

The Alcohol Warning and Adolescents: 5-Year Effects

ABSTRACT

Objectives. This study, a follow-up to the authors' earlier report, examined the effects of the alcohol warning label on adolescents during the first 5 years that the warning was required.

Methods. Surveys were administered to 10th-grade ($n=16661$) and 12th-grade ($n=15856$) students from the 1989–1990 school year through the 1994–1995 school year. The measures were awareness of, exposure to, and recognition memory of the alcohol warning label; beliefs about the risks listed on the warning; and open-ended statements about consequences of alcohol use, alcohol consumption, and self-reported driving after drinking.

Results. There were increases in warning awareness, exposure, and recognition memory. These effects leveled off approximately 3.5 years after the inclusion of the warning on alcohol beverage containers. There was no beneficial change attributable to the warning in beliefs, alcohol consumption, or driving after drinking.

Conclusions. The initial positive effects of the alcohol warning label on adolescents have leveled off, consistent with theories of repeated exposure to persuasive information. The alcohol warning has not affected adolescents' beliefs about alcohol or alcohol-related behaviors. (*Am J Public Health.* 2000;90:1589–1594)

David P. MacKinnon, PhD, Liva Nohre, MA, Mary Ann Pentz, PhD, and Alan W. Stacy, PhD

The following warning label is required to appear on alcohol beverage containers manufactured since November 18, 1989¹:

Government Warning: (1) According to the Surgeon General, women should not drink alcoholic beverages during pregnancy because of the risk of birth defects. (2) Consumption of alcoholic beverages impairs your ability to drive a car or operate machinery, and may cause health problems.

The risks described in the alcohol warning have well-documented and substantial social and economic costs, including traffic fatalities and injuries, fetal alcohol syndrome, liver cirrhosis, cancer, assaults, drownings, and work-related injuries.^{2,3}

Laws requiring alcohol warnings have been consistently proposed at both local and federal levels as a cost-effective, universal prevention strategy to communicate health risks across entire populations.^{3,4} Warning labels have been shown to receive the highest public support among a variety of alcohol control policies, including policies on availability, educational programs, and higher taxes.^{3,4} Warnings on alcohol containers are a unique method to disseminate prevention information because amount of alcohol use is directly related to exposure to the information. The number of potential exposures to the warning is large for heavy drinkers who pour their own drinks. In most other informational prevention strategies, exposure is not directly related to problem behavior.

The text of the alcohol warning label law specifies that the goal of the warning is to inform and remind people of the risks associated with alcohol use, but effects on behavior are likely to be of the most importance to public health. As part of the law requiring the alcohol warning, federal agencies were mandated to monitor its effects.¹ Across several studies, short-term effects of the warning label have been reported on awareness, exposure, and memory but not beliefs about risks or alcohol use and abuse.^{5–7} Warning effects on awareness and memory are important because they

are measures of the purpose of the warning as described in the law's text.

Awareness and memory are also important because changes in these cognitive measures may ultimately lead to reductions in alcohol-related problems. The alcohol warning label was initially effective in communicating risks, meeting the law's intent. Now that the law has been in effect since 1989, it is important to evaluate the duration of the initial effects and whether effects on intermediate cognitive measures translate to changes in alcohol use behavior.

Theories of repeated exposure to information may shed light on the effects of warnings over time. According to the 2-factor model of message repetition,^{8–13} repetition initially provides an opportunity for deeper understanding that results in positive attitude change. The tedium of additional repetitions leads to less attitude change and attention to the message.^{10,11,14} The model predicts a quadratic effect such that warning label effects increase, level off, and then decrease. Longitudinal studies of warning label effects on adults have produced evidence that effects have leveled off,^{15,16} and similar results have been observed for an alcohol warning poster.¹⁷ If the 2-factor model provides an accurate account of warning label effects, then changing the format of the warning, rotating warnings, or using other methods to increase the noticeability and novelty of the warning may be necessary.

The present study examined the longitudinal effect of the alcohol warning label, 5 years after the label was required to appear, on a large

David P. MacKinnon and Liva Nohre are with the Department of Psychology, Arizona State University, Tempe. Mary Ann Pentz and Alan W. Stacy are with the Department of Preventive Medicine, University of Southern California, Los Angeles.

Requests for reprints should be sent to David P. MacKinnon, PhD, Department of Psychology, Arizona State University, Tempe, AZ 85287-1104 (e-mail: davidpm@asu.edu).

