AN EVALUATION OF BEHAVIOR-BASED INTERVENTIONS TO INCREASE SAFE DRIVING

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

SIGNIFICANT FINDINGS

Overall, the result of these studies indicate that a wide variety of behavior-based safety interventions can be used to decrease at-risk driving in organizational settings. With the exception of a policy intervention targeting turn-signal use, all of the interventions investigated showed significant improvement in the various driving behaviors targeted, including safety-belt use, turn-signal use, and complete stops.

According to the Multiple Intervention Level (MIL) model (Geller, 1998a; Geller *et al.*, 1990; Ludwig & Geller, 1991), when an intervention becomes more individual focused in its operation, the likelihood of behavior change increases. This was demonstrated in the current set of studies. All licensed drivers are presumed to have taken a driver training course where turn-signal use was emphasized. Also, most states, including the two in which this study took place, have a law requiring safety-belt use, turn-signal use, and complete stops at intersections controlled by a stop sign. These legislative interventions, while applying to most of the population, are not very intrusive at the individual level. Thus, further "higher-level" intervention is necessary to increase compliance.

Study 4 (group goal-setting/feedback, followed by public individual feedback) clearly demonstrates that increasing the individual focus (or accountability) of an intervention can result in greater behavior change. While the group goal-setting/feedback intervention resulted in substantial increases in turn-signal use, the addition of publicly posted individual feedback resulted in further increases in turn-signal use. In addition, the more intrusive intervention resulted in greater response generalization than group feedback/goal-setting alone.

Response generalization (increase in the safety of behaviors not targeted by the intervention) was demonstrated in most of the studies, with as much as 53% increases over baseline for nontargeted behaviors. In general, studies which relied on extrinsic control without soliciting involvement (i.e., policy and assigned goal-setting) showed either no change or decreases in the safety of nontargeted behaviors, suggesting that drivers showed reactance against the overt controlling operations. It is also notable that those interventions with a larger degree of social support and intrinsic control (as in participative goal-setting) showed the greatest amount

of long-term maintenance of behavior change in targeted behaviors and the most generalization to nontargeted behaviors.

Response generalization seems to be a special benefit of programs that facilitated employee participation (or empowerment) in the design, development, and implementation of the intervention. For example, employees who: a) implemented a community safety-belt program, b) participated in goal-setting to increase complete stops, and c) received individual feedback with rewards to increase complete stops or turn-signal use, also increased the safety of nontargeted behavior. In contrast, employees who experienced a policy intervention and assigned goal-setting actually decreased their safe performance of the nontargeted driving behavior.

The community program directly prompted and reinforced safety-belt use among the pizza deliverers. And response generalization was found because turn-signal use also increased. In addition, the program promoted deliverers' active participation in helping others drive more safely. It is possible some deliverers internalized their role of "change agent" for community safety, as delivers at the pizza store showed substantial and long-term positive improvement in their own driving behavior. Thus, when employees got involved in the development and implementation of a community safety program, they increased their safe performance of other driving behaviors.

The studies of participatory goal-setting and individual feedback/reward further demonstrated the need to involve employees in the safety process. In Study 3a, participation in the selection of the target behavior (complete stops) and in setting a group goal resulted in significant increases in both safety-belt and turn-signal use. In contrast, assignment of the target behavior and group goal, while producing prominent increases in the target behavior, had no affect on nontargeted behaviors.

While the policy intervention was effective at increasing and maintaining significant increases in turn-signal use, a negative side-effect of this intervention was a concomitant decrease in safety-belt use. In addition, assigned goal-setting was successful at increasing and maintaining complete stops, but failed to influence response generalization. Thus, "top-down" safety interventions (such as disincentive programs and assigned goal-setting) could have a

detrimental effect on nontargeted safety behaviors. As a result, behavior-based safety initiatives which do not involve employees in the design and/or implementation of the program may not influence an overall reduction in vehicle crashes and resulting injuries.

The results of these studies contribute to the behavior-based safety literature by: a) introducing new field methodologies which can be used to study the direct and indirect effects of behavior-based safety interventions, and b) demonstrating that investigating response generalization can lead to important insights regarding the ecological validity of certain behavior-based safety intervention strategies. The research exemplified the need to venture beyond demonstration projects that target a single behavior and are over a short term.

