Meta-analysis of the effectiveness of school substance abuse prevention programs in Spain

José P. Espada, María T. Gonzálvez, Mireia Orgilés, Daniel Lloret and Alejandro Guillén-Riquelme
Universidad Miguel Hernández

Abstract

Background: There has been an increase in adolescent substance use that has led to the development and implementation of prevention programs. New evidence is needed in order to improve them and optimize the resources. The aim of this paper is to use a meta-analysis to analyze the effectiveness of school drug prevention programs in Spain. Method: Twenty-one studies that evaluated drug abuse prevention programs in schools, were published between 2002 and 2013, and that met the selection criteria were identified. Results: Preventive program effectiveness was low ($d=0.16$), although it was higher at the follow-up ($d=0.30$). The programs were most effective in changing attitudes ($d=0.44$) towards drugs. The models of health education ($d=0.48$) and social learning ($d=0.20$) were also very effective, especially in combination with oral, written, and audiovisual support material ($d=0.21$) and the implementation of joint programs by health education professionals and faculty members ($d=0.25$). Conclusions: Is possible to determine the need for more rigorous evaluations of interventions to establish useful programs.

Keywords: meta-analysis, prevention, drugs, school environment, teens.

Adolescent substance use remains a serious problem in Spain. Better prevention programs are of paramount importance in addressing this problem. However, it is first necessary to evaluate the effects of current Spanish drug prevention programs and to examine what would make them more effective.

Meta-analyses are a fast and safe way of consolidating the latest scientific evidence on any subject (Sánchez-Meca & Botella, 2010). The methodology of meta-analysis is noted for its ability to direct the replication of studies and to allow for the analysis of the sources of heterogeneity in study results (Marín-Martínez, Sánchez-Meca, & López-López, 2009).

The first meta-analysis regarding substance abuse (Tobler, 1986) found that the programs produced a moderate effect on the levels of drug knowledge, but had a negligible effect in changing attitudes. Bangert-Drowns (1988) concluded that voluntary participation produced greater behavioral changes and the programs that used fellow group leaders as monitors did better. The meta-analysis conducted by Rundall and Bruvold (1988) agreed with Tobler that programs did not change attitudes but they increased the level of knowledge, and retention of this knowledge had a positive long-term effect on consumption.

Rooney and Murray (1996) reviewed smoking prevention programs, discovering that the most effective of these had the following characteristics: annual follow-ups, observation and feedback, random assignment of prevention groups, follow-up booster sessions in later years, peers of the same ages as the monitors, and they lasted for ten sessions or less. Shortly after this meta-analysis, Tobler, Lessard, Marshall, and Ochshorn (1999) analyzed marijuana prevention programs. This time, they concluded that interactive programs implemented by psychologists and educators produced major changes if they were supported by peers or teachers.

The reviews carried out in recent years to determine the effectiveness of substance prevention programs have established...
that social influence (Cuijpers, 2002) and social skills (Faggiano et al., 2005, 2008), combined with the use of group leaders to strengthen the impact of programs (Thomas, 2004), all improve the efficacy of treatment programs. Additionally, Faggiano et al. (2005) highlighted the importance of evaluating the individual components making up the interventions (e.g., peers, parents, booster sessions). They also stated that affectivity-based programs improved decision making and knowledge, while knowledge-based programs improved mediating variables, but that neither was as effective as skills-based programs (Faggiano et al., 2008).

In Spain, a meta-analysis of prevention program studies published between 1985 and 2002 was performed (Espada et al., 2002), concluding that the preventive efficacy of the programs tended to increase over time. As for the substance involved, the more effective programs always focused on alcohol abuse prevention. Regarding the theoretical model of choice, the programs based on the theories of reasoned action and social learning performed better than others did.

Researchers at the international level have recently conducted several meta-analyses of school substance abuse prevention programs. However, in Spain, for more than a decade, there has been a lack of quantitative analyses on determining the efficacy of current programs. However, in Spain, for more than a decade, there has been a lack of quantitative analyses on determining the efficacy of current programs. Moreover, Faggiano et al. 2005 highlighted the importance of evaluating the individual components making up the interventions (e.g., peers, parents, booster sessions). They also stated that affectivity-based programs improved decision making and knowledge, while knowledge-based programs improved mediating variables, but that neither was as effective as skills-based programs (Faggiano et al., 2008).

