Proactive telephone counseling as an adjunct to minimal intervention for smoking cessation: a meta-analysis

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Abstract
Proactive telephone counseling is an effective adjunct to minimal intervention for smoking cessation, but its effect has not been quantitatively synthesized thoroughly. The present meta-analysis reviewed 22 studies published between January 1990 and December 2003 and found that there was a heterogeneous, significant adjunct effect of proactive telephone counseling for smoking cessation. This meta-analytic review also found that the following study characteristics explained most of the variation in the adjunct effect: year of publication, follow-up time, mean age of participants, proportion of female participants, participants' readiness to quit smoking and number of cigarettes smoked per day before intervention. In other words, based on the 22 studies, proactive telephone counseling is effective as an adjunct to other minimal interventions for younger, male, light-smoking participants. The results of this meta-analytic review imply that researchers and health care providers may need to focus on participants as much as on intervention process to obtain more effective interventions.

Introduction
Statistics show that smoking is a causal factor in diseases and mortality [1–5]. Fortunately, many effective intervention programs are available to quit smoking. An extensive meta-analytic review was performed by Viswesvaran and Schmidt [6] on 633 smoking cessation studies, involving 71 806 participants in 15 different intervention programs that ranged from instructional programs to conditioning-based programs and drug-based programs to medically sponsored programs. The outcome measure was the smoking quit rate based on the self-reported cigarette smoking cessation or abstinence after a follow-up period for at least 3 months. The authors found that all intervention programs were effective at increasing cessation or abstinence with an average observed quit rate of 18.6%, ranging from 1 to 36%, after adjustment for the control group quit rate of 6.4%.

Unfortunately, Viswesvaran and Schmidt’s [6] extensive review did not include telephone counseling. In fact, telephone counseling is an attractive alternative intervention for smoking cessation [7–15, references marked with an asterisk indicate studies included in the meta-analysis] due to accessibility and convenience. With this intervention, there are no transportation difficulties and fewer scheduling conflicts than with most other intervention programs. In addition, receiving counseling in the privacy of patients’ homes provides treatment access to individuals who might not normally seek ‘counseling’ to quit smoking otherwise [13]. There are two major approaches in telephone counseling: (i) ‘Reactive’ approach where smokers use hotlines or helplines to call for...
information or assistance and (ii) ‘Proactive’ approach where a trained counselor initiates calls to the smoker [9, 13]. Interventions with telephone counseling, especially proactive telephone counseling, have achieved various but consistent smoking cessation or abstinence rates ranging from 10 to 45% [11, 13, 16–19]. In addition, telephone counseling has shown significantly higher quit rates during earlier follow-ups (3–6 months) than later follow-ups (12–18 months) [8, 12, 20–22].

The Cochrane Review [23] and the Clinical Practice Guideline [17] recommend using proactive telephone counseling as an adjunct to minimal intervention (i.e. a single or combination of a few less intensive or self-help interventions, such as self-help materials, nicotine replacement therapy (NRT), reactive telephone hotlines or helplines, computer programs or Internet, physician advice [17, 23]), because it is potentially more effective than telephone counseling or minimal intervention alone [11, 24]. In the literature, several research syntheses have reviewed studies that included proactive telephone counseling as one of the interventions for smoking cessation [9, 17, 23, 25, 26]. Specifically, Lichtenstein et al. [9] did a meta-analytic review on proactive phone calls in 13 randomized trials and confirmed a heterogeneous, significant increase in smoking cessation rates compared with control conditions with an average odds ratio of 1.34 at short-term follow-up and 1.20 for long-term follow-up. However, it would have been more informative if they had explored the relationships between the heterogeneous smoking cessation rates and the study characteristics. This would have provided more complete information about the effectiveness of proactive telephone counseling for smoking cessation. In 1999, McBride and Rimer [26] reviewed 74 studies on using the telephone to improve health behavior and health service delivery. Among the 74 studies, 17 were related to smoking cessation. They found that proactive telephone-delivered interventions have resulted in significantly higher cessation rates compared with self-help materials alone and have been demonstrated to increase the likelihood of resumed abstinence among relapsed smokers. Unfortunately, the review was limited to qualitative descriptions. Fiore et al. [17] reviewed 26 arms out of 58 studies (25 of the 58 studies were published before 1990) on proactive telephone counseling for smoking cessation and they recommended that proactive telephone counseling was an effective intervention and should be used in smoking cessation. They also described the effectiveness related to some study characteristics, such as intensity of the intervention, ethnic minority status, hospital patients and age. However, no statistical evidence was reported for these relationships. Review of Hopkins et al. [25] included 32 studies about multicomponent interventions that included telephone support for tobacco-use patients. The effectiveness of the telephone support was found across the 32 studies in terms of absolute percentage differences in smoking cessation, ranging from −3.4 to +23 percentage points with a median of 2.6. The review also mentioned some study characteristics that might be related to the effect of the intervention, but no quantitative findings were reported. Recently, Stead et al. [23] found heterogeneous smoking cessation rates among 13 studies on proactive telephone counseling for smoking cessation at the longest follow-ups (> 6 months), but it would be more informative to quantitatively explore the relationships of the heterogeneous smoking cessation rates and study characteristics.