Our findings indicate that empowerment is an important component in the maintenance of long-term behavior change and can facilitate positive changes in safety behaviors not directly targeted by an intervention. This issue is of particular importance for injury prevention because interventions that target a single behavior, but have indirect beneficial effects on other desired behaviors, can be particularly cost-effective at reducing unintentional injury.

USEFULNESS OF FINDINGS

1) Empowerment is an important component in the maintenance of long-term behavior change and can facilitate positive changes in safety behaviors not directly targeted by an intervention. This issue is of particular importance for injury prevention because interventions that target a single behavior, but have indirect beneficial effects on other desired behaviors, will be particularly cost-effective at reducing unintentional injury.
   - Participation in the selection of the target behavior and in setting a group goal is more effective than assigning a target behavior and group goal.
   - Interventions with a larger degree of intrinsic control (as in participative goal-setting) and facilitate social support result in the greatest amount of long-term maintenance of behavior change in targeted behaviors and the most generalization to nontargeted behaviors.
   - Interventions which rely on extrinsic control without soliciting involvement are effective at increasing the targeted behaviors, but result in either no change or decreases in the safety of nontargeted behaviors.
   - Response generalization was a beneficial side-effect of interventions that facilitated employee participation (or empowerment) in the design, development, and implementation of the intervention.
2) Increasing the individual focus (or accountability) of an intervention can result in greater changes in the target behavior. In addition, more intrusive interventions can result in greater improvements in nontargted safety behaviors.
3) When employees got involved in the development and implementation of a community safety program, they increase their own safety performance. Thus, when people act as a "change agent" for others' safety they improve the safety of their own behavior.
4) "Top-down" safety interventions (such as disincentive programs and assigned goal-setting) may have a detrimental effect on nontargeted safety behaviors. As a result, behavior-based safety initiatives which do not involve employees in the design and/or implementation of the program may not influence an overall reduction in vehicle crashes and resulting injuries.

ABSTRACT

The primary aim of this two-year project was to assess the relative effectiveness of specific *behavior-focused* interventions designed to increase safe driving. The following safe driving interventions were evaluated: a) a policy statement mandating turn-signal use, b) a community-based program that involved pizza delivery employees as intervention agents promoting safety-belt use among their customers, c) a comparison of participatory vs. assigned goal-setting, d) the addition of individual feedback to a group goal-setting and feedback intervention, e) the addition of extrinsic rewards to an individual feedback intervention, and f) a safety self-management program for short-haul truckers.

All studies included control sites and used multiple baseline designs, staggering the introduction of interventions at different sites to show functional control of the target behavior. Overall, the result of these studies indicate that a wide variety of behavior-based safety interventions can be used to decrease at-risk driving in organizational settings. With the exception of the policy intervention targeting turn-signal use, all of the interventions investigated showed significant improvement in the various driving behaviors targeted, including safety-belt use, turn-signal use, and complete stops.

The research supported various predictions made from: a) the Multiple Intervention Level (MIL) model (Geller, 1998a; Geller *et al.*, 1990), and b) response generalization (Bandura, 1969; Carr, 1988). With regard to the MIL model, research findings indicate that as an intervention becomes more individual focused in its operation, the likelihood of behavior change increases. For example, while a group goal-setting/feedback intervention resulted in substantial increases in turn-signal use, the addition of publicly posted individual feedback resulted in further increases in turn-signal use. In addition, the more intrusive interventions resulted in greater amounts of response generalization, or improvement in nontargeted safe driving behaviors.

Response generalization was demonstrated in most of the studies, with as much as 53% increases over baseline for nontargeted behaviors. In general, studies which relied on extrinsic control without soliciting involvement (i.e., policy and assigned goal-setting) showed either no change or decreases in nontargeted safe driving behaviors, suggesting reactance against the overt

controlling operations. It is also notable that those interventions with a large amount of intrinsic control (as in participative goal-setting) and social support showed the greatest amount of long-term maintenance of behavior change in targeted behaviors and the most generalization to nontargeted behaviors.

Response generalization seems to be a special benefit of programs that facilitated employee participation (or empowerment) in the design, development, and implementation of the intervention. Thus, while "top-down" safety interventions (such as disincentive programs and assigned goal-setting) may improve the targeted behaviors, they can have a detrimental effect on nontargeted safety-related behaviors. As a result, behavior-based safety programs which do not involve employees in the design and/or implementation of the program may not result in an overall reduction in vehicle crashes and resulting injuries.