The literature search and inclusion criteria

The literature search was conducted using major databases (PsychInfo, Medline, Scopus, Tripdatabase, Social Science Citation Index, Cochrane, and the databases of CSIC: ICYT, ISOC, and IME), gray literature (Google Scholar and Teseo), and a direct review of specialized journals, books, and monographs. We included theses, books, and monographs to minimize the publication bias. In all of these documents, we used the inclusion criteria, and guarantee the use of a control group or repeated measures and methodological aspects to control for the methodological quality of these documents.

The search terms were: teen, young, youth, intervention, study, program, school, meta-analyses, Spain, abuse, drug use, illegal drugs, psychoactive substances, snuff, alcohol, cocaine, ecstasy, marijuana, and cannabis. These terms were searched in full documents. Only Spanish or English studies were included. The criteria for study inclusion were:

a) The program had been implemented with Spanish adolescents.

b) The study had been published between 2002, the year in which the last meta-analysis (Espada et al., 2002) with the same objectives as this study took place, and 2013, which was the year this review was conducted.

c) The study reported on the program outcome evaluations, which were aimed at primarily preventing drug abuse in adolescents between ages 10 and 19 years within a school context.

d) The study submitted sufficient data to calculate effect sizes.

e) The study had an experimental, or quasi-experimental, design with pretest-posttest and/or follow-up measures.

The literature search identified 15,543 studies, of which 21 were finally included in the meta-analysis (Figure 1). The 18 articles were published. Fifteen expert authors in the field of study were contacted by e-mail in order to obtain information concerning unpublished work that had not yet been included in our study. Only three authors responded without providing further studies.

Coding the studies

A manual detailing of the criteria for coding the study characteristics in order to increase the accuracy of the results was developed. To avoid bias due to coding order, the studies were presented randomly to the coders.

Two reviewers read 1,078 abstracts to assess the relevance of each summarized study and to make an inclusion decision. The full text of the 103 works remaining after the abstract review was obtained. Eighty-two papers were excluded for methodological reasons (i.e., lack of preventive program control or a comparison group, insufficient data for statistical analysis, and/or duplicate data that presented in other studies).

Data from the 21 papers finally included in the meta-analysis were extracted independently by the two reviewers. The degree of agreement was found with Cohen’s kappa coefficient and intraclass correlation coefficient. The average value was .714 (range: .518 to 1). Disagreements were resolved by a third reviewer.

Methods

Figure 1. Identification of included studies
Characteristics of the studies

The year 2008 saw the highest percentage (20%) of studies compared to every other year in the period of interest. In the past two years, there has been a sharp decline in the research into this field, with a representation of 5% of the total publications in both 2012 and 2013. Three of the studies were doctoral theses, while the others were scientific articles. All the studies included had control group, to ensure the methodological quality of them.