In sum, the existing research syntheses on proactive telephone counseling for smoking cessation were limited either by qualitative descriptions or by lack of quantitative explorations for the relationships of the heterogeneous smoking cessation rates and study characteristics.

Therefore, the purpose of the current meta-analysis is to provide a more thorough quantitative review on the adjunct effects of proactive telephone counseling for smoking cessation by answering the following three research questions: (i) Do the adjunct effects of proactive telephone counseling for smoking cessation vary across studies? (ii) What is the overall adjunct effect of proactive telephone counseling for smoking cessation? (iii) What study characteristics explain the variation of the adjunct effects of proactive telephone counseling for smoking cessation?
Methods

Literature search
A preliminary literature search using MEDLINE and PsycINFO produced 153 relevant studies published between January 1990 and December 2003, with keywords of ‘smoking or tobacco’, ‘telephone or quitline or helpline or hotline’ and ‘counseling or counselling’. An ancestry search in the 153 studies resulted in 29 additional studies. After applying the criteria for inclusion described below, 22 final studies were selected for this meta-analysis.

Among the 22 final studies, six were among the 13 studies reviewed earlier by Lichtenstein et al. [9]; seven were among the 17 studies reviewed earlier by McBride and Rimer [26]; six were among the 26 arms reviewed earlier by Fiore et al. [17]; seven were among the 32 studies reviewed earlier by Hopkins et al. [25] and 11 were among the 13 studies reviewed earlier by Stead et al. [23]. Because not all the previously reviewed studies were about the ‘adjunct’ effect of ‘proactive’ telephone counseling, only the relevant studies were included in the current meta-analysis. Table I lists the studies that were included in the previous reviews but not in the current meta-analytic review and reasons for exclusion.

Criteria for inclusion
The first criterion for inclusion was whether the studies had sufficient quantitative information for calculating the outcome measure: odds ratio of smoking quit rates. Odds ratio is the ratio of the probability of being in the group of interest to the probability of being in the other group [53], that is

\[
\text{odds ratio} = \frac{(\text{quit}/\text{not quit}) \text{ in treatment}}{(\text{quit}/\text{not quit}) \text{ in comparison}}
\]

which reflects how many participants in the treatment group quit smoking compared with those in the comparison group. Odds ratio is useful in the interpretation of the results of statistical analysis involving dichotomous outcomes. Electing odds ratio as an effect size for meta-analysis facilitates the evaluation of how similar or dissimilar results are across related studies. Reporting effect size has become a common practice after the APA Publication Manual [54] emphasized the importance of reporting effect sizes, and the manual states that failure to report effect sizes is one of defects in the design and reporting research.

Since ‘reactive’ telephone counseling is usually listed as one of self-help interventions [17], ‘proactive’ telephone counseling was the second criterion. Also, the proactive telephone counseling should be used as an ‘adjunct’ intervention to self-help materials or other minimal interventions. The third criterion was that the research design in the study should be a randomized design, because a randomized design is a more rigorous scientific method and provides more valid research results than a non-randomized design.

The fourth and last criterion was whether the effect of proactive telephone counseling can be independently evaluated. That is, whether the studies provided a telephone counseling treatment group and a comparable comparison group. This was the most difficult and complex criterion to apply, because most studies on smoking cessation have multiple treatment groups with multiple components of intervention. In this case, the most similar intervention was chosen as the comparison group. For example, Curry et al. [16] had three treatment groups and a non-treatment control group. The three treatment groups, respectively, received (i) a self-help booklet alone; (ii) a self-help booklet with computer-generated personal feedback and (iii) a self-help booklet, computer-generated personal feedback and outreach telephone counseling. In the present meta-analysis, when the odds ratio of smoking quit rates was calculated for the study of Curry et al. [16], Group (iii) was used as the telephone-counseling treatment group and Group (ii), rather than the non-treatment control group, as the comparison group.