SPECIFIC AIMS

Three primary aims of this two-year research project were to: 1) assess the relative effectiveness of specific *behavior-focused* interventions designed to increase safe driving; 2) determine the *short- and long-term effectiveness* of an intervention process based on either intrinsic or extrinsic principles of motivation; and 3) compare predictions of *response generalization* vs. the theory of *risk homeostasis* with regard to the impact of certain intervention strategies on target vs. nontarget behaviors.

These major objectives were achieved as a result of conducting: a) five studies at pizza delivery stores in Virginia and North Carolina, b) one study at a large beverage distributor in Virginia, and c) one study conducted at two privately-owned driving schools in Virginia. The following safe driving interventions were evaluated: a) a policy statement mandating turn-signal use, b) a community-based program that involved pizza delivery employees as intervention agents promoting safe driving among their customers, c) participatory versus assigned goal-setting, d) group versus individual feedback, e) individual feedback plus a reward contingency, and f) a safety self-management program for short-haul delivery drivers.

To date, this research has resulted in a) three publications in a refereed professional journal (these publications are included as appendices to this report: Ludwig & Geller, 1997, see Appendix C; Ludwig & Geller, in press, see Appendix D; Geller & Clarke, in press, see Appendix I); b) seven publications in conference proceedings and non-refereed journals, and c) eight manuscripts under review or in preparation for refereed journals (four of these manuscripts are included as appendices to this report: DePasquale & Geller, 1998, see Appendix H; Ludwig & Geller, 1998, see Appendix E; Ludwig, Geller, & Clarke, 1998, see Appendix F; Capplinger, Ludwig, Benton, & Geller, 1998, see Appendix G).

In addition, during the course of this grant, the research team has disseminated results from our research in: a) seven books or book chapters, b) three published abstracts, c) six training manuals, d) 23 presentations at professional research conferences, e) four presentations at professional safety conferences; f) six workshops/seminars at professional safety conferences, and g) ten workshops/seminars in industry. Thus, the results of this research are already being

widely disseminated to safety professionals working in industry, to upper management decision-makers at major U.S. corporations, and to prevention researchers. A list of these grant-related activities is included in Appendix A.

BACKGROUND AND SIGNIFICANCE

Injury is the primary cause of lost-person-years of productive life in the U.S. (Waller, 1987a). Because of its prominence, the U.S. Department of Health and Human Services has identified injury prevention as priority for attaining the goals outlined in *Healthy People 2000: National Health Promotion and Disease Prevention Objectives* (U.S. Dapartment of Health and Human Services, 1991). Injuries from motor vehicle crashes account for approximately 45% of total unintentional injuries (Sleet, 1987). Vehicle crashes are the single-leading cause of death and injury to Americans between the ages of 4 and 35 (McGinnis, 1984), and were estimated to cost the nation $69.5 billion in 1984 (National Highway Traffic Safety Administration, 1985). Thus, the national health objectives call for a reduction of deaths caused by motor vehicle crashes (Objective 9.3 in *Healthy People 2000*; U.S. Department of Health and Human Services, 1991). In the United States alone, 39,235 people died from motor vehicle crashes in 1992 (Insurance Institute for Highway Safety, 1993). It is estimated that 55% of all fatalities and 65% of all injuries from vehicle crashes could be prevented if safety belts were used.

According to *PARADE Magazine* (1997), The Insurance Institute for Highway Safety indicates that large trucking carriers make up only 3% of all registered vehicles, but were surprisingly involved in 21% of all deaths in multi-vehicle crashes. In 1995, such crashes killed approximately 5,000 persons and injured 116,000. In addition, 98% of all vehicle/large truck collisions result in the death of an occupant of the passenger vehicle.

Particularly prone to injury by motor vehicle crashes are adolescents and young adults. *Healthy People 2000* (1991) identifies motor vehicle crashes as the single leading cause of death among adolescents and young adults between the ages of 15 through 24, and has labeled this group a special target population for active intervention to reduce death and injury (Objective 9.3b). In addition, these national health objectives cite the need to develop community and

organizational interventions aimed at special population targets to reduce the threat of death by unintentional injury (Objective 8.13, Footnote 22).