Tables 1 and 2 show the main variables of the included studies. Eighteen of the studies reported the gender of the participants, with a high percentage of women (M= 53.92%; SD= 18.09%). Only four studies requested their participants to complete homework, and parental participation was assessed in five studies.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main substance</td>
<td>Tobacco</td>
<td>10 (47.62%)</td>
</tr>
<tr>
<td></td>
<td>Alcohol</td>
<td>2 (9.52%)</td>
</tr>
<tr>
<td></td>
<td>Alcohol + Synthetic drugs</td>
<td>2 (9.52%)</td>
</tr>
<tr>
<td></td>
<td>Cannabis</td>
<td>1 (4.76%)</td>
</tr>
<tr>
<td></td>
<td>Alcohol + Tobacco + Synthetic drugs</td>
<td>1 (4.76%)</td>
</tr>
<tr>
<td></td>
<td>Drugs, in general</td>
<td>5 (23.81%)</td>
</tr>
<tr>
<td>Theory</td>
<td>Social learning</td>
<td>2 (10%)</td>
</tr>
<tr>
<td></td>
<td>Reasoned action</td>
<td>1 (5%)</td>
</tr>
<tr>
<td>Methodology</td>
<td>Active</td>
<td>17 (80.95%)</td>
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<tr>
<td></td>
<td>Incidental</td>
<td>9 (42.86%)</td>
</tr>
<tr>
<td>Assignment</td>
<td>Passive</td>
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</tr>
<tr>
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<td>Random</td>
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<tr>
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<td>Pseudorandom</td>
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<tr>
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<td>Unspecified</td>
<td>2 (9.52%)</td>
</tr>
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<td>Components</td>
<td>Information</td>
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</tr>
<tr>
<td></td>
<td>Modeling</td>
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<td>Social skills</td>
<td>13 (61%)</td>
</tr>
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<td>Solving problems</td>
<td>6 (29%)</td>
</tr>
<tr>
<td></td>
<td>Self-control</td>
<td>3 (14%)</td>
</tr>
<tr>
<td></td>
<td>Educational</td>
<td>4 (19%)</td>
</tr>
<tr>
<td></td>
<td>Operational techniques</td>
<td>4 (19%)</td>
</tr>
<tr>
<td></td>
<td>Making personal decisions</td>
<td>11 (52%)</td>
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<tr>
<td></td>
<td>Public commitment</td>
<td>7 (33%)</td>
</tr>
<tr>
<td></td>
<td>Normative expectations + advertising</td>
<td>3 (14%)</td>
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<tr>
<td></td>
<td>Leverage</td>
<td>2 (10%)</td>
</tr>
<tr>
<td></td>
<td>Leverage + advertising</td>
<td>1 (0.5%)</td>
</tr>
<tr>
<td>Information</td>
<td>Oral</td>
<td>2 (9.52%)</td>
</tr>
<tr>
<td></td>
<td>Oral + written</td>
<td>3 (14.29%)</td>
</tr>
<tr>
<td></td>
<td>Oral + written + audiovisual</td>
<td>8 (38.1%)</td>
</tr>
<tr>
<td></td>
<td>Unspecified</td>
<td>8 (38.1%)</td>
</tr>
<tr>
<td>Administrator</td>
<td>Professional</td>
<td>16 (76.19%)</td>
</tr>
<tr>
<td></td>
<td>Mixed</td>
<td>2 (9.54%)</td>
</tr>
<tr>
<td></td>
<td>Unspecified</td>
<td>3 (14.28%)</td>
</tr>
<tr>
<td>Administrator training</td>
<td>Psychologist</td>
<td>9 (21.95%)</td>
</tr>
<tr>
<td></td>
<td>Educator</td>
<td>6 (14.63%)</td>
</tr>
<tr>
<td></td>
<td>Professor</td>
<td>18 (43.90%)</td>
</tr>
<tr>
<td></td>
<td>University student</td>
<td>6 (14.63%)</td>
</tr>
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</table>
|            | Other           | 2 (4.88%)     

Of all the programs examined, only four included booster sessions. Of the 21 studies, twelve included only one program, two included two programs, three included three programs, and four included four programs. The total sample size in the posttest was n= 10,956, and in the follow-up was n= 9,149. More than one-third (38.1%) of the studies reported that they had conducted a preliminary training of administrators. In most cases, this training was conducted via a special training course before administration. In one study, the training was provided through a self-manual. One of the studies carried out follow-ups with the administrators via fortnightly meetings. There was great variability in the training times, with the longest duration being 48 hours. More than one-third (35%) of the studies used manualized programs.

As for the measurement instruments used in the evaluations, 70% of the studies used at least one objective or standardized assessment method (stable measurements), while 10% employed standardized self-reports, and 20% used unstandardized self-reports. In 55% of the cases, the psychometric data of the utilized instruments were provided. Implementation fidelity was controlled only in two of the studies, analyzed by self-reports.

Of the 21 studies analyzed, 42.9% held a cluster effect control by center and application group, controlling for contamination bias. Only 16.2% applied an experimental design.