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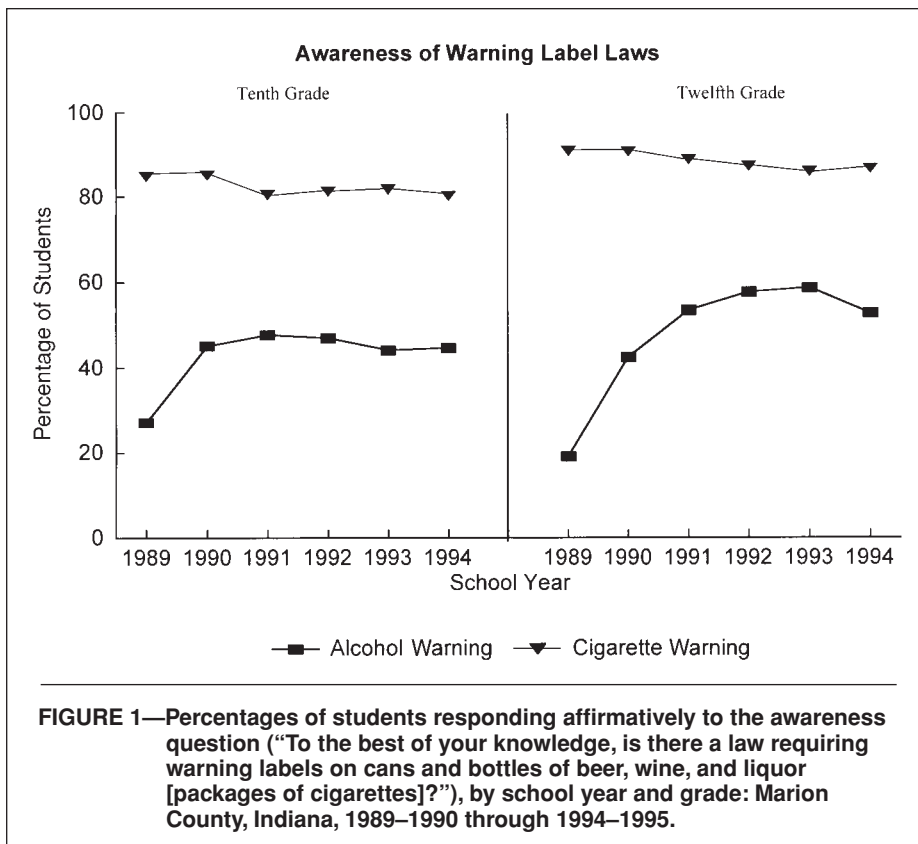


FIGURE 1—Percentages of students responding affirmatively to the awareness question (“To the best of your knowledge, is there a law requiring warning labels on cans and bottles of beer, wine, and liquor [packages of cigarettes]?”), by school year and grade: Marion County, Indiana, 1989–1990 through 1994–1995.

adolescent sample. Experimentation with alcohol typically begins in adolescence, and many attitudes regarding alcohol use are established during this period,¹⁸ making adolescents an important group to study. Our previous study,¹⁹ which evaluated the 1-year effects of the warning label on a portion of the current adolescent sample, showed positive effects on intermediate measures of the alcohol warning.

If the initial effects on intermediate measures of the warning label lead to reductions in alcohol-related problems, then reductions in alcohol use and driving under the influence of alcohol should be observed. Even small effects on alcohol consumption and driving after drinking may be detectable in such a large adolescent sample. Of the 4 risks addressed by the warning label (birth defects, health problems, impaired operation of machinery, and impaired driving), only effects on impaired driving may be likely in a general population of adolescents.

Methods

Sample

The sample consisted of 16661 grade 10 and 15856 grade 12 students surveyed during each school year from 1989–1990 through 1994–1995. The average numbers of 10th- and 12th-grade students measured in each school

year were 2777 and 2643, respectively. The sample was 50% male and 74% White; 52% reported their father’s job as executive, business owner, professional, or high-end salesperson; and 45% had consumed at least 1 alcoholic beverage in the previous month.

