Preventing Alcohol-Impaired Driving through Community Self-Regulation Training

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Abstract: A community education program was designed to train the individual drinker to self-regulate his or her blood-alcohol concentration (BAC) below a level of impairment (.05 g/dl or 11 mmol/L). Drink calculators (cardboard wheels and wallet cards) were disseminated to customers of bars and licensed beverage outlets; bartenders and counter clerks were trained to demonstrate use of the calculators and demonstrations were presented in television spots. Program components were evaluated in three matched Vermont communities, one receiving the full community education program, one receiving the TV spots only, and one serving as control. After six months of intervention, a roadside survey of nighttime drivers (N = 892) indicated 5.3 per cent fewer drivers with BACs above 0.05 g/dl in the community program group and 1.0 per cent fewer in the TV-only group compared to the control group; however, substantially fewer drivers were found above .00 BAC in either program community than in the control. Drivers reporting heavy drinking and youthful drivers both indicated higher utilization of the materials than did other drivers. Although limited in scale and duration, this study suggests that a community education program can be effective in preventing alcohol-impaired driving. (Am J Public Health 1989; 79:287–290).

Introduction

Alcohol-impaired driving remains the leading human cause of highway deaths, despite repeated efforts to deter this behavior through a variety of interventions. In the past, public education has been employed largely to raise awareness of alcohol and highway safety issues and to promote moral persuasion, while most direct interventions to reduce alcohol-impaired driving have focused on external regulation through legislation and enforcement.1-3 Server interventions show potential for prevention although they have not been evaluated with driving populations.4,5

In this study, we have evaluated a community education program which was designed to provide the individual drinker with a cognitive method of self-regulating his or her blood-alcohol level through the use of “drink calculators” which were distributed and demonstrated at licensed alcoholic beverage outlets. In Vermont, such calculators have been used sporadically for a number of years, particularly in school driver education courses, but their use in a concentrated community-wide education program has not been evaluated previously.

Methods

Educational Program

The community education program included: a series of meetings with community leaders; a system through which drink calculators were distributed and demonstrated to community members through licensed alcoholic beverage outlets; and broadcast of public service television spots in which use of drink calculators was demonstrated. The full program was implemented in a single Vermont community with a target population of about 4,000 persons of legal age for both drinking and driving.

Drink calculators are inexpensive devices which provide estimates of blood-alcohol concentrations (BAC) for individuals by body weight and rate of alcohol consumption. Persons using the calculators can estimate the number of drinks they could consume in a given period of time without exceeding the Vermont legal driving limit of 0.10 g/dl BAC (22 mmol/L); estimates are also provided for the number of drinks likely to produce a BAC of 0.05 g/dl (11 mmol/L), at which impairment of driving skills begins to be perceptible for most people. A drink is defined as one ounce of 100 proof liquor, 12 ounces of beer, or 4 ounces of table wine. Two types of drink calculators were used. Drink calculator wheels are 3"x4" cards with a rotating wheel mounted. Using the wheel to match body weight and number of drinks consumed provides an estimate of BAC level in a window; a second window provides a time adjustment if these drinks were consumed in a period of more than one hour. The second type of calculator was a simplified wallet-sized card version of this device. Directions for use and motivational messages were printed on the drink calculators.

The distribution-demonstration system for drink calculators was implemented by visits to each retail outlet every four weeks on average throughout the six-month intervention period; visits were scheduled to cover different shifts and were more frequent at the beginning of the period, less frequent later. Service personnel were asked to rehearse demonstration skills and any difficulties were addressed. They were urged to demonstrate and distribute the calculators to customers. Brightly-colored countertop displays which held the calculator wheels were installed prominently at each location.

Logs of these contacts recorded 150 visits to retail outlets. Fifty-three customer service personnel were trained directly in use of the calculator, who, in turn, trained a number of other customer service personnel. Comments from the outlet workers and owners reflected generally good acceptance throughout the implementation period. The calculators were distributed through all 25 retail alcoholic beverage outlets identified in the program community, including: convenience stores (6), restaurants (6), private clubs (5), filling stations (3), lounges (2), supermarkets (2), and one
state liquor store. No licensees refused to participate. About 3,000 drink calculator wheels were distributed through countertop displays, and about 3,000 wallet cards were distributed with purchases of alcoholic beverage. Excess distribution above the target population of 4,000 persons can be attributed to visitor traffic and multiple liquor sales per person.

In addition to face-to-face instruction, use of drink calculators was demonstrated in a series of television public service announcements. A 60-second message featured a well-known race car driver, who was also a local resident, demonstrating use of a drink calculator to his racing crew. Two 30-second messages featured demonstration by popular local bartenders. These messages were broadcast an average of 20 times during each week of the six-month intervention period, primarily during late afternoon and late night hours. The television station was a local network affiliate, with about a 20 per cent share of the audience, whose management undertook the project as a major public service initiative.