Recorded variables
Study characteristics
The following study characteristics were recorded for the analysis: name of first author, year of publication, setting, follow-up time, sample size,
### Table I. Studies included in the previous reviews but not in the current review and reasons for exclusion

<table>
<thead>
<tr>
<th>Reference no.</th>
<th>First author</th>
<th>Year</th>
<th>Previous reviews</th>
<th>Reason for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>[8]</td>
<td>Lando</td>
<td>1992</td>
<td>Hopkins et al. [25]; Lichtenstein et al. [9]; McBride et al. [26]; Stead et al. [23]</td>
<td>Telephone counseling as a main effect, not an adjunct.</td>
</tr>
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<td>[38]</td>
<td>McBride</td>
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<td>Combined intervention versus no intervention.</td>
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<td>[46]</td>
<td>Rigotti</td>
<td>1997</td>
<td>Fiore et al. [17]; Hopkins et al. [25]; McBride et al. [26]</td>
<td>Combined intervention versus other interventions.</td>
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<td>[51]</td>
<td>Taylor</td>
<td>1990</td>
<td>Fiore et al. [17]; Lichtenstein et al. [9]; McBride et al. [26]</td>
<td>Face-to-face counseling. See Stead et al. [23].</td>
</tr>
<tr>
<td>[52]</td>
<td>Thompson</td>
<td>1993</td>
<td>Fiore et al. [17]; Hopkins et al. [25]; McBride et al. [26]</td>
<td>Reactive telephone counseling.</td>
</tr>
</tbody>
</table>

Fiore et al. [17] did not mention that the 26 arms were from which studies among 58 studies they reviewed for a broader purpose. Also, 25 of the 58 papers were published before 1990.
biochemical validation on smoking quit rate, length of abstinence, mean age of participants, proportion of female participants, number of cigarettes smoked per day before intervention, participants’ readiness to quit smoking, number of phone calls during the telephone intervention and minutes per call. The selection of the study characteristics was partially guided by previous reviews [17, 25] and partially based on common information available in the studies.

**Outcome measure**

An odds ratio tells us how likely it was that participants in the treatment group quit smoking compared with those in the comparison group. For this meta-analytic review, the outcome measure was ‘log odds ratio’ because it takes on a value of zero when both groups have an equal chance of quitting smoking. This yields an interpretation similar to that of a zero effect size, for either a zero correlation or Cohen’s $d$ [55]. In line with previous reviews [23], the outcome measure was calculated at the ‘longest’ follow-up. The longest follow-up times ranged from 3 to 34 months across the studies. In addition, the outcome measure was computed for continuous abstinence, and if continuous abstinence was not available in the studies, point prevalence abstinence was computed.

**Coding**

A concurrent double coding was performed independently by the researcher and a colleague. Forty hours, equivalent to five full-time workdays, were spent on coding the 22 studies. Then, every coded item was compared among the coders with extensive discussions. No variable was finalized until reaching an agreement.

**Statistical analysis**

Descriptive analysis was first conducted by calculating the unweighted mean quit rates for both treatment group and comparison group and the unweighted mean log odds ratio of quitting, along with 95% confidence intervals of the log odds ratios. The confidence intervals show whether the log odds ratios are heterogeneous across the studies.

In addition, a funnel plot of the log odds ratios against the sample sizes was presented to detect potential publication bias [56]. Typically, small studies would show more variability among the effect sizes than would larger studies, and therefore, the plot would look like a funnel. A bite will be taken off from the funnel plot when publication bias exists against studies with small effect sizes [57].

For inferential analysis, a Hedges and Olkin’s [58] $Q$-statistic was computed. A test for the $Q$-statistic can provide statistical evidence for the heterogeneity of the 22 studies. If the test was significant, a random-effects model would be tested, and the weighted mean log odds ratio would be calculated to compare it with the unweighted mean log odds ratio.

In the case of heterogeneous log odds ratios, the study characteristics would be entered into a ‘weighted regression model’ to explain the variation in the heterogeneous log odds ratios. Following Hedges’ [59] suggestion, the standard error used in the $t$-test for individual regression coefficient would be adjusted as follows:

$$S_j = \frac{SE_j}{\sqrt{MSError}},$$

where $S_j$ is the adjusted standard error, $SE_j$ is the original standard error as given by common computer programs and $MSError$ is the mean square value for errors from the analysis of variance for the regression as given by the computer programs. A few missing values resulted from unavailable information from some studies and were replaced by means [60]. The rationale of this missing data approach is that the mean is the best single replacement value when no other information is available [61–63]. It should also be mentioned that since the variable of setting was confounded with the variable of participants’ readiness to quit smoking, only the latter was modeled in the weighted regression analysis.