The participants surveyed during the 1989–1990 school year constituted the pre-warning label group. All of the 12th-grade students and approximately half of the 10th-grade students in the 1989–1990 school year were surveyed before the alcohol warning label’s legislated date of appearance. That half of the 10th graders were measured after the warning in the 1989–1990 school year may have reduced the warning effect size; however, excluding these students did not change the pattern of results. Some of the 10th graders may have been measured in the 12th-grade sample 2 years later. Public, parochial, and private schools were assessed each year. The number of schools measured each year varied somewhat (from 24 to 27) owing to school closures and openings, but the sample included almost all of the high schools in Marion County, Indiana.

Two sampling plans were combined to provide the data for the cross-sectional analyses described in this report. In the primary sampling plan, classrooms of students were randomly selected from each school and measured cross sectionally. Beginning in the 1989–1990 school year for 10th graders and the 1991–1992 school year for 12th graders, some par-

ticipants were surveyed as part of a concurrent longitudinal study that originally began when the students were in 6th or 7th grade. Those students in the longitudinal study who reached 10th or 12th grade during each school year were included in the sample for this report. Thus, each year data were available for the cross-sectional participants along with those longitudinal study participants who were in the 10th or 12th grade.

Measures

The variables described in this report were included on a questionnaire administered yearly in school classrooms to measure attitudes, beliefs, knowledge, and consumption of drugs. All surveys included demographic and drug use items. Several forms of the questionnaire were used, so not all of the items were answered by all of the students. Questionnaire forms were randomly assigned to individuals.

The items used as outcome measures are shown in the figures. The awareness, exposure, and belief measures had 4 response options: yes, definitely; probably; I don’t think so; and no. A comparison variable, identical to the alcohol awareness variable except that it asked about awareness of the cigarette warning, was included because changes in this measure may suggest response bias or a general tendency to pay more attention to warnings.

The recognition memory composite consisted of the sum of correct responses to the 4 risks listed on the warning label (alcohol use by a pregnant woman can harm the baby, alcohol use impairs the ability to drive, alcohol use impairs the ability to operate machinery, and alcohol use can cause health problems) and 2 distractor risks (alcohol use can lead to addiction and alcohol use can cause family problems). Correct responses were yes to risks on the label and no to risks not on the label.

The beliefs measure was the mean of 4 items: Can drinking alcohol during pregnancy cause birth defects? Can drinking alcohol impair your ability to work with machinery? Can drinking alcohol impair your ability to drive a car? and Can drinking alcohol lead to health problems?

The open-ended alcohol expectancy item was as follows: “During the next minute, write down up to four things that can happen if someone drinks alcohol (beer, wine, or liquor). Write as many as you can but don’t worry if you leave blank spaces. After one minute, go on to question 2.” The open-ended consequence item was hypothesized to measure the memory accessibility of alcohol use consequences.^{20–22} For each participant, the number