Evaluation

The impact of the educational program was evaluated through a controlled quasi-experiment in three Vermont communities. The first community (A) received the full educational program; the second community (B) received broadcasts of the drink calculator television spots but no other element of the educational program; the third community (C) was a measurement-only control.

The three communities were selected from two Vermont counties which had, for the most recent five years, the highest average annual automotive fatality rates (0.33 deaths per 1,000 residents). One of these counties was served by a television station which could not be seen in the second county. Within the former county, the two largest communities were found to provide good demographic matches (see Table 1); the smaller community was designated to receive the full educational program (A) and the larger received television spots only (B). One of two equivalently sized communities in the second county providing the better demographic match was chosen as the measurement-only control site. The two program communities were located about 20 miles apart. The measurement-only community was in a non-adjacent county 80-90 miles from the program communities; a mountain range separates the two areas.

Roadside surveys were conducted in the three communities during April and May 1983 on Friday and Saturday nights between 9 pm and 3 am; police officers stopped all drivers at previously designated locations and visually checked them for signs of drinking. Vermont drivers (N=1,332) were asked to participate in a brief survey administered by the officers; there were no refusals. The officers were not aware of the study design. The survey asked about usual frequency and quantity of alcohol consumption and knowledge of the number of drinks in an hour to reach a BAC of .10 g/dl (22 mmol/L).

For consistency with program exposure and to obtain the maximum number of respondents, survey participants were assigned to study group by town of residence regardless of the interview location. Participants living outside the boundaries of the community receiving the full educational program but within range of the television station which broadcast the spots were included in the TV-only group; participants residing in other Vermont towns outside of the range of the television signal were included in the measurement-only group.

In October and November 1983, after completion of the six-month educational program, a more comprehensive series of roadside surveys was conducted at equivalent times on weekend nights. Police officers stopped all traffic and, except for a few drivers considered by police to be legally impaired, all Vermont drivers were passed on to a separate team of interviewers. These drivers were assured that, if found to be impaired during BAC measurements given voluntarily, no penalties would be exacted. If drivers and all other occupants of their cars were found to be impaired or otherwise unable to drive they were driven home by members of the survey team. The interview teams collected survey data, including BACs, from all consenting Vermont drivers; BACs of drivers processed by police were also included in the analysis. Of 1,009 eligible drivers, 927 (91.9 per cent) consented to be interviewed; 881 of these 927 (95% per cent) consented to have their BACs measured. Refusal rates by study area were nearly identical. Sixty-nine per cent of the drivers were males, and 53 per cent were age 30 and under; these distributions were nearly identical among the three study areas.

Results

In the baseline survey, there were no differences in the usual drinking patterns reported by drivers or in their estimates of the number of drinks which they could consume within a one-hour period and not be considered legally impaired for driving. Police officers reported that 16.8 per cent of the surveyed Vermont drivers had been drinking: 16.3

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**TABLE 1—Population Characteristics of Study Communities**

<table>
<thead>
<tr>
<th>Study Area</th>
<th>Education</th>
<th>Income</th>
<th>Age: (Proportion 16-29)</th>
<th>Population (1980 Census)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High School and Above</td>
<td>Median Household</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Community A</td>
<td>19.5</td>
<td>$13,086</td>
<td>11.3</td>
<td>12.3</td>
</tr>
<tr>
<td>Community B</td>
<td>18.7</td>
<td>$13,326</td>
<td>10.6</td>
<td>12.6</td>
</tr>
<tr>
<td>Community C</td>
<td>18.8</td>
<td>$12,723</td>
<td>12.8</td>
<td>13.4</td>
</tr>
</tbody>
</table>

**TABLE 2—Reported Usual Quantities of Alcohol Consumed by Drivers in Each Study Group at Follow-up Survey**

<table>
<thead>
<tr>
<th>Study Group</th>
<th>None</th>
<th>One or Two</th>
<th>Three or More</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (N = 311)</td>
<td>19.5</td>
<td>58.8</td>
<td>21.7</td>
</tr>
<tr>
<td>TV Only (N = 377)</td>
<td>19.2</td>
<td>60.1</td>
<td>20.7</td>
</tr>
<tr>
<td>Community Program (N = 132)</td>
<td>20.5</td>
<td>57.0</td>
<td>22.5</td>
</tr>
</tbody>
</table>

*Number of drinks usually consumed in a one-hour period.
per cent were reported in the community program group, 19.3 per cent in the TV-only group, and 14.2 per cent in the control group. As indicated in Table 2, reported drinking patterns also were found to be similar among all three study groups in the follow-up survey.