Behavior-Based Interventions to Prevent Personal Injury

The antecedent-behavior-consequence model of applied behavior analysis has been used successfully over recent years to develop primary prevention programs. Indeed, behavior analysis has a great deal to offer the field of injury control by enhancing the understanding of the determinants of injury-causing behaviors and guiding the development of effective behavior change strategies (e.g., Geller, 1988, 1996, 1998b; Geller et al., 1990; Roberts *et al.*, 1987; Sleet, Hollenbach, & Hovell, 1986). For example, behavior-change research has used: a) participative education to increase vehicle safety-belt use (Cope, Smith, & Grossnickle, 1986; Geller, Rudd, Kalsher, Streff, & Lehman, 1987; Weinstein, Grubb, & Vautier, 1986) and the acquisition of fire emergency skills (Jones, Ollendick, McLaughlin, & Williams, 1998); b) *incentives/rewards* to increase the use of safety belts (i.e., Campbell, Hunter, & Stutts, 1984; Geller, 1984; Roberts, Fanurik, & Wilson, 1988) and child safety seats (Roberts & Fanurick, 1986); c) behavioral feedback to decrease traffic crashes (Evans, 1987), reduce driving speed (Van Houten & Nau, 1983) and increase safety-belt use (Geller, 1996; Grant, 1990); and d) *pledge-card commitment* to increase safety-belt use (Geller & Lehman, 1991; Kello, Geller, Rice, & Bryant, 1988; Geller *et al.*, 1989) and the use of personal protective equipment at industrial sites (Streff, Kalsher, & Geller, 1993).

Intervention Impact Models

Over two decades of behavior change research has led to our development of three theoretical models: (a) a *multiple intervention level* (MIL) hierarchy to categorize behavior change approaches and evaluate the cost-effectiveness of successive intervention strategies to alter the behavioral patterns of large numbers of individuals, (b) a *behavior change taxonomy* to guide the development of more effective behavior change techniques (Geller *et al.*, 1990; Ludwig & Geller, 1991), and (c) a theory of *response generalization* which predicts the spread of an intervention's impact to behaviors not directly targeted by the intervention. The primary purpose

of the research reported here was to evaluate the effectiveness of these models to predict the relative impact of various interventions designed to increase safe driving behaviors.

A Multiple Intervention Level Hierarchy

Our multiple intervention level (MIL) hierarchy (see Figure 1) is characterized by dividing intervention strategies into multiple tiers or levels, each defined by certain dimensions of intervention effectiveness. At the first (i.e., bottom) level of the MIL hierarchy, the interventions are least intrusive and target the maximum number of people. At this level, the intervention is designed to have maximum large-scale appeal and minimum individual-to-individual contact.

The individuals affected at a particular intervention level may benefit from repeated exposure to similar interventions (as booster sessions), but it's assumed those individuals uninfluenced by the first exposure to a particular intervention will generally be uninfluenced by