As for the drop rate, 45% of the studies controlled for attrition. The average percentage of students who continued at posttest was 75.45% (SD= 31.09%).

An assessment of the average quality of the reviewed studies was made according to nine criteria [0-9]: randomization, type of design, sample size, attrition, follow-up actions, evaluator-blind procedure, average pre-post consistency, use of objective and standardized tools, and implementation fidelity. The average methodological quality of the studies was moderate (M= 4.88; SD= 1.43).

Effect size index

The effect size was calculated using the standardized difference between the pre-post mean for the intervention group. We calculated the effect size for each dependent variable included in the analysis (Knowledge of drugs, attitudes towards drugs, intention and drug consumption). This effect size was used for the efficacy in each dependent variable and for total effect. We calculated the effect size for posttest and follow up independently.

Statistical analysis

To calculate the general effect size, we used a fixed effects model, because the number of studies was lower. Moderator
analysis was done with analysis of variance and weighted continuous moderators with weighted meta-regression models. The homogeneity in the results was examined with the Q statistic. To analyze the publication bias, Egger’s regression test was used. We used metafor package for R program (Viechtbauer, 2010).

Results

Short-term efficacy of the programs

The effect sizes of the programs were calculated from the mean scores and standard deviations of the intervention. A summary of these is shown in Table 3, where it can be seen that the global average effect size is 0.16 (SE= 0.03). When analyzing observed variability, heterogeneity was shown to be very high (Q= 132.4; p<.01). The Egger’s regression test was Z= 2.28 (p=.02) for posttest and Z= 0.97 (p=.33) for follow up.

Influence of moderator variables on short-term efficacy

Because homogeneity was observed in the effect sizes, we proceeded to analyze the source of variability. A summary of these is shown in Table 4. First, we included the underlying theory for each of the preventive programs. The model in which interventions are most effective is the health education model. We observed no effect sizes greater than 0.2 for the rest of the included theoretical models.

With respect to the support materials, the effect size was small for all combinations, but it was somewhat higher when the oral, written, and audiovisual materials were used together. Conversely, programs that combined the oral and audiovisual material were not effective, but the oral material alone obtained somewhat

### Table 3

<table>
<thead>
<tr>
<th>Program effectiveness</th>
<th>Posttest</th>
<th>95% CI</th>
<th>Q</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>k</td>
<td>d/b</td>
<td>Lower limit</td>
<td>Higher limit</td>
</tr>
<tr>
<td>Global</td>
<td>36</td>
<td>0.16</td>
<td>0.10</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Efficacy variable

| Knowledge of drugs | 18 | 0.34 | 0.23 | 0.45 | 70.66 | <.01 |
| Attitudes towards drugs | 15 | 0.44 | 0.33 | 0.54 | 65.36 | <.01 |
| Intention           | 14 | 0.23 | 0.14 | 0.32 | 20.55 | <.01 |
| Drug consumption     | 20 | 0.18 | 0.11 | 0.26 | 25.42 | <.01 |