Lastly, a fail-safe $N$ or file-drawer number [64] was computed to see if there was a file-drawer problem. This addresses the studies that have not been published because there were no significant effects. If those studies in the file drawer had been published, then the effect sizes for those treatments would be smaller. The fail-safe $N$ is the number of
non-significant studies that would be necessary to reduce the effect size to a non-significant value. The file-drawer analysis is complementary to the funnel plot for detecting potential publication bias.

**Results**

**Descriptive analysis**

Table II summarizes the 22 studies with the recorded variables. The unweighted mean quit rates were 19%, ranging from 7 to 33%, for the treatment group and 15%, ranging from 4 to 33%, for the comparison group. The unweighted mean odds ratio was 1.64 and the corresponding mean log odds ratio was 0.38, which means that the odds of quitting in the treatment group with telephone counseling was 64% greater than that in the comparison group. Figure 1 shows the 95% confidence intervals for the log odds ratios. From the confidence interval plot, we can see that there were heterogeneous data on the log odds ratios across the studies. Figure 2 is a funnel plot of the log odds ratios against the sample sizes, which does not suggest possible publication bias, since no bite was taken off from the funnel plot.

**Inferential analysis**

**Test of homogeneity**

Under the null hypothesis of $H_0: \theta_1 = \ldots = \theta_{22} = \theta$, the Hedges and Olkin’s [58] $Q$-statistic value of $Q_{\text{Total}}$ was 389.40 with $df = 21 (P < 0.001)$, which means that the log odds ratios across the 22 studies were statistically heterogeneous. By testing a random-effects model under $H_0: \theta = 0$, a $z = 3.49 (P < 0.001)$ indicated that the random-effects average of the 22 studies was statistically different from zero; and the weighted random-effects average was 0.37. Note that the unweighted average of the log odds ratios was 0.38. Therefore, the 22 studies confirmed the actual success of proactive telephone counseling as an adjunct to minimal intervention for smoking cessation.

**Weighted regression analysis**

Since the log odds ratios were heterogeneous, a weighted regression analysis was conducted to find what study characteristics explained the heterogeneity. Table III displays the estimated coefficients of the significant study characteristics from the weighted regression analysis that adjusted for standard errors. From Table III, we can see that four of the study characteristics related to participants were significant in explaining the variation in the log odds ratios. Specifically, older ($B = -0.02, t = -5.00, P < 0.001$), female ($B = -0.69, t = -3.45, P < 0.004$) and heavier smoking ($B = -0.05, t = -7.29, P < 0.001$) participants were less likely to quit smoking; while participants ready to quit smoking were of course more likely to quit smoking ($B = 0.53, t = 9.58, P < 0.001$). For the remaining study characteristics, only two of them were significant. Specifically, year of publication ($B = -0.02, t = -4.00, P < 0.002$) and the longest follow-up time ($B = -0.01, t = -2.33, P < 0.010$) were significant explanatory variables of the heterogeneous log odds ratios.

In addition, it was also found that $Q_{\text{Model}(6)} = 204.13 (P < 0.001)$ and $Q_{\text{Error}(15)} = 185.27 (P < 0.001)$, which means that the six explanatory variables explained a significant amount of the variation in the log odds ratios, although the explanatory variables did not give a full explanation.

**File-drawer problem**

Lastly, a Rosenthal’s [64] fail-safe $N$ was found to be 211 which is larger than Rosenthal’s rule of thumb of 120 (= $5 \times k + 10$, where $k = 22$, the number of studies in the meta-analysis). Therefore, > 200 unreported studies averaging a null result would have to exist somewhere in the file drawer before the overall result could reasonably be ascribed to publication bias, indicating that the publication bias was not evident in the data of this meta-analysis. This finding is consistent with the funnel plot in the descriptive analysis.