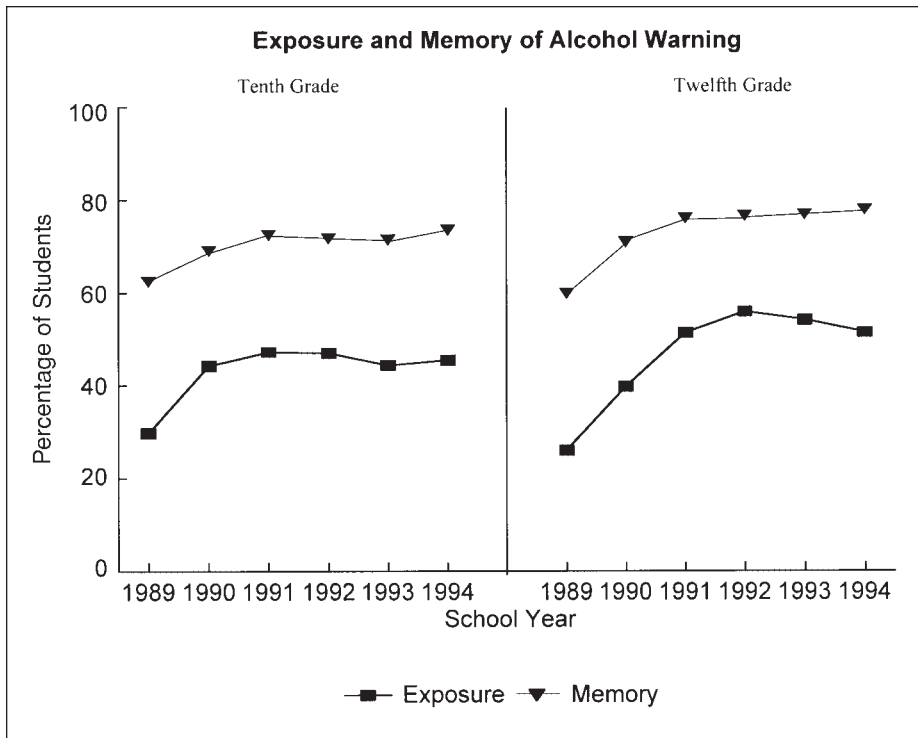


FIGURE 2—Percentages of students responding affirmatively to the exposure question (“Have you seen warning labels on alcohol beverage cans or bottles?”) and showing correct recognition memory for risks, by school year and grade: Marion County, Indiana, 1989–1990 through 1994–1995.

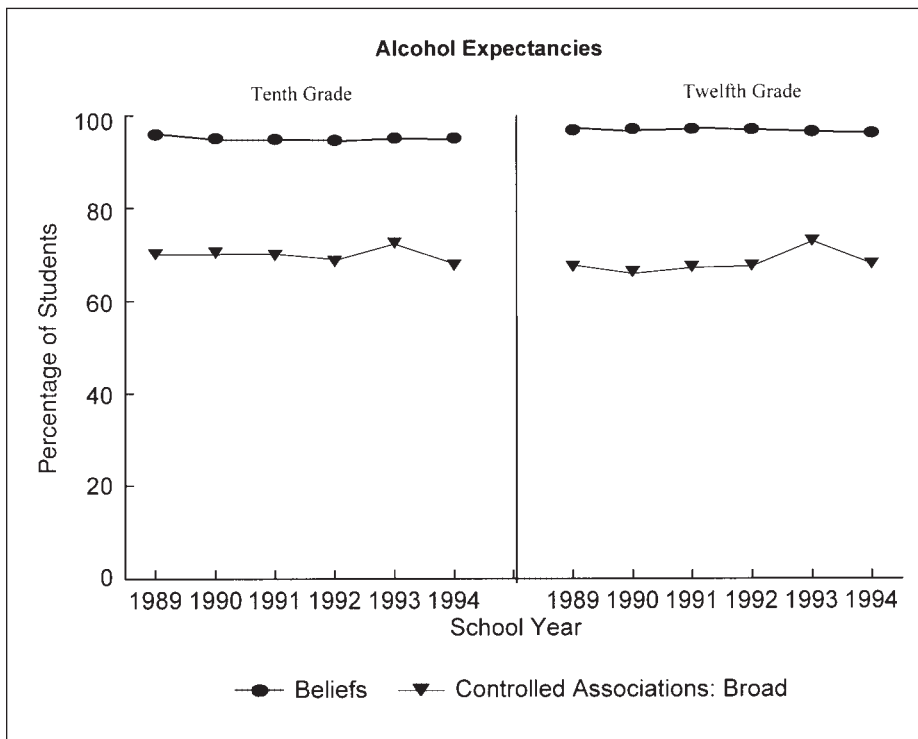


FIGURE 3—Percentages of students responding affirmatively to the belief questions and spontaneously stating risks on the warning label in response to an open-ended alcohol use consequence question, by school year and grade: Marion County, Indiana, 1989–1990 through 1994–1995.

of consequences with the same general meaning as the risks on the alcohol warning was computed. Alcohol use, intoxication, driving under the influence, and riding with someone driving under the influence were dichotomized such that the students either had or had not engaged in these activities within the previous month.

Data Analysis

The regression model involved a 1-factor between-subjects design with covariates estimated separately for 10th- and 12th-grade students. The test of the overall (prewarning–postwarning [“pre–post”]) effect of the warning compared the prewarning measure with the average of the postwarning measures.

In a separate regression model, the trend analysis regression model, the orthogonal linear and quadratic trend components for the school years were the planned contrasts among the years that tested the 2-factor theory of repeated exposure to the alcohol warning.²³ Consistent increasing effects of the alcohol warning label would yield a statistically significant linear trend only. If these effects have reached an asymptote, consistent with the 2-factor theory, then the quadratic trend would be statistically significant. If the effects have started to decline after leveling off, then the quadratic trend, but not necessarily the linear trend, should be significant.

