ABSTRACT

We evaluated gender differences in demographic, smoking history, nicotine dependence, transtheoretical, and perceived stress variables as predictors of smoking cessation. Participants (n=381) smoked at least 15 cigarettes per day and were motivated to quit. The outcome variable was 7-day abstinence at 1-year follow-up. Predictor variables included: age, education level, number of years smoking, cigarettes per day, quit attempts, nicotine dependence, stage of change, decisional balance, processes of change, self-efficacy, and perceived stress. Logistic regression analysis was used to derive predictive models for women and men. In women, lower scores for pre- and mid-treatment perceived stress significantly increased the likelihood of being abstinent at follow-up. For men, a higher level of education or number of quit attempts lasting >24 hours in the past year, along with less frequent use of behavioural processes of change at baseline increased the probability of being abstinent at follow-up.

GENDER DIFFERENCES IN PREDICTORS FOR LONG-TERM SMOKING CESSATION FOLLOWING PHYSICIAN ADVICE AND NICOTINE REPLACEMENT THERAPY

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ABRÉGÉ

Nous avons évalué les différences attribuables au sexe dans certaines variables prédictives du renoncement au tabac. Les participants (N=381) fumaient au moins 15 cigarettes par jour et voulaient cesser de fumer. La variable de résultat était une abstinence de sept jours lors du suivi après un an. Les variables prédictives étaient l’âge, le niveau de scolarité, le nombre d’années de tabagisme, le nombre de cigarettes fumées par jour, les tentatives de renoncement au tabac, la dépendance envers la nicotine, la phase de changement, l’équilibre décisionnel, les processus de changement, l’auto-efficacité et le stress perçu. Par analyse de régression logistique, nous avons dérivé des modèles de prévision pour les femmes et les hommes. Chez les femmes, un score plus faible pour le stress perçu (avant le traitement et à mi-parcours) augmentait considérablement la probabilité d’abstinence lors du suivi. Chez les hommes, des scores supérieurs pour la scolarité ou les tentatives de renoncement au tabac de plus de 24 heures au cours de l’année précédente, ainsi qu’un recours moins fréquent, au départ, aux processus de changement de type comportemental, augmentaient la probabilité d’abstinence lors du suivi.

METHODS

Design and participants

We conducted logistic regression analyses of data from a clinical trial of telephone counselling in addition to physician advice and nicotine replacement therapy.4 Participants (n=381) smoked at least 15 cigarettes per day and were motivated to quit. The trial excluded people with psychiatric disorders, and included 205 males and 189 females.

Outcome variable

The dependent variable was self-reported abstinence for at least 7 days prior to follow-up at one year (i.e., point-prevalent abstinence).32 Non-responders were considered to be smoking. Point-prevalent abstinence is appropriate for process and mechanistic questions, and can accommodate non-linear patterns of change (i.e., relapse and recycling) and delayed quitst3 which are typical of the cessation process. Confirmation of quitting, by carbon monoxide monitoring of breath samples, was attempted for all those reporting abstinence at 12 months; samples were obtained for 75.5% (71/94) of self-reported quitters. As the present study was not an evaluation of an intervention, and false negative report-
ing of smoking status is primarily a problem for studies of high risk/medical patients or adolescents,\textsuperscript{33} we used self-reported quit rates for the gender-related analyses.

Predictor variables

Categories of predictor variables included demographic, smoking history, nicotine dependence, intervention group, transtheoretical, and perceived stress. Predictor variables were measured at baseline, prior to any intervention. Transtheoretical processes of change and perceived stress were also assessed at mid-treatment (4 weeks after target quit date).

Demographics

Demographic variables included age and education level (high school graduate or less vs. some post-secondary).

Smoking History

Smoking history variables included number of years smoked and number of quit attempts lasting > 24 hours in the past year.

Nicotine Dependence

Nicotine dependence variables included number of cigarettes smoked per day, how soon after waking the first cigarette of the day was smoked (< 30 minutes v. ≥ 30 minutes), and the Fagerstrom Tolerance Questionnaire score.\textsuperscript{34}

Intervention Group

Participants were randomly assigned to either of two groups: usual care (control group) and usual care plus telephone counselling (treatment group). Usual care involved physician advice, self-help materials, and 12 weeks of nicotine replacement therapy. For participants in the treatment group, 3 sessions of telephone counselling were added.