**Discussion**

It is common that telephone-counseling intervention is integrated with minimal interventions like self-help materials. The current meta-analysis
<table>
<thead>
<tr>
<th>Reference no.</th>
<th>First author</th>
<th>Year</th>
<th>Setting</th>
<th>Follow-up time (months)</th>
<th>Mean age (years)</th>
<th>Percentage of female</th>
<th>Cigarettes per day</th>
<th>Ready to quit</th>
<th>Quit rate in treatment group</th>
<th>Quit rate in comparison group</th>
<th>Biochemical validated</th>
<th>Abstinence No.</th>
<th>Call duration (min)</th>
<th>Call duration (min)</th>
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<td>9 months</td>
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<td>Community</td>
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<td>38*</td>
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</tr>
</tbody>
</table>

Mean 13 40 0.61 23 0.191 348 0.152 338 4

Total 7301 7101

*The mean age was estimated from the limited information provided by the study.

b The information was not available from the study.

c The study only provided total sample size 187.
provided a more thorough quantitative review of the adjunct effects of proactive telephone counseling to minimal interventions for smoking cessation. The results from the present meta-analytic review on the 22 studies shows that (i) the adjunct effects of proactive telephone counseling for smoking cessation significantly varied across the studies; (ii) the overall adjunct effect of proactive telephone counseling for smoking cessation was significantly different from zero with a positive mean log odds ratio of 0.37 and (iii) year of publication, follow-up time, mean age of participants, proportion of female participants, participants’ readiness to quit smoking and number of cigarettes smoked per day before intervention explained a significant amount of the variation in the adjunct effect of proactive telephone counseling for smoking cessation.

The results from the current meta-analytic review confirmed the findings in the literature that proactive telephone counseling as an adjunct to minimal interventions was more effective than telephone counseling or minimal intervention alone [11, 17, 23, 24]. Although the large effect of the intervention with telephone counseling may not exclusively come from telephone counseling, this effect with the mean log odds ratio of 0.37 can be interpreted as an enhancement effect of telephone counseling to minimal interventions. Nevertheless, if we look at the quit rates, some seemed rather low—the averages were only 19% and 15% for the treatment group and the comparison group, respectively (c.f. Table II). Overall, these were not exceptionally effective but, clearly, the phone component had a boost effect as an adjunct to minimal interventions. Therefore, telephone counseling was an effective aid for the smoking cessation program.

It is important to note that year of publication was a significant explanatory variable, implying that in the earlier years people tended to publish significant studies or that the studies with smaller effect sizes took longer to be published. The longest follow-up time was also a significant explanatory variable, which suggests that, in general, the longer the follow-up time, the less likely people were to quit smoking. Of course, some participants might possibly have quit at earlier follow-up periods but have relapsed later, which does not necessarily mean that the intervention did not work, since the
number of times a person successfully quits smoking for a period of time, the more likely the person will be to quit for good in the future. It is also worth to note that the finding that proportion of female participants was a significant explanatory variable for the adjunct effect may not be consistent with some studies in the literature [79, for example]. Since [79] is a non-randomized study, while all the 22 studies in the present meta-analysis are randomized trails, the inconsistent finding necessitates more matured meta-analysis synthesizing both randomized and non-randomized studies.

Interestingly, none of the study characteristics related to intervention process, such as number of phone calls during the telephone intervention and minutes per call, significantly explained the variation in the log odds ratios. This finding was consistent with some previous research [80, for example], but not with others [13, for example]. This finding needs to be reinforced by future research; and more study characteristics related to intervention process need to be explored more thoroughly.

Lastly and most importantly, the fact that the study characteristics related to participants’ individual differences explained most of the variation in the adjunct effect of proactive telephone counseling for smoking cessation suggests that the participants played as important of a role as did the intervention process in smoking cessation. Therefore, researchers and health care providers may need to focus on participants as much as on intervention process to obtain more effective interventions.

Table III. Estimated coefficients of the significant study characteristics in explaining the variation in the heterogeneous log odds ratios with t-tests from the weighted regression analysis with the adjusted standard errors

<table>
<thead>
<tr>
<th>Explanatory variable</th>
<th>B</th>
<th>Sj</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of publication</td>
<td>−0.020</td>
<td>0.005</td>
<td>−4.000</td>
<td>0.002</td>
</tr>
<tr>
<td>Longest follow-up time</td>
<td>−0.007</td>
<td>0.003</td>
<td>−2.333</td>
<td>0.010</td>
</tr>
<tr>
<td>Mean age</td>
<td>−0.015</td>
<td>0.003</td>
<td>−5.000</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Percentage of female</td>
<td>−0.687</td>
<td>0.199</td>
<td>−3.452</td>
<td>0.004</td>
</tr>
<tr>
<td>No. of cigarettes per day</td>
<td>−0.051</td>
<td>0.007</td>
<td>−7.286</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Ready to quit</td>
<td>0.527</td>
<td>0.055</td>
<td>9.582</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

The t values and P values were computed based on the adjusted standard error, Sj.
Telephone counseling for smoking cessation

Conflict of interest statement

None declared.

References