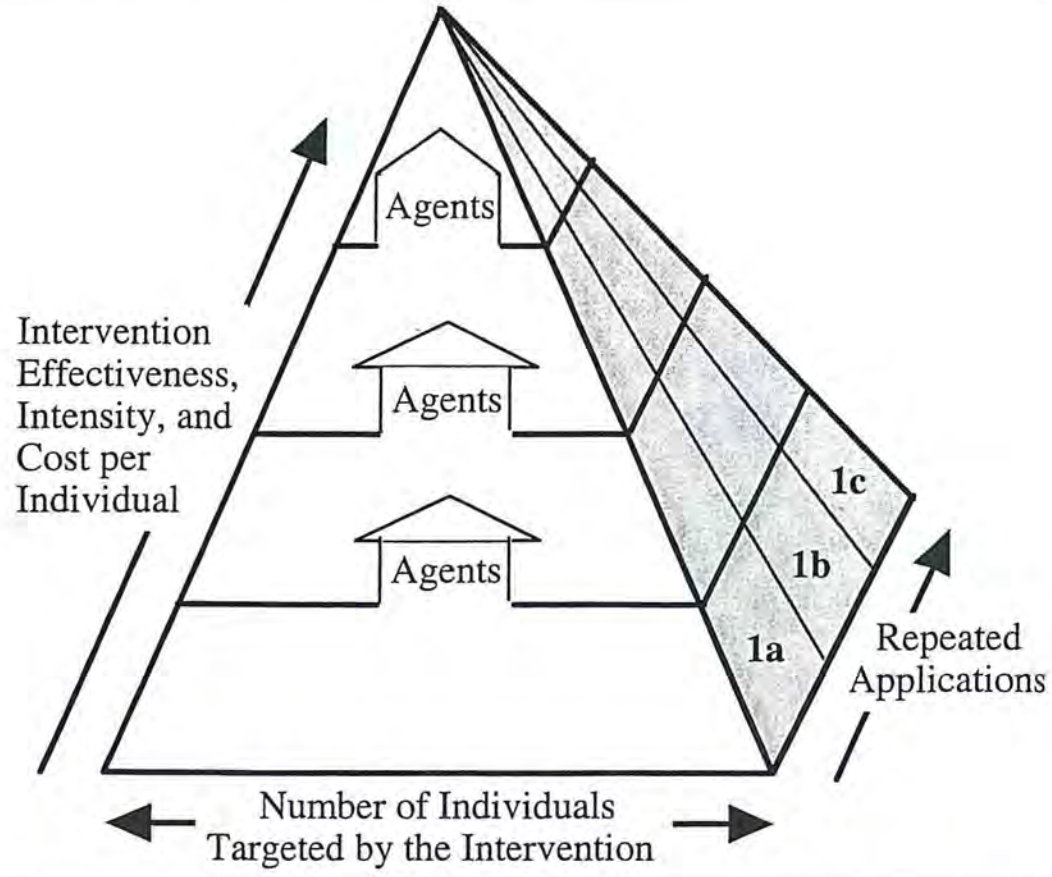


Figure 1. **MIL hierarchy, differentiating repeated prevention interventions at the same effectiveness level and more intrusive or higher-level prevention interventions.**

repeated exposure to interventions at the same level of intrusiveness. These individuals require a higher-level (more involving) intervention. Successively higher intervention levels are more costly and intrusive, but they are needed for the "hard core" problem individuals selected out by their resistance to previous lower-level interventions. These problem persons are probably at greater risk for injury. Thus, a MIL approach to public health has critical implications with regard to implementing cost-effective behavior-based safety programs.

Given the propositions of problem behavior theory, the persons most difficult to reach with low-intrusive interventions are the persons most likely to emit the most risky behaviors (Jessor, 1987; Melton, 1988). For example, it has been hypothesized that individuals most likely to drive in a risky or noncompliant manner (such as exceeding the speed limit or driving while intoxicated) are least likely to use safety belts (Evans, 1985; Hedlund, 1986). Belt-use laws are rarely sufficient to get these individuals to buckle up, and therefore more intrusive or higher-level interventions are needed. Such higher-order intervention will be cost-effective in the long run, if the more risky individuals are influenced.

Finally, the MIL model suggests that individuals influenced at a particular level of the intervention hierarchy become potential intervention agents for the next level of intervention (cf. Katz & Lazarfeld, 1955). Thus, enrolling individuals who already exhibit the desired behaviors as intervention agents enables an increase in the agent-to-target ratio, which is presumably needed to influence the more resistant individuals.

Behavior Change Taxonomy

Geller *et al.* (1990) hypothesize that four factors determine intervention effectiveness, measured by the proportion of a target population showing desired behavior change over the short- and long-term, or by the degree to which individuals initiate and maintain the behavior(s) targeted by a certain intervention (see Table 1). That is, based on our comprehensive literature review and empirical studies of injury prevention, we hypothesize intervention effectiveness to be a direct function of the amount of: a) individual *empowerment* elicited or enabled by the intervention, b) *social support* promoted by intervention procedures, c) *response information* transmitted by the intervention, and d) *external consequences* exerted by the intervention.

Empowerment is defined by the amount of behavioral activity or participation resulting from the intervention, as well as the amount of choice individuals have in managing the intervention. Empowerment also varies as a function of the agent-to-target ratio. That is, with fewer participants per program administrator greater individual involvement is promoted. Social support is a function of the degree of interactive participant involvement facilitated by the intervention. Behavioral information varies directly with the amount of new response knowledge provided by the intervention, and can be facilitated by increasing the salience of the information and the proximity between the behavioral request and the opportunity to emit the desired response (cf. Geller, Winett, & Everett, 1982). External control is determined by the implementation of response contingencies (such as incentive/reward or disincentive/penalty programs).

