Questioning the Construct of "Susceptibility" in the Causal Link Between Tobacco Industry Promotion and Adolescent Smoking

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Abstract

The first article to report on a causal connection between tobacco industry promotion and adolescent smoking (Pierce et al. 1998) had, and continues to have, a significant influence on the marketing of cigarettes in many parts of the world. A key construct in determining causality was the ability to identify the respondents' "susceptibility to smoke". Through an analysis of the questions, and reanalysis of the original data used by Pierce et al. (1998), it is shown that the construct is flawed, and needs revision before a causal link can be claimed with the original data.

Keywords: Susceptibility; children and smoking; tobacco marketing

Introduction

One of the most referenced studies in recent anti-tobacco efforts is the *Journal of the American Medical Association* (JAMA) article by Pierce et al. (1998) titled, "Tobacco Industry Promotion of Cigarettes and Adolescent Smoking". This article reported on the analysis of data from the 1993 and 1996 California Tobacco Studies (CTS) longitudinal sample on adolescent smoking behaviour. The authors reported that, "promotional activities are causally related to the onset of smoking" (Pierce et al., 1998, p. 511). The study proposed, tested and reported support for the theory that adolescents who are exposed to, pay attention to and understand cigarette advertising will cognitively internalise the messages and develop a favourable affective response to those messages. Pierce et al. (1998) found that adolescents identified as "receptive to tobacco marketing" were significantly more likely to become "susceptible to smoking" cigarettes. An adolescent's willingness to use or possess a tobacco premium was cited as a particularly strong factor for being "susceptible" to cigarette smoking.

The findings of Pierce et al. (1998) appear to be quite different when one considers the literature on marketing receptivity and susceptibility (e.g. Alesci, Forster, & Blaine, 2003; Beals, 1996; Bearden & Etzel, 1982; Bearden, Netemeyer, & Teel, 1989; Bonoma & Johnston, 1979; Lancaster & Lancaster, 2003; Warner, 2000). These marketing researchers maintain that "susceptibility" refers to the adolescent's response to peers and reference groups in their choice of habits and products. Reference group literature reports that exposure to social groups (Stafford, 1966), observed consumption in these groups (Alesci et al., 2003), group influence (Sheinkopf, Atkin, & Bowen, 1972), and predisposition to smoke (Warner, 2000) were more influential causal agents than advertising in changing behaviour.

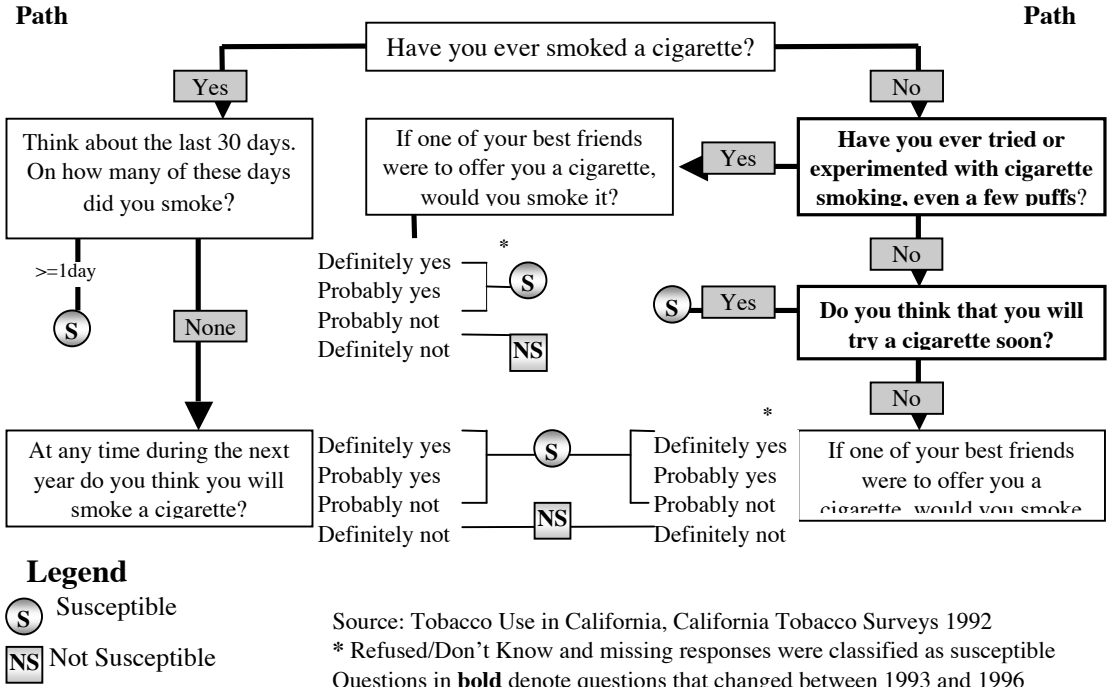
Econometric literature also has findings that are contrary to those reported by Pierce et al. (1998). Studies by Abernethy and Teel (1986), Johnson (1986), and Luik (1994) suggest that over time, tobacco advertising has limited impact on increasing smoking rates, and that tobacco advertising bans are not effective in reducing smoking rates or smoking uptake.