For each dependent variable, we describe the pretest–posttest effect of the warning label and the trend analysis with unstandardized regression estimates (β_{10} and β_{12}), standard errors, and partial correlations (r^2_{p10} and r^2_{p12}) for 10th and 12th graders. For those variables with statistically significant quadratic trends, we calculated the approximate time at which the effects leveled off by calculating the first partial derivative of the regression equation with respect to time.²⁴ The slope of the equation was zero when the curve leveled off.

School-level analyses were conducted because schools represented natural clustering in the data, and individual-level analyses could yield reduced standard errors.²⁵ All analyses were adjusted for demographic variables (percentage male, percentage Caucasian, and percentage high socioeconomic status) and for students’ exposure to drug prevention programming (figures present unadjusted percentages). Prevention program exposure rates ranged from 0% in 1989–1990 to 100% in 1992–1993 among 10th graders, and the 1994–1995 rate for 12th graders was 100%. The results for the tests of pre–post, linear, and quadratic effects were consistent with individual-level analyses, within-subjects

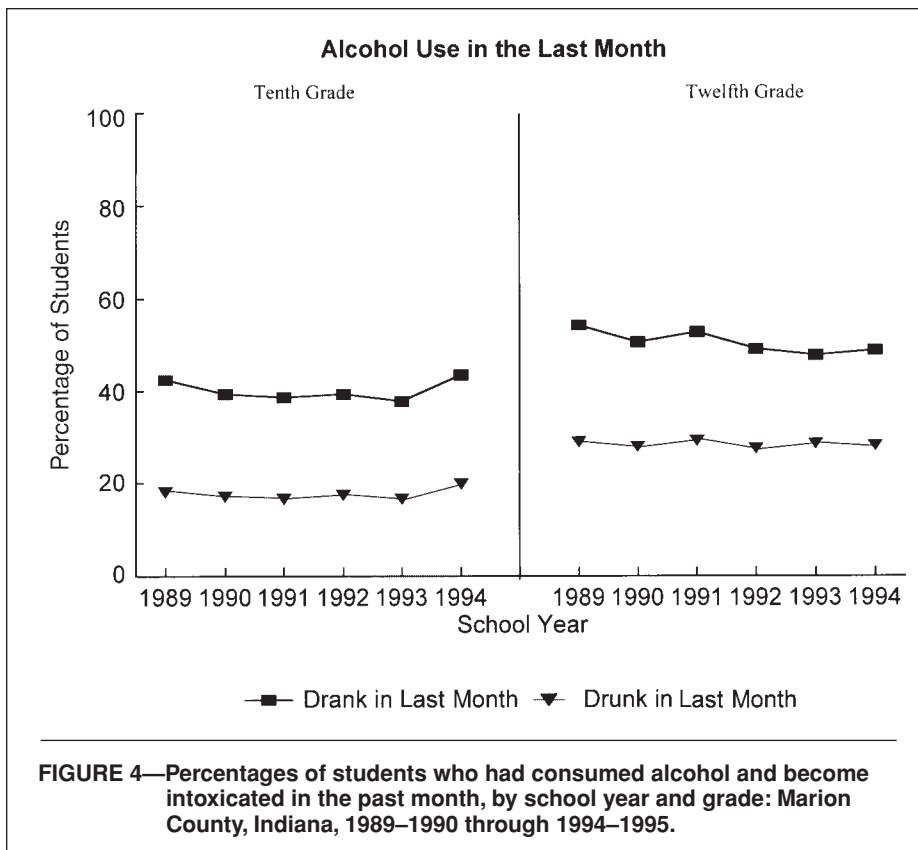


FIGURE 4—Percentages of students who had consumed alcohol and become intoxicated in the past month, by school year and grade: Marion County, Indiana, 1989–1990 through 1994–1995.

analyses (repeated measures from schools), and analyses not involving adjustment for covariates and program exposure.

Results

Awareness

For both grades, there was a statistically significant pre–post effect of the warning label ($\beta_{10}=0.087$, $SE=0.007$, $r^2_{p10}=0.49$; $\beta_{12}=0.140$, $SE=0.006$, $r^2_{p12}=0.79$) on awareness of the warning label law. Among 10th and 12th graders alike, significant linear ($\beta_{10}=0.044$, $SE=0.009$, $r^2_{p10}=0.13$; $\beta_{12}=0.095$, $SE=0.009$, $r^2_{p12}=0.44$) and quadratic ($\beta_{s10}=-0.038$, $SE=0.005$, $r^2_{p10}=0.25$; $\beta_{s12}=-0.051$, $SE=0.004$, $r^2_{p12}=0.54$) trends provided evidence for the 2-factor model. As shown in Figure 1, the results were consistent with an initial linear increase in awareness that reached its asymptote for 10th and 12th graders, respectively, approximately 3.3 and 3.7 years after the warning was introduced.