To derive the factor scores for each behavior change technique, we first defined each behavior change procedure according to recent applications of behavior analysis for health and safety promotion. Then we judged whether the procedures and operations inherent in a behavior change technique included aspects of the evaluation factors. With one exception (explained below), a simple all-or-none scoring system was used (present = 1, absent = 0).

Brief definitions of the 26 behavior change techniques in Table 1 are given in Appendix B. The factor scores in Table 1 were determined by assigning a "1" if any of the following questions per factor were answered affirmatively:

1) *Empowerment*: Does the behavior change technique set the occasion for overt participant action relevant to the target behavior? Does the behavior change procedure offer an opportunity for personal choice or control? This was the most difficult factor to score reliably, but it may be the most critical when considering long-term response maintenance in the absence of the intervention context. Note that we only used this factor when totaling the points for "Long Term Effects." The motivational literature persuaded us to assign a score of "-1" to procedures which offer rewards or threaten penalties, as they are presumed to reduce perceptions of personal or self control (Deci & Ryan, 1987).

Behavior Change Technique	Empowerment	Social Support	Response Information	External Consequences	Immediate Impact	Long-term Impact
1. Lecture	0	0	1	0	1	0
2. Demonstration	0	1	1	0	2	1
3. Policy	0	0	1	1	2	1
4. Commitment	1	0	1	0	2	1
5. Discussion/Consensus	1	1	1	0	3	3
6. Intervention Agent	1	1	1	0	3	3
7. Written Activator	0	0	1	0	1	0
8. Oral Activator	0	1	1	0	2	1
9. Assigned Individual Goal	0	0	1	1	2	0
10. Personal Goal-Setting	1	0	1	0	2	1
11. Individual Competition	1	0	1	1	3	2
12. Individual Incentive	1	0	1	1	3	2
13. Individual Disincentive	1	0	1	1	3	2
14. Individual Feedback	0	0	1	1	2	0
15. Individual Reward	0	0	1	1	2	0
16. Individual Penalty	0	0	1	1	2	0
17. Self-Observation	1	0	1	1	3	3
18. Self-Reward	1	0	1	1	3	3
19. Assigned Group Goal	0	1	1	1	3	2
20. Team Goal-Setting	1	1	1	0	3	3
21. Group Competition	1	1	1	1	4	4
22. Group Incentive	1	1	1	1	4	4
23. Group Disincentive	1	1	1	1	4	4
24. Group Feedback	0	1	1	1	3	2
25. Group Reward	0	1	1	1	3	2
26. Group Penalty	0	1	1	1	3	2

Table 1. **A Taxonomy of Behavior Change Techniques for Predicting Intervention Effectiveness (adapted from Geller *et al.* 1990).**

2) *Social support*: Does the behavior change procedure include opportunities for continual program-relevant support from program participants, other individuals, or other groups (e.g., family, friends, work groups)?

3) *Response information*: Does the behavior change procedure offer new and specific information relevant to the behavior(s) targeted? This factor was difficult to judge, because

the amount of response information depends upon the particular message conveyed by the intervention and the program recipient's prior knowledge of the target behavior. For example, written activators (such as signs or memos that specify desired behaviors) are often informative for the initial exposures to viewers. However, after individuals become aware of the appropriate response, the same activator essentially becomes a *reminder*, and thus conveys less information. Thus, while lectures, discussions, and demonstrations often provide new response information to an individual, in some instances they are merely reminders.

4) *External consequences*: Does the behavior change procedure manipulate a response consequence (i.e., a reward or penalty) in order to influence a target behavior?

Response Generalization

A short-coming of the majority of the published behavior-change studies is that they took a rather piecemeal or narrow approach when assessing intervention effectiveness. That is, most researchers intervened upon, measured, and reported their findings on a single target response, failing to consider that a variety of responses may covary as a function of similar reinforcement histories on outcomes they produce. In other words, safety-related behaviors can be conceived of not as individual responses, but as groups of functionally related behaviors (such as safe driving practices). If safety practices covary in a consistent fashion, then intervening to increase one desired behavior may have indirect effects on other desired safety behaviors within the same response class. This behavioral covariation can occur in one of two ways, resulting in either an increase in safety-related behaviors (as in response generalization, Bandura, 1969; Carr, 1988) or a decrease in safety-related behaviors (as in risk compensation, Peltzman, 1975, or risk homeostasis, Wilde, 1982).