Program effects were assessed in the follow-up survey using the breath sample measurements of BAC as indicated in Table 3. Only 5.8 per cent of the drivers in the community program had BACs above the level of impairment (.05 g/dl or 11 mmol/L), compared to 10.1 per cent in the TV-only group and 11.1 per cent in the controls. The odds ratio for the community program group staying below the level of impairment relative to the control group was 0.51 (95% CI: 0.24, 1.10); for the TV-only group the odds ratio for BACs below the level of impairment was 0.91 (95% CI: 0.56, 1.45) compared to controls. The odds ratio for a BAC of .00 for the community program group relative to the control group was 0.54 (95% CI: 0.33, 0.91); for the TV-only group this odds ratio was 0.74 (95% CI: 0.49, 0.99).

Results from Jonckheere's distribution-free test for ordered alternatives based on recorded BAC levels supported the hypothesized ordering of effects (p = .03).

Mediating variables were found to be consistent with these results. As indicated in Table 4, 47 per cent of the drivers residing in the town receiving the full community program said that they had used a drink calculator wheel, 59 per cent said they still possessed a drink calculator wheel at the time of the follow-up survey, 56 per cent recalled seeing the countertop display, and 81 per cent reported seeing the drink calculator wheel demonstrated on television, compared with substantially lower levels of activity in the other two groups.

Driver recall data also indicated that persons at highest risk of alcohol-impaired driving, because they reported usually drinking three or more drinks at a time (i.e., in "an hour or so"), were most likely to be exposed to the drink calculator wheel cards. Table 5 shows higher levels of exposure to program components for high-risk drivers in the town receiving the full community program compared to drivers at lower risk residing in the same town. Similar patterns also exist for high- and low-risk drivers in the TV-only and control groups.

A higher level of exposure to the full range of educational approaches was also reported by youthful drivers (30 years of age and younger) compared to older drivers residing in the town receiving the full community program, as indicated in Table 6. Among youthful and older drivers in the TV-only and control groups, similar exposure patterns were found for drink calculator wheel use. Youthful drivers were more likely to recall the TV spots in the TV-only area than older drivers; no differences were found with regard to the other educational approaches.

**Discussion**

Questions have been raised about the appropriateness of using drink calculators. For example:

- They are calibrated primarily for a young male population and may give BAC estimates per drink as much as 15 per cent too low for females and the elderly who have different body fat distribution.
- While the dose-BAC relationship may be accurate on average for young males, there is enough personal variation in alcohol metabolism so that some individuals who carefully follow the calculator may still exceed the legal limit if their goal is simply to stay legal.
- The calculators are based on an assumption of a standard "drink" containing about 18 cc (0.6 oz) of pure alcohol. But, as served, many drinks of liquor contain much larger quantities of alcohol, and the distinction between a "standard" drink and a "real" drink for those consuming hard liquor may be too subtle for much of the intended audience.
- Recent reanalyses of epidemiologic and laboratory data indicate that for many people alcohol-related impairment actually begins below 0.5 g/dl (11 mmol/L), although it does not become appreciable until levels of .08 g/dl (18 mmol/L) or higher are reached.

These arguments, although cogent, are insufficient to warrant abandonment of the drink calculator as a useful tool for self-regulation of drinking. Although more women are drinking and drinking heavily as evidenced by crash fatality trends, young males still comprise the vast majority of those who drink heavily and get into trouble with alcohol-impaired driving. These individuals commonly drink enough to reach the maximum legal BAC, and often go far beyond it. If the goal were simply to get these people down to the legal limit, many of them would have to cut their alcohol consumption in half. But the goal of the drink calculator educational program

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**TABLE 3—Blood-Alcohol Concentrations (BAC) for Drivers in Study Groups (Follow-up Survey)**

<table>
<thead>
<tr>
<th>BAC</th>
<th>Control (N = 333)</th>
<th>TV Only (N = 405)</th>
<th>Community Program (N = 154)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>.01-04</td>
<td>14.4</td>
<td>9.1</td>
<td>9.7</td>
</tr>
<tr>
<td>.05-09</td>
<td>8.1</td>
<td>5.4</td>
<td>5.2</td>
</tr>
<tr>
<td>.10 and Above</td>
<td>3.0</td>
<td>4.7</td>
<td>0.6</td>
</tr>
</tbody>
</table>

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**TABLE 5—Reported Use of Drink Calculators by Heavy, Light, and Non-drinkers in Community Program Group**

<table>
<thead>
<tr>
<th>Drinker Type</th>
<th>Used Wheel</th>
<th>Used Card</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy Drinkers (N = 34)</td>
<td>62</td>
<td>45</td>
</tr>
<tr>
<td>Light Drinkers (N = 37)</td>
<td>52</td>
<td>27</td>
</tr>
<tr>
<td>Non-Drinkers (N = 31)</td>
<td>23</td>
<td>10</td>
</tr>
</tbody>
</table>

*Reported usually drinking three or more drinks at a time (i.e., in "an hour or so").