To rule out effects of response bias, we also analyzed awareness of the cigarette labeling law. In contrast to the alcohol label finding, there was not an overall change in awareness of the cigarette labeling law in either grade ($\beta_{10}=0.009$, $SE=0.005$, $r^2_{p10}=0.02$; $\beta_{12}=-0.000$, $SE=0.003$, $r^2_{p12}=0.00$), and the linear and quadratic trends were nonsignificant. As shown in Figure 1, the

trend effects for the alcohol warning label were clearly different from the trends for the cigarette warning measure. If response bias were present, then the trends should have been the same for the cigarette and alcohol measures.

Exposure

For both grades, there was a statistically significant pre–post effect of warning label exposure ($\beta_{10}=0.062$, $SE=0.010$, $r^2_{p10}=0.22$; $\beta_{12}=0.087$, $SE=0.008$, $r^2_{p12}=0.42$). For both grades as well, there were significant linear ($\beta_{10}=0.038$, $SE=0.011$, $r^2_{p10}=0.08$; $\beta_{12}=0.077$, $SE=0.011$, $r^2_{p12}=0.25$) and quadratic ($\beta_{10}=-0.031$, $SE=0.006$, $r^2_{p10}=0.15$; $\beta_{12}=-0.035$, $SE=0.005$, $r^2_{p12}=0.26$) trends. Much as with the awareness measure, the initial positive effects of exposure among 10th and 12th graders leveled off approximately 3.3 years and 4.0 years, respectively, after the warning was introduced (see Figure 2).

Recognition Memory

For both grades, there was a statistically significant pre–post effect of the warning label ($\beta_{10}=0.059$, $SE=0.012$, $r^2_{p10}=0.13$; $\beta_{12}=0.145$, $SE=0.009$, $r^2_{p12}=0.65$) on recognition memory for the label risks. Also, there were significant linear ($\beta_{10}=0.056$, $SE=0.013$, $r^2_{p10}=0.11$; $\beta_{12}=0.138$, $SE=0.013$, $r^2_{p12}=0.45$) and qua-

dratic ($\beta_{s10}=-0.029$, $SE=0.008$, $r^2_{p10}=0.09$; $\beta_{s12}=-0.039$, $SE=0.005$, $r^2_{p12}=0.26$) trends for both grades. As shown in Figure 2, the initial positive effects leveled off 3.8 and 4.9 years (3.7 years in the analysis without covariates) after the warning for 10th and 12th graders, respectively. In Figure 2, the number of correct responses was converted to the percentage of correct responses.

Alcohol Expectancies

The pre–post effect of the warning on beliefs about the risks on the label was not significant for either grade ($\beta_{10}=-0.005$, $SE=0.004$, $r^2_{p10}=0.01$; $\beta_{12}=0.002$, $SE=0.002$, $r^2_{p12}=0.01$). For both grades, the linear and quadratic trends were nonsignificant. It is important to note, however, that most of the students already had indicated their belief in the accuracy of these risks in the prewarning measurement. Figure 3 shows belief endorsement as a percentage rather than a mean.

For both grades (see Figure 3), the pre–post effect of the warning in regard to open-ended alcohol use consequences was nonsignificant ($\beta_{10}=0.004$, $SE=0.005$, $r^2_{p10}=0.00$; $\beta_{12}=-0.002$, $SE=0.003$, $r^2_{p12}=0.00$). Linear and quadratic trends also were nonsignificant.

Alcohol Use

For both grades, the pre–post effect of the warning on alcohol use in the previous month was nonsignificant ($\beta_{10}=-0.009$, $SE=0.005$, $r^2_{p10}=0.02$; $\beta_{12}=-0.003$, $SE=0.004$, $r^2_{p12}=0.00$), as was the linear trend. Among 10th graders, there was a statistically significant positive quadratic trend in alcohol use ($\beta_{10}=0.008$, $SE=0.003$, $r^2_{p10}=0.04$) indicating a small decline in use after the warning's appearance and a subsequent return to the baseline level at the final data collection.

