*: Degrees of Freedom. *p*: Probability level. R^2: Determination coefficient.

that the techniques of reduction and aversion are below the mean level of effectiveness, not that they are ineffective. This equation allows the prediction of the effect size of a study for a given quality level and for a specific combination of technique and sex of the sample. For example, for a maximum quality level (10), self-control techniques are seen to be the most effective, both for male (*d'* = 5.274) and female (*d'* = 0.633) samples, whilst the application of aversion techniques with female samples even produced negative results (*d'* = -0.281). The possible combinations with the set of variables included in the equation are multiple. In any case, the hierarchical model proposed should be interpreted with extreme caution, since it is based on a small number of studies.

DISCUSSION AND CONCLUSIONS

Given the great disparity of results found by reviews of empirical research (Becoña, 1985; Schwartz, 1987), the main objective of our study was to find out whether multi-component programs were effective, and what differences existed among the main techniques included in them. We also aimed to discover which moderating variables most influenced the results.

We found multi-component programs to be effective both in the short and long term, though the effect sizes decrease with time (d_+ = 1.450 in the posttest, d_+ = 0.915 after six months and d_+ = 0.846 after twelve months). Effectiveness at six months is almost the same as at twelve months, indicating, as Becoña (1995) affirms, that the relapse curve is greater between the end of the treatment and the six-month follow-up point, gradually decreasing from then to the twelve-month point, with no relapses usually occurring between 24 and 36 months.

Focusing on the hypothesis that the different techniques would give different results, we found that it was true, this variable explaining 5.33% of the variability of the results, once the variables "sex" and "quality of the study" had been controlled. We observed that the cognitive techniques, specifically that of self-control, obtained the best results. The greater effectiveness of self-control may be explained by the fact that the reduction or elimination of smoking behaviour has been considered one of the most typical examples of self-control (Ferraro, 1973; Newman and Bloom, 1981). Teaching the subject to be able to reject immediate reinforcement in favour of a more distant kind is one of the key factors in the self-control approach.

In our results we have been able to confirm how the variables "sex" and "age" affected the magnitude of effect sizes. With respect to the variable "sex", our findings coincide with those reported by Becoña (1995), according to which females improve less than males, perhaps due to the fact that for many women giving up smoking leads to an increase in body weight, in which case they prefer to continue smoking; this is a very important variable to bear in mind with regard to treatment, since it explains a high percentage of variance (approximately 14.64%). As far as the variable "age" is concerned, the results may be contaminated by the presence of illness in older subjects as an incentive to stop smoking, though this is a supposition we have been unable to confirm due to a lack of information in the studies.

As for the "duration" of the treatment, we have been able to confirm that, as Becoña and García noted (1995; García and Becoña, July 1994), excessively lengthy treatments are detrimental in terms of effectiveness, perhaps due to tiredness and demotivation. Moreover, Froján (1991) remarked that the sophistication of the techniques and long duration of programs not only fails to increase effectiveness, but may actually be counter-productive. The variables "number of cigarettes smoked" and "years as smoker" do not affect our results, perhaps because of the fact that they are influenced by the age of the subjects; nor is "number of sessions" influential, though it does support the theory that treatments with little contact and short treatments obtain similar results to those with a large number of sessions. Also, we found that direct treatment is more effective than programs carried out by mail, due to unidentified factors.

Meanwhile, our results support the hypothesis of greater effectiveness of mixed treatments, along the lines of those of Kottke et al. (1988), and with regard to the hypothesis concerning motivation or the use of a monetary deposit (found to have a positive influence on the magnitude of effect sizes), we found that certain techniques, such as feedback, assessment, self-recording, etc., appear to be sufficient for obtaining control of smoking, at least when subjects are motivated to control it (Baillie et al., 1995; Curry, Wagner and Grothaus, 1990).

The hypothesis that type of measure would affect the results could not be properly tested due to lack of data, given that the majority of studies did not report any type of measure other than self-recording. Thus, despite the fact that in the literature it is stated that the assessment of smoking addiction treatments has been oriented to an analysis of the modifications produced as a consequence of treatment applied at three response levels: motor, cognitive and physiological, programs continue to use the measure most common in the 1970s –rate of cigarette consumption, analysed by means of indirect measures (e.g., counting cigarette ends), collaborators' reports (e.g., external observers close to subject) and self-

reports. The last of these presents the well-known problem of reactivity. The modification of cigarette consumption should imply not only the parallel modification of certain cognitive variables (attitudes towards smoking, self-efficacy and motivation to change), but also changes in terms of physiological measures, which allow the evaluation of modifications of consumption patterns independent of whether consumption rate has decreased or not. The studies analysed provided scarcely any information on these variables.

FUTURE PERSPECTIVES

The results of our meta-analytical review suggest some recommendations for future research within the field of addiction to smoking. An important aspect of any smoking program is abstinence maintained over time, whilst two relevant complementary criteria are the reduction of cigarette consumption in those who continue to smoke months or years after ending the treatment, and, as part of the follow-up assessment, the number of months or weeks of abstinence maintained by subjects who are once again smoking 12 months after the treatment. This latter aspect is relevant for several reasons: (a) it makes the smoker aware that he/she can stop smoking, because he/she has managed to abstain for some period in the previous 12 months, (b) it facilitates further attempts, in which the probability of giving up definitively is increased, and (c) it reduces the health risk, given that the subject has gone x number of weeks/months without smoking. Only two studies (Becoña 1995) reported on these variables. We therefore believe that they should be taken more into consideration in future research.

There are other important variables that have not been analysed due to lack of information –changing the brand of cigarettes, non-attendance at treatment sessions, the smoker's goals, etc.– and which we consider should be reported on in future studies. It would also be interesting, with a view to providing more objective data, for studies to provide results related to biochemical measures of tobacco consumption, such as the analysis of carbon monoxide and of tiocianate in saliva.

Although, as regards methodology, it is considered that any smoking program should have a follow-up of at least one year (Lando, 1993; Lichtenstein and Glasgow, 1992), few studies provide data on longer follow-ups. We consider it highly important that studies be designed with follow-up measures extended beyond 12 months, since this would allow researchers to monitor the temporal stability of the effectiveness of the programs.

Similarly, the question of relapses should be a prime concern for researchers working in this field, who should aim to improve prevention programs, analyse elements of the process that optimise long-term results, focus more on abstinence maintained over time, etc., since maintenance of results is the true indicator of the effectiveness of addiction treatments in general and of smoking programs in particular.

Finally, we have proposed a predictive model of effectiveness as a function of treatment techniques, of methodological quality and of sex. We believe that this predictive model can be used in future research to provide a tentative estimation of the effect size that would be obtained under certain conditions. Nevertheless, we are aware that relevant variables are missing from the model –variables we have been unable to include due to the small number of studies available; this situation can be improved in future through successive enlargements of our meta-analytic database.

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