Transtheoretical Variables

Transtheoretical variables included stage of change (contemplation vs. preparation), decisional balance, use of experiential and behavioural processes of change, and self-efficacy. Stage of change was measured by a 5-item questionnaire\textsuperscript{18} that queried current smoking status and intentions concerning quitting. Decisional balance was measured by a 6-item Pros and Cons of Smoking Scale.\textsuperscript{35} Processes of change were measured using a 20-item questionnaire that included two items for each of 10 processes (5 experiential and 5 behavioural).\textsuperscript{25} Self-efficacy was measured using a 20-item questionnaire\textsuperscript{36} that measured confidence in not smoking across daily situations.

Perceived Stress

Perceived stress was measured by Cohen’s 4-item Perceived Stress Scale.\textsuperscript{37} The PSS-4 queries how often in the past month respondents have been able to control important things in their lives, felt confident in handling their personal problems, felt things were going their way, and felt that difficulties were piling up so high that they could not be overcome. The coefficient alpha reliability estimate for the PSS-4 is 0.72 and the scale is correlated with a range of self-report (e.g., life events scores, depressive and physical symptomatology) and behavioural criteria (utilization of health services, smoking reduction).

Data analyses

Baseline differences between males and females were assessed using Chi-square tests for categorical variables and t-tests for continuous variables.

Univariate logistic regression analyses were used to estimate the relation of each variable to abstinence at one year. Further logistic regression analyses tested whether gender moderated the association between each variable and abstinence. The predictor variable was entered on the first step, gender on the second step, and interaction between the two on the third step. Predictor variables significant at $p < 0.20$ in the univariate analyses or in their interaction with gender were entered into multivariate logistic regression analyses separately for each gender. Variables were dropped using a backward elimination process; the predictor with the smallest, non-significant Wald Chi-Square value was removed at each step. Interactions among the variables retained in the final model were also tested.

To confirm that our data supported a different model for each gender, predictors from the women’s model were tested in the men’s model and vice versa.

RESULTS

Participant characteristics

Study participants were mostly high nicotine-dependent smokers with long smoking histories (Table I). The average number of years smoked was 21.7, and the mean number of cigarettes smoked per day was 23.5.

\begin{table}[h]
\centering
\caption{Relationships of Predictor Variables with Gender}
\begin{tabular}{|l|c|c|c|}
\hline
Predictor Variable & \multicolumn{2}{c|}{Relation with Gender} & \\
 & Women & Men & \\
\hline
Demographics & & & \\
Age & M (SD) & M (SD) & P \\
Education (% >High school) & 38.07 (8.18) & 37.97 (8.12) & 0.90 \\
Smoking History & & & \\
Years smoking & 55.6 & 56.1 & 0.91 \\
Number previous quit attempts & 22.00 (8.00) & 21.46 (8.45) & 0.51 \\
Nicotine Dependence & & & \\
Cigarettes per day & 22.80 (7.24) & 24.08 (8.02) & 0.10 \\
Time to first cigarette (% <30 min) & 88.4 & 82.0 & 0.08 \\
Fagerstrom Score & 7.28 (1.71) & 6.97 (1.84) & 0.09 \\
Heaviness of smoking (% >25 cigs/day) & 17.5 & 19.5 & 0.60 \\
Intervention Group & & & \\
% in Treatment Group & 50.3 & 48.3 & 0.70 \\
Pre-cessation Transtheoretical Variables & & & \\
Pros-cons & -0.85 (3.81) & -1.02 (3.57) & 0.65 \\
Confidence & 44.64 (15.06) & 47.20 (13.16) & 0.08 \\
% in Contemplation Stage & 37.6 & 45.9 & 0.10 \\
% in Preparation Stage & 62.4 & 54.1 & 0.10 \\
Experiential POCs & 34.83 (6.91) & 30.91 (6.14) & 0.00 \\
Behavioural POCs & 26.00 (6.80) & 25.71 (6.09) & 0.65 \\
Mid-cessation Transtheoretical Variables & & & \\
Experiential POCs & 26.79 (12.62) & 27.76 (13.12) & 0.45 \\
Behavioural POCs & 28.81 (13.31) & 29.99 (13.75) & 0.39 \\
Pre-cessation Perceived Stress & 5.03 (2.80) & 5.01 (2.58) & 0.96 \\
Mid-cessation Perceived Stress (4 weeks) & 5.33 (3.44) & 4.56 (3.06) & 0.02 \\
\hline
\end{tabular}
\end{table}
Gender differences in abstinence