Table 4

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>k</th>
<th>d/b</th>
<th>95% CI</th>
<th>Q</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory</td>
<td></td>
<td>37</td>
<td></td>
<td></td>
<td>76.87</td>
<td>104.95</td>
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<td></td>
<td>Social learning</td>
<td>0.1031</td>
<td>0.0102</td>
<td>0.1959</td>
<td>.0296</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reasoned action</td>
<td>0.0999</td>
<td>-0.2253</td>
<td>0.4251</td>
<td>.5469</td>
<td></td>
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<tr>
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<td>Social influence model</td>
<td>0.1181</td>
<td>-0.4879</td>
<td>0.7241</td>
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<tr>
<td></td>
<td>Health education</td>
<td>0.478</td>
<td>0.3547</td>
<td>0.6041</td>
<td>&lt;.0001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>0.1895</td>
<td>0.0901</td>
<td>0.2895</td>
<td>.0002</td>
<td></td>
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<td>Materials</td>
<td>Oral</td>
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<td>-0.5567</td>
<td>0.8567</td>
<td>.6774</td>
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<tr>
<td></td>
<td>Oral + written</td>
<td>0.0171</td>
<td>-0.1611</td>
<td>0.1953</td>
<td>.8508</td>
<td></td>
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<tr>
<td></td>
<td>Oral + written+audiovisual</td>
<td>0.2126</td>
<td>0.1214</td>
<td>0.3039</td>
<td>&lt;.0001</td>
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<tr>
<td></td>
<td>Oral + audiovisual</td>
<td>0.04</td>
<td>-0.0714</td>
<td>0.1514</td>
<td>.4816</td>
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<tr>
<td>Information</td>
<td>Oral</td>
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<td>0.1159</td>
<td>0.4033</td>
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<td>Audiovisual</td>
<td>0.04</td>
<td>-0.0714</td>
<td>0.1514</td>
<td>.4816</td>
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<td>0.1961</td>
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<td>Oral + written+audiovisual</td>
<td>0.3481</td>
<td>0.2369</td>
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<td>0.1999</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Professional + teachers</td>
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<td>0.0785</td>
<td>0.4146</td>
<td>.004</td>
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<tr>
<td>Report</td>
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<td>0.0558</td>
<td>0.1811</td>
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<td>Doctoral dissertation</td>
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<td>0.2099</td>
<td>0.4832</td>
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<tr>
<td>Duration</td>
<td>14</td>
<td>0.0031</td>
<td>-0.0134</td>
<td>0.0196</td>
<td>0.1336</td>
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<tr>
<td>Hours</td>
<td>16</td>
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<td>-0.0692</td>
<td>-0.0347</td>
<td>34.96</td>
<td>51.27</td>
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<tr>
<td>Number of sessions</td>
<td>26</td>
<td>-0.014</td>
<td>-0.0302</td>
<td>0.0023</td>
<td>2.8293</td>
<td>91.92</td>
</tr>
</tbody>
</table>

Note: a Number of studies; b Overall intragroup homogeneity test; * Continuous variable
better results. Regarding the type of program administrator, both in the programs run by professionals alone and in programs implemented jointly by professionals and teachers, the effect sizes were small.

Program duration, number of program hours, and number of sessions had no influence on the efficacy of the program. In contrast, programs reported in articles published in journals had smaller effects on overall program efficacy than did programs presented in dissertations. In Table 5, we summarize the moderator effects of each quality item and the total quality.

Medium and long-term program efficacy

Table 6 reports the mean effect sizes for programs that included a follow-up year (± 2 months) and for those doing track after two years of program implementation (± 2 months). At the 12-month follow-up, 27 programs were reported as effective. In this case, the medium effect size was small (d = 0.3; p < .01). Again, variability was very high (Q = 57.4; p < .01), so the sources of variability were examined. Oral and written program information together showed statistically significant results (d = 0.69; p < .01). The type of therapist implementing the program explained part of the variability, as the programs implemented by professionals alone (d = 0.25; p < .01) and those implemented by professionals and teachers together (d = 0.48; p < .01) showed remarkable differences in effectiveness. Again, duration (bj = 0.06; p = .02), number of hours (bj = 0.01; p < .01), and number of sessions (bj = -0.06; p < .01) had no impact on the effectiveness of these programs. In the 24-month follow-up, only four articles that the programs were still effective, which is a paltry proportion (d = 0.03; p = 0.65; Q = 11.4; p = 0.02).

Discussion

The aim of this study was to evaluate the efficacy of school drug prevention programs in Spain and to analyze how various modulating variables influence the efficacies of such programs. The programs implemented in the school context showed small effect sizes (d = 0.25), with a tendency to increase in follow-up assessments (d = 0.3), although there is a high variability among the studies. For global effect, the heterogeneity was very high. This result is normal because we included experimental studies and quasi experimental studies, but it is important to interpret this result with caution. In this sense, the results of scientific examinations of school-based prevention in our country have not changed substantially over the past decade, if we compare the present results to those of previous meta-analyses (Espada et al., 2002).

Similar to previous observations, the programs evaluated herein were more effective in preventing alcohol use and in changing the attitudes towards drugs in the short term. They were less effective at preventing consumption. According to Griffin, Botvin, Scheier, and Nichols (2002), variations in consumption usually are detected at follow-up.