Other studies have concluded that anti-smoking messages, health scares, and increases in cigarette retail prices seem to have the most effect on reducing cigarette smoking rates (Abernethy & Teel, 1986; Bishop & Yoo, 1985; Hamilton, 1972, 1977). A reanalysis of the Pierce et al.'s (1998) data finds significant methodological issues that challenge the conclusions of that article. For the sake of brevity, this investigation focuses solely on the construct of an adolescents' susceptibility to smoking.

Susceptibility

To operationalize the construct of susceptibility, Pierce et al. (1998) developed a questioning sequence (Figure 1) in the baseline 1993 CTS sample. This sequence was used to classify respondent susceptibility to smoking. This questioning format was based on a previous study that found an association between being classified as "susceptible" to actual smoking behaviour.

Figure 1: Defining Susceptibility to Smoke in Adolescents



1993 Sample questions determining susceptibility

Pierce et al. (1998) had several categories for adolescent smokers, depending on their reported smoking history and future intentions about smoking cigarettes. They were classified by their reported degree of development in the starting to smoke process (see Figure 1). For the 1993 baseline interview, *Established Smokers* were those who had smoked at least 100 cigarettes in their lifetime. Adolescents who were unable to answer "Definitely Not" to the questions "Have you ever smoked a cigarette" or "Have you tried or experimented with cigarette smoking, even a few puffs" were classified as *Experimenters*. Those who were not E*stablished Smokers* or E*xperimenters* could be *non-susceptible never smokers*. They had to also respond "Definitely Not" to the questions, "Do you think you will try a cigarette soon?",

"If one of your best friends were to offer you a cigarette, would you smoke it?" and "At any time during the next year do you think you will smoke a cigarette?" in the baseline 1993. *Susceptible Never Smokers* were those adolescents that provided a "Definitely Not" response (as compared to "Probably Not") to the questions that categorized Susceptible Never Smokers (California Department of Health Services, 1990). Respondents that refused to answer, or were unable to provide answers, were considered *Susceptible Never Smokers*.

1996 Susceptibility

The 1996 follow up survey asked questions from subjects that were classified as *Non-Susceptible Never Smokers* in 1993. The question "Do you think you will try a cigarette soon?" used in the 1993 measure of susceptibility, was omitted in 1996. The question was replaced with, "Have you ever thought of experimenting with cigarettes?" (in bold typeface in Figure 1) A question on intent ("think you will try") appears to be changed to past thoughts of experimenting ("have you ever thought").

The dichotomous choice of responses (yes / no) to the original question in 1993 was changed to a four item Likert - type scale with option of "Definitely Yes", "Probably Yes", "Probably No", and "Definitely No" in the 1996 interview (Pierce et al., 1998). This significantly increases the probability of a respondent reporting a "Susceptible" response. For example, a subject could have chosen a "Probably Not" susceptible response in 1996 that could have been a "No" *Not Susceptible* response in 1993. No explanation has been given for this significant modification to a measure between two data collection periods.

In summary, there appear to be three major problems with how responses from the susceptibility construct were measured or used, and these may have led to inaccurate conclusions in the original study. First, "Missing", "Don't know", and "Refused to Answer" responses were coded as belonging to the "Susceptible" responses smoking category. Second, the questioning sequence categorises answers such as "Probably Not" in 1996 into the "Susceptible" category, although the respondent would be *Nonsusceptible* by 1993 standards. Third, a question used in deciding the susceptibility of the respondent was changed between the baseline and the 3 year follow-up study.

Reanalysis of 1993 and 1996 Data

The data used in the 1998 article is available free-of-charge online, so some of the effects of these problems with the susceptibility scale can be evaluated. Table 1 presents the original findings reported by Pierce et al. (1998, p. 513) along with the results of a re-analysis of their data with the same SAS software. The replication process involved using cross-tabulations and percentages. Reanalysis of the data involved identifying and reclassifying "Missing", "Refused to Answer" and "Don't Know" responses as negative answers. Pierce et al.'s (1998) original findings are in italics, the column titled Replication are findings that result from following the data analysis methodology used in Pierce et al. (1998). Pierce et al. (1998) classified "Missing", "Refused to Answer", and "Don't Know" answers to questions as being affirmative answers (i.e. yes to trying smoking). The figures in the "Replication" columns in Table 1 followed this classification system. The Non-Response Deleted column are the results after subtracting "Missing", "Refused to Answer" and "Don't Know" responses.

The findings from the samples presented in Table 1 are all based on weighted data. This weighting was used by Pierce et al. so the sample would conform to the 1993 and 1996 Californian adolescent population profile. The dataset was first analysed in order to see if it was possible to replicate Pierce et al's. results (1998). The reanalysis of the 1993 data showed almost identical demographic characteristics (all differences highlighted in bold) between the original (*1993 Baseline*) and reanalysed samples (1993 Replication). This indicates that the sample achieved in this replication study duplicated or very closely matched the one used by Pierce et al. (1998).