The 7-day abstinence rate at 1-year follow-up in the combined sample was 23.6% (95/394). The quit rate was 6.7% higher in men than women (27.3% vs. 20.6%; p = 0.12). While this difference in quit rate was not statistically significant, many practitioners would consider it clinically important.

Gender differences on predictor variables

Interactions of predictor variables with gender are shown in Table II. There were significant interactions between gender and number of previous quit attempts and pre-cessation use of behavioural processes of change, confirming the appropriateness of separate analyses for each gender.

Relations of predictor variables and abstinence

Univariate regression and correlation coefficients associated with predictor variables are shown in Table II. Eight variables, identified as univariate predictors of long-term quitting (at p < 0.20), were entered into multiple logistic regressions to derive predictive models for each gender. Coefficients and odds ratios for predictors are shown in Table III.

Through systematic model reduction, a model that fit the data and reliably predicted long-term abstinence was derived for each gender. For women, perceived stress scores at pre- and mid-cessation were significant predictors of abstinence (\(-2\log L = 176.75; \text{model } \chi^2 = 15.68, \text{df} = 2, p < 0.001\)). For men, level of education, the number of previous quit attempts, and use of behavioural processes of change pre-cessation were significant predictors of abstinence (\(-2\log L = 217.636; \text{model } \chi^2 = \)...

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**TABLE II**

Univariate Relationships and Gender Interactions of Predictor Variables with 7-day Abstinence at One-year Follow-up

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Relation with Abstinence (n=394)</th>
<th>Predictor Variable X Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-0.368</td>
<td>n/a</td>
</tr>
<tr>
<td>Age</td>
<td>-0.006</td>
<td>n/a</td>
</tr>
<tr>
<td>Education (&gt;High school)</td>
<td>0.762</td>
<td>n/a</td>
</tr>
<tr>
<td>Smoking History</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years smoking</td>
<td>-0.011</td>
<td>-0.022</td>
</tr>
<tr>
<td>Number previous quit attempts</td>
<td>0.049</td>
<td>-0.333</td>
</tr>
<tr>
<td>Nicotine Dependence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarettes per day</td>
<td>-0.007</td>
<td>-0.021</td>
</tr>
<tr>
<td>Time to first cigarette (&lt;30 min)</td>
<td>0.288</td>
<td>-1.156</td>
</tr>
<tr>
<td>Heaviness of smoking (&gt;25 cigs/day)</td>
<td>-0.285</td>
<td>0.000</td>
</tr>
<tr>
<td>Intervention Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment Group</td>
<td>-0.099</td>
<td>0.253</td>
</tr>
<tr>
<td>Pre-cessation Transtheoretical Variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pros-cons</td>
<td>-0.004</td>
<td>0.001</td>
</tr>
<tr>
<td>Confidence</td>
<td>-0.007</td>
<td>0.011</td>
</tr>
<tr>
<td>Contemplation Stage</td>
<td>0.102</td>
<td>-0.552</td>
</tr>
<tr>
<td>Experimental POCs</td>
<td>-0.002</td>
<td>0.056</td>
</tr>
<tr>
<td>Behavioural POCs</td>
<td>-0.030</td>
<td>0.101</td>
</tr>
<tr>
<td>Mid-cessation Transtheoretical Variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental POCs</td>
<td>0.006</td>
<td>-0.014</td>
</tr>
<tr>
<td>Behavioural POCs</td>
<td>0.010</td>
<td>-0.018</td>
</tr>
<tr>
<td>Pre-cessation Perceived Stress</td>
<td>-0.159</td>
<td>-0.029</td>
</tr>
<tr>
<td>Mid-cessation Perceived Stress</td>
<td>-0.139</td>
<td>-0.101</td>
</tr>
</tbody>
</table>