Espada et al. (2002) found that programs based on the theories of reasoned action and social learning were the most effective, while the present review shows that the social learning and health education theories yielded the best results.

Currently, many prevention programs are implemented in the classroom by outside specialists. Several investigations have been conducted to discover the most effective preventive agent, with mixed results. In previous research, it was found that programs implemented by professionals outside the school achieved better

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>k</th>
<th>d</th>
<th>Lower</th>
<th>Higher</th>
<th>p</th>
<th>Qb</th>
<th>Qe</th>
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<tr>
<td>Randomization</td>
<td>Not randomization; no control</td>
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<td>0.2293</td>
<td>0.149</td>
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<td>50.6769</td>
<td>131.0147</td>
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<td>&lt;.0001</td>
<td>49.5046</td>
<td>132.3632</td>
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<td>Mortality</td>
<td>&gt; = 20%</td>
<td>13</td>
<td>0.2121</td>
<td>-0.1641</td>
<td>0.5883</td>
<td>.2691</td>
<td>16.7498</td>
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<td>No follow up</td>
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<td>0.5245</td>
<td>.0186</td>
<td>16.9061</td>
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<td>&lt;.0001</td>
<td>68.4161</td>
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<td>-0.176</td>
<td>0.216</td>
<td>.8415</td>
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</tr>
<tr>
<td>Global quality*</td>
<td>36</td>
<td>-0.0512</td>
<td>-0.0901</td>
<td>-0.0124</td>
<td>.0096</td>
<td>6.7007</td>
<td>117.0394</td>
<td></td>
</tr>
</tbody>
</table>

Note: In "sample size", "average pre-post consistency" and "blind" all studies had the same values. * Number of studies; Qb Overall intragroup homogeneity test. * Continuous variable.
results (Espada et al., 2002; Espada, Rosa, & Méndez, 2003). Meanwhile Moral, Ovejero, Sirvent, and Rodríguez (2005) found significant results in reducing drug use when the program was applied by outside experts. Conversely, Gázquez (2010) concluded that teachers achieve results that are more favorable to reduce drug use. The present study concludes that the programs implemented by professionals and teachers together are those with the greatest efficacy ($d=0.48$).

Program intensity is another variable that needs to be considered when obtaining evidence about preventive program efficacy. In this paper, duration, number of hours, and number of sessions were not influential in obtaining the preventive effect,
and these results are contrary to what was observed by Espada et al. (2002), in which programs with a higher number of sessions tended to be more effective. According to Cuijpers (2002), there is no conclusive evidence that more intensive programs are more effective than those that are less intense. This finding implies that, in order to optimize resources, it would be of interest for professionals to carry out programs distributed in fewer sessions.

This study provides data so far unknown about the effectiveness of prevention programs in Spain over the past twelve years. However, there are some limitations to consider. First, the methodological shortcomings (e.g., the lack of objective assessments, the lack of a control group, the absence of sufficient data to carry out the appropriate analyses) likely had an impact on our current results. Second, the studies in the meta-analysis are not without their own limitations; therefore, it is necessary to be cautious in concluding certain evident aspects. Many of the studies showed only what was effective, and others have severe methodological problems (e.g., sample attrition, lack of randomness in the selection of subjects, and lack of long-term assessments). Third, the existence of few evaluating studies, and the heterogeneity and the variability of the results obtained is evident.

However, the present meta-analysis helps to integrate the findings of the studies that have been conducted over the past decade with a common metric, which allows us to discover the relationships between the study characteristics and results. In addition, from our results, it is possible to determine the need for more rigorous evaluations of interventions, such as by controlling for the fidelity and integrity of the applications when implementing well-established programs and monitoring the effects of the variables that may influence the effectiveness of the results. In addition, such control is essential for future research in order to evaluate the results of programs and to recognize their usefulness and for possible replications.

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References

(The studies marked with an asterisk were included in the meta-analysis)


Enseñanza Secundaria [Smoking prevention program in secondary school students]. *Archivos de Bronconeumología*, 45, 16-23.