Table 1: Findings from Pierce et al. (1998) and a Reanalysis of the Data

		1993 Baseline		Established Smokers		Susceptible Smokers			Experimenters		
Demographics		*Pierce et al.*	Replication	*Pierce et al.*	Replication	*Pierce et al.*	Replication	Non-Response Deleted	*Pierce et al.*	Replication	Non-Response Deleted
Overall		*1752*	1752	*3.6*	3.6	*16.6*	57.0	24.3	*29.5*	**33.0**	3.9
Gender	Male	*48.5*	48.5	*4.1*	4.1	*17.3*	**31.4**	24.5	*28.6*	**32.7**	3.9
	Female	*51.5*	51.5	*3.1*	3.1	*16.1*	**30.0**	24.1	*30.3*	**33.4**	4.0
Age group	12-13	*45.5*	45.5	*3.3*	3.3	*29.4*	**34.2**	29.4	*29.4*	**32.7**	4.0
	14-15	*31.3*	31.3	*4.8*	4.8	*15.9*	**29.3**	22.9	*26.3*	**31.1**	2.7
	16-17	*23.1*	23.1	*2.5*	2.5	*8.9*	**25.8**	16.4	*33.9*	**36.4**	5.6
Ethnicity	White	*48.7*	**47.2**	*5.8*	**5.2**	*12.4*	**24.5**	21.1	*28.6*	**26.9**	11.7
	African American	*10.2*	**10.8**	*1.9*	1.9	*22.4*	**43.5**	25.5	*25.8*	**33.8**	7.2
	Hispanic	*28.9*	**29.7**	*1.3*	**1.6**	*18.9*	**32.7**	24.4	*34.2*	**35.7**	12.8
	Asian/Other	*12.2*	**12.4**	*1.6*	**3.6**	*23.5*	**43.2**	35.7	*24.5*	**26.6**	11.7
School Performance											
	Much better	*25.4*	25.4	*2.0*	2.0	*15.6*	**29.7**	24.2	*26.8*	**27.4**	8.4
	Better than average	*40.5*	40.5	*3.0*	3.0	*17.4*	**34.2**	25.6	*29.5*	**32.3**	12.6
	Average/below	*34.1*	**34.0**	*5.5*	5.5	*16.6*	**27.1**	22.7	*31.4*	**37.0**	7.6

The questioning sequence for categorizing an "established smoker" (100 cigarettes in a lifetime) did not change between the 1993 and 1996 interviews. The reanalysis largely replicated the Pierce et al. (1998) findings, with 10 of 13 values successfully replicated (see Table 1, Established Pierce et al. and Established Replication). All differences are relatively small and appear only in the "Ethnicity" variables.

Replicated figures for the "Susceptible" and "Experimenters" groups overall, and by select demographics often show large absolute differences. For example, Pierce et al, (1998) found 16.6 percent of the 1993 Non-Susceptible-Never-Smokers sample had reported responses that would categorize them as "Susceptible to Smoking" in 1996. Using the same data and categorization, the reanalysis of the data found 57 percent of the sample should be classified as Susceptible. The differences between the Pierce et al. findings and the reanalysis were consistently less for classifying respondents as "Experimenters", but the reanalyses were consistently (one exception) higher than Pierce et al.'s reported findings.

Effect of non-response on categorization

The inclusion of a non-response to questions to classify a respondent as "Susceptible" had a large effect on the findings. The column "Non-Response Deleted" represents the proportion of respondents that would be categorized as either "Susceptible to Smoking" or "An Experimenter" by deleting those that had non-responsive answers. Deleting non-responses from the analyses found that the proportion of "Susceptible" adolescents would be consistently, and often much higher than the findings reported by Pierce et al. (1998). However, deleting those that gave non-responses showed much lower levels of "Experimentation" for all comparisons.

Summary and Conclusion

There were several issues on the way the construct of Susceptibility was developed and used. These concerned both the validity and reliability of the Susceptibility to Smoking construct. The construct of "Susceptibility to Smoking", featured in Pierce et al. (1998) and a number of replications after Pierce et al., was found to have several methodological flaws. These flaws tended to exert consistent effects when the study data was reanalysed. This suggests a problem with the reliability of the findings by Pierce et al. When non-responses were deleted to gauge the validity of the findings, the reanalyses obtained very different findings, with consistent patterns that depended on the category (e.g., "Susceptible" vs. "Experimenter").

These findings tend to question the conclusions that Pierce et al. make about a causal link between "tobacco marketing" and "adolescent susceptibility to smoke" in their data. This doesn't mean that the causal link does not exist – just that Pierce et al. (1998) have not found it. The findings also suggest that the changing of questions, and the response scaling to those questions may need further tests of its validity to serve as a measure of progression toward smoking by adolescents.

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