For both grades (see Figure 4), the pre–post effect of the warning on becoming intoxicated in the previous month was nonsignificant as well ($\beta_{10}=-0.002$, $SE=0.004$, $r^2_{p10}=0.00$; $\beta_{12}=0.001$, $SE=0.003$, $r^2_{p12}=0.00$). Also, the linear and quadratic trends did not significantly predict intoxication in the past month.

Drinking and Driving

For both grades, the pre–post effect of the warning on driving after drinking during the previous month was nonsignificant ($\beta_{10}=0.001$, $SE=0.002$, $r^2_{p10}=0.00$; $\beta_{12}=-0.001$, $SE=0.002$, $r^2_{p12}=0.00$). Among 10th graders, there was a statistically significant positive linear trend in

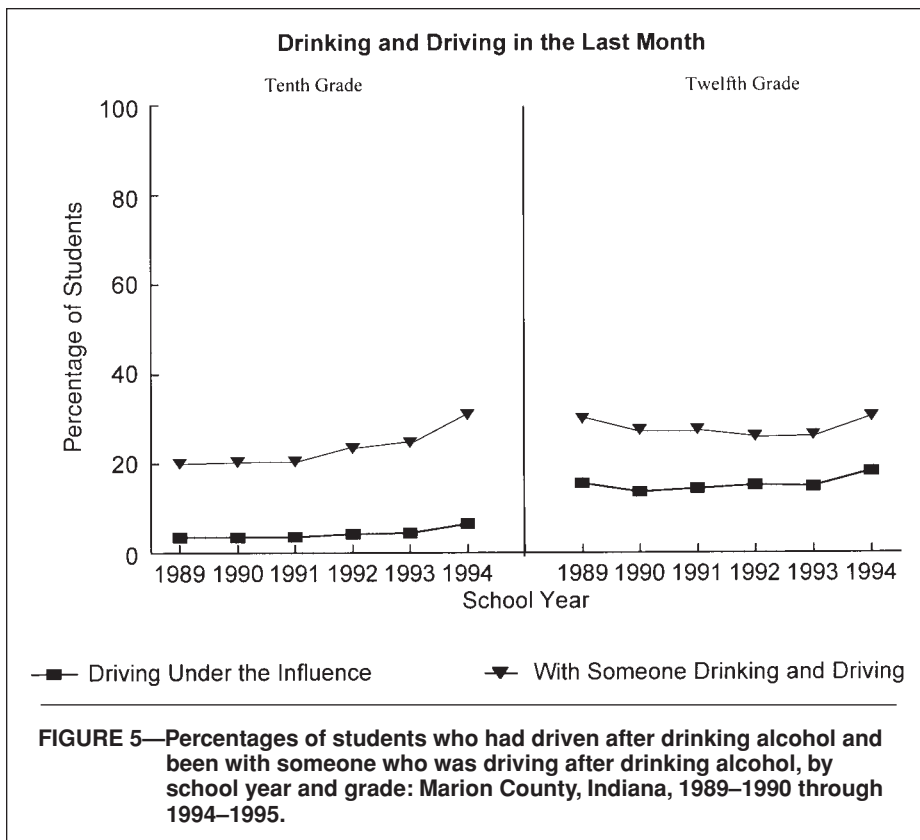


FIGURE 5—Percentages of students who had driven after drinking alcohol and been with someone who was driving after drinking alcohol, by school year and grade: Marion County, Indiana, 1989–1990 through 1994–1995.

driving after drinking ($\beta_{10}=0.006$, $SE=0.002$, $r^2_{p10}=0.08$). Among 12th graders, there was a statistically significant positive quadratic trend ($\beta_{12}=0.003$, $SE=0.002$, $r^2_{p12}=0.03$) suggesting an initial decline that returned to the baseline level.

For both grades (see Figure 5), the pre-post effect of the warning on riding with a driver who had been drinking was non-significant ($\beta_{10}=0.000$, $SE=0.004$, $r^2_{p10}=0.00$; $\beta_{12}=-0.004$, $SE=0.003$, $r^2_{p12}=0.02$). Among 10th graders, there was a statistically significant positive linear trend in regard to riding with a driver who had been drinking ($\beta_{10}=0.013$, $SE=0.003$, $r^2_{p10}=0.09$). Among 12th graders, there was a statistically significant positive quadratic trend ($\beta_{12}=0.005$, $SE=0.002$, $r^2_{p12}=0.04$) suggesting an initial decline that returned to the baseline level.