**TABLE III**

Multivariate Logistic Regression Analysis of Predictors of 7-day Abstinence at One-year Follow-up by Gender

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Women (n=189)</th>
<th>Men (n=205)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td>B = Logistic Regression Coefficient; OR = Adjusted Odds Ratio</td>
<td>B = Logistic Regression Coefficient; OR = Adjusted Odds Ratio</td>
</tr>
<tr>
<td>Education (&gt;High school)</td>
<td>0.29</td>
<td>0.89</td>
</tr>
<tr>
<td>Smoking History</td>
<td>0.07</td>
<td>0.13</td>
</tr>
<tr>
<td>Number previous quit attempts</td>
<td>-0.27</td>
<td>-1.34</td>
</tr>
<tr>
<td>Nicotine Dependence</td>
<td>-0.14</td>
<td>-0.02</td>
</tr>
<tr>
<td>Time to first cigarette (&lt;30 min)</td>
<td>-0.35</td>
<td>0.89</td>
</tr>
<tr>
<td>Fagerstrom Score</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>Experimental POCs</td>
<td>0.02</td>
<td>-0.01</td>
</tr>
<tr>
<td>Behavioural POCs</td>
<td>-0.17</td>
<td>-0.14</td>
</tr>
<tr>
<td>Pre-cessation Perceived Stress</td>
<td>-0.14</td>
<td>-0.16</td>
</tr>
<tr>
<td>Mid-cessation Perceived Stress</td>
<td>-0.14</td>
<td>-0.14</td>
</tr>
</tbody>
</table>

B = Logistic Regression Coefficient

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The relationship between perceived stress and outcome in women was not surprising. Other authors have noted that negative affect, stress and depression are important determinants of outcomes among women; women more often report using smoking as a coping mechanism to deal with negative affect.\textsuperscript{38-40} This suggests that perceived stress would be a target for interventions designed for women. We reran the analysis separating specific items on the perceived stress scale into individual predictor variables. Baseline confidence in handling personal problems and mid-treatment feelings that things were going their way were independently related to abstinence.

With respect to processes of change, Perz, DiClemente, and Carbonari\textsuperscript{41} suggested that successful smoking cessation would be associated with an optimal pattern of high use of experiential processes and low use of behavioural process during contemplation and preparation stages of change (i.e., before quitting) and the inverse pattern during the action stage. Our data partially supported this pattern of use; we observed that men abstinent at 1-year follow-up used fewer behavioural processes of change at baseline than men who were smoking at follow-up (23.6 v. 26.5; p < 0.01). Men who quit successfully also showed a greater change in the use of behavioural processes between baseline and mid-treatment than men who were unsuccessful (+8.6 points v. +2.7 points; p = 0.01), indicating that it may be the change over treatment that is more important than the total volume of processes. Men attempting to quit smoking would do well to focus more on tasks centering on attitude change and less on behavioural processes prior to taking action. Once an action attempt is begun, relatively greater focus should be placed on behavioural tasks.

It was somewhat surprising that measures of nicotine dependence were not independent predictors of success among men or women. One possible explanation is that study participants were predominantly high nicotine dependent, limiting the ability of this variable to discriminate between successful and unsuccessful quitters.

Participants in clinical trials tend to have a higher motivational readiness to quit smoking and may be more addicted to nicotine compared to smokers at large; 88% of the present sample smoked their first cigarette of the day within 30 minutes of waking, an indicator of high nicotine dependence.\textsuperscript{42} This compares with 60% of daily smokers in Canada.\textsuperscript{43} The intervention components were consistent with current guidelines;\textsuperscript{3} still it is unclear whether these gender differences would apply to smokers attempting to quit with different forms of assistance or on their own.

This study has functional implications: tailored interventions can be designed to more effectively address gender-specific factors that are amenable to change. More effective treatment matching could lead to higher cessation rates.
ACKNOWLEDGEMENTS

The authors thank Drs. Mariana Herskovitz, Arlene Pagtakhan, and Joie Zeglini, who served as study physicians; and Sue Tracey, Vivian Welch, and Karin Boucher, for their assistance in data collection during this trial.

REFERENCES