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**TABLE 4—Reported Exposure to Drink Calculator Wheels and Cards by Drivers in Each Study Group**

<table>
<thead>
<tr>
<th>Study Group</th>
<th>Used Wheel</th>
<th>Have Wheel</th>
<th>Saw Wheel on Counter</th>
<th>Saw Wheel on TV</th>
<th>Used Card</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (N = 337)</td>
<td>31</td>
<td>29</td>
<td>10</td>
<td>22</td>
<td>10</td>
</tr>
<tr>
<td>TV Only (N = 405)</td>
<td>24</td>
<td>36</td>
<td>17</td>
<td>50</td>
<td>9</td>
</tr>
<tr>
<td>Community Program (N = 154)</td>
<td>47</td>
<td>59</td>
<td>56</td>
<td>81</td>
<td>28</td>
</tr>
</tbody>
</table>
was to convince individuals that a more sensible approach is to stay below the level of .05 g/dl (11 mmol/L).

Roadside survey methods for research purposes, such as those used in this study, have been examined by several courts in relation to Fourth Amendment issues of search and seizure. One opinion by a judge of the US District Court of Minnesota (Stark vs Perpch, et al, 1984) suggested methods other than those described in this study. Because US courts are still considering these issues, we as authors feel that we are not in a position to say which of these methods is most appropriate for use in future roadside research.

Limitations of the present study include a six-month intervention and a post-test-only measurement of BAC using three matched communities. Fortunately, there were no differences in the age, gender, and reported drinking patterns of respondents among the three study groups. Proportions of drivers observed by police officers to have been drinking were also similar among study groups, although visual observation is generally imprecise compared to chemical measures.

To maximize usable data collected from nighttime drivers in a small rural state, all Vermont drivers stopped in roadside surveys in the study communities were included by assigning them to study groups based on town of residence and the level of program exposure reaching each town. The modest size of the community receiving the full educational program restricted the number of drivers available for roadside surveys in that area and resulted in a smaller sample than was expected for statistical analysis; results must be viewed with this limitation in mind.

Media exposure was distinctly partitioned by the Green Mountain range to exclude a vast majority of Vermont towns; reported exposure to the TV spots in the control group (22 per cent) was similar to that noted in previous research, and can be attributed to confusion with similar media materials, agreement bias and, to a small extent, true exposure although mobility between control and program communities is limited. It is also interesting to note the increased awareness of the TV campaign in the community program group (81 per cent) compared to the TV-only group (50 per cent) while the channel availability is similar between areas; this may be an example of the supportive roles played by interventions on both the interpersonal and mass media communication levels observed in other intervention studies.12

The present study is based on the distribution of drink calculators and the training of customer service personnel at alcohol beverage outlets throughout the community. This study has resulted in the development of a community education program involving relatively low cost in personnel and material. The total estimated cost of the six-month program was $3,325: TV-spot production, $1800; materials, $725; personnel and travel, $800.

Results suggest that the community program with mass media support was more effective in preventing alcohol-impaired driving than were the media messages alone, but that the media messages alone also produced a general behavioral effect of deterring the consumption of any alcohol before driving. The primary distinction in results between the groups receiving the full community program and the media intervention alone appeared to be in the proportion of drivers having BACs above the state’s legal limit: 0.6 per cent in the community program compared to 4.7 per cent in the TV-only group. This result tends to underscore the role of skills training, since both approaches emphasized the importance of staying below the state’s legal limit (as well as the .05 g/dl or 11 mmol/L level of impairment), but the hands-on experience of operating the drink calculators with personal corrective feedback may have served to reinforce the message. Anecdotal reports also reflected social support in the community through the sharing of drink calculators and discussion of how to use them. This self-regulation approach could be included as a component of server interventions described by Mosher.6

Most importantly, this type of intervention has stimulated self-regulation by the individual drinker without direct coercion by outside authority. In addition, the known presence of enforcement was an important positive incentive to persons living in all of the study areas. However, this education program has had the distinct advantages of being truly preventive of hazardous behavior and not requiring corrective action by police or the courts. It also was designed to give the individual the skills and social support to develop long-term positive habits which can eliminate the personal risk of driving while impaired by alcohol.

ACKNOWLEDGMENTS

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REFERENCES