Covariates

The predictive effects of covariates (program exposure, sex, ethnicity, socioeconomic status) are not a focus of this article. Sex and program had only a few significant effects, and these effects varied across grades and dependent variables. Ethnicity and socioeconomic status showed a greater number of effects, but the direction of these relationships often varied across dependent variables. A full report of

these rather inconsistent effects is available from the authors.

Discussion

The findings of this report are consistent with those of our earlier report on 1-year effects among 12th graders¹⁹ but extend the earlier results in several ways. There were significant increases in awareness of, exposure to, and memory for the warning after its inclusion on alcohol containers. These measures are posited to occur relatively early in the hypothesized chain of effects leading to behavior change.²⁶ These linear increases were qualified by quadratic trends suggesting that the effects leveled off. Consistent with the 2-factor model,^{10,11} the initial novelty of the warning label appears to have led to some initial positive effects. The novelty of the warning label, however, appears to have worn off in that most of the effects did not increase substantially from the 1992–1993 to the 1994–1995 school year. It will be important to continue to study the alcohol warning label to determine whether the tedium effect predicted by the 2-factor theory leads to a decrease in these measures.

Another purpose of the study was to examine the effects of the alcohol warning label on alcohol consumption and driving after drinking alcohol 5 years after the appearance of the

warning, when behavioral effects should have had sufficient time to appear. The lack of clear reductions attributable to the warning on self-reported alcohol consumption and driving under the influence suggests that the warning did not affect these behaviors. The 1994–1995 school year data showed increases in driving under the influence in both grades and an increase in alcohol use among 10th graders. Such increases are similar across the United States and may reflect secular trends.²⁷ Research using longitudinal models relating earlier exposure to the warning label to subsequent alcohol-related problems may shed further light on the possible relation between the warning label and alcohol problems.

There are several limitations to consider when evaluating the results of this study. First, the alcohol warning label represents a large-scale, universal prevention²⁸ intervention delivered to the entire United States. Thus, exposure to the message was not under experimental control, and effects were based on a comparison of measures before and after the warning was required. The universal nature of this prevention strategy diminishes confidence in the study's inferences.

Second, it may have been more difficult to find evidence supporting the 2-factor model of message repetition in this field setting than in the laboratory settings where the theory was developed. It was assumed that each year after the warning label was required added a year of possible exposure to the warning for the students in the study.

Another limitation of this study is that some students surveyed in 10th grade may have completed the survey again 2 years later when they were in 12th grade. We do not believe that repeated testing can explain the effects revealed because of the small number of warning questions included and the length of time between measurements. It is also likely that warning measures would have continued to increase over time if respondents had been cued to these measures 2 years earlier.

One possible explanation of the effects described in this report is that more students had received the school-based intervention in later years of data collection. This interpretation is unlikely because the program effect on the warning label measures was small and the trend effects were present regardless of whether program exposure was included as a covariate. Another explanation of the trends is one involving secular norms, response bias, or attitude change. It is possible, for example, that students were changing their tendency to answer questionnaire items in a way that might explain the observed results. If such response tendencies were present, then similar effects should have been observed for awareness of the cigarette warning comparison variable. This

interpretation is also inconsistent with the fact that some of the warning label measures did not change after the warning label appeared, along with the fact that the recognition memory measure included distractor items.

One practical implication of the findings, a leveling off of the warning label effects, is that the content of the warning may need modification to increase its novelty. The content of the warning could be rotated in a manner similar to the cigarette warning label. Rotating warning messages may produce alcohol attitudes that are more resistant to outside influence, as has been found for media advertising repetition.¹² Other changes, such as a horizontal rather than a vertical layout, larger type size, or a more conspicuous location, may increase the noticeability of the warning label.²⁹

Finally, education-based prevention programs³⁰ may enhance warning label effects if they formally integrate their messages with the warning label. The label could potentially act as a cue for remembering health-promoting information and skills learned in these programs. In several models of health behavior,^{20,26,31} cues provide a fundamental link to use of previously learned information.

Contributors

D.P. MacKinnon planned the study and wrote the paper. L. Nohre conducted most of the data analysis, wrote several sections of the paper, and edited the manuscript. M. A. Pentz and A. W. Stacy contributed to the study design and the writing of the paper.

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