Response generalization occurs when multiple behaviors clustered in a functional response class (such as safe driving) increase as a result of intervening on one of the behaviors within that response class (Russo, Cataldo, & Cushing, 1981). On the other hand, risk compensation occurs when an increase in the targeted behavior results in a decrease in other behaviors within the same functional response class. Risk compensation is based on risk homeostasis theory (Wilde, 1982) which purports that at any point in time, individuals are

willing to accept a certain level of risk. When perceived and accepted levels of risk are not in equilibrium, the individual presumably alters his/her behavior in such a manner as to bring the perceived and accepted levels of risk into homeostatic balance. As a result, efforts to increase the frequency of one safe behavior may have the *undesirable* side-effect of decreasing other safe behaviors within the same response class.

Both community-based (McKenna, 1985; O'Neill, Lund, & Ashton, 1985) and laboratory (Wilde, Claxton-Oldfield, & Platenius, 1985) studies have found little support for risk homeostasis theory. In one notable exception, Streff and Geller (1988) found when subjects operated a 5-hp go-cart on a closed track without a safety belt (for 15 laps) and then buckled up (for 15 laps), they increased their driving speed significantly when using a safety belt, compared to subjects who used a safety belt for all 30 laps in the go-cart. In addition, changes in subjects' perceived risk assessed prior to each 15-lap run matched their speed differences. That is, risk compensation was shown for both perceptions and overt behaviors in this within-subject manipulation of safety-belt use.

Further evidence for risk compensation was found by Janssen (1994) using real cars on real roads. Compared to measures taken when unbuckled, hard-core non-users of safety belts drove faster when buckled up, and followed more closely behind vehicles in front of them, changed lanes at higher speeds, and braked later when approaching obstacles.

Recent field studies of injury control intervention have supported response generalization theory over risk compensation. More specifically, field studies have demonstrated: a) an employee-based intervention to increase safety-belt use facilitated a concomitant increase in turn-signal use (Ludwig & Geller, 1991), and b) a commitment intervention to increase the use of safety glasses on the job resulted in a significant increase in safety-belt use when employees arrived to and departed from work (Streff et al., 1993).

RESEARCH FINDINGS

All studies included control sites and used multiple baseline designs, staggering the introduction of interventions at different sites to show functional control of the target behavior.

All observations were made by trained research assistants who unobtrusively observed driving behaviors. The reliability (interobserver agreement) of all observed behaviors exceeded 85% agreement.

Study 1: Policy and Mandates

(A more detailed description of this study is under review for publication in Journal of Organizational Behavior Management as given in Appendix E.)

Legislative attempts to control vehicle speeds and increase safety-belt use have decreased injuries and fatalities from vehicle crashes. Safety-belt use has increased dramatically in virtually every state that has passed a belt-use law (BUL). For example, during the last six months of 1985, observations of safety-belt use by front-seat occupants in 17 states without a BUL revealed 21.6% buckled up (Zeigler, 1986); whereas mean post-BUL belt use across states with BULs was 48% in 1986 (Campbell, Stewart, & Campbell, 1987) and 47% in 1987 (Campbell, Stewart, & Campbell, 1988). Hence, legislation alone has been insufficient to motivate the safety-belt use of half the population. Currently, safety-belt use across the U.S. is about 67% (Nichols, 1998), with slightly more belt use in states with primary BULs then those with secondary BULs.

The primary aim of this study was to compare the effectiveness of a company policy mandate on a targeted and nontargeted behavior. According to the MIL model and the behavior change taxonomy, a policy-type intervention which contains no empowerment or social support, and little response information, but relies on a non-specific external consequence will have a marginal immediate impact on the targeted behavior, but have minimal if any long-term impact.

Method

Participants and Settings

Pizza deliverers at two pizza restaurants (n = 36 at Store A; n = 24 at Store B) were observed departing for and arriving from their deliveries. Both franchises were from the same national corporation. The stores were located in adjacent towns (pop. 30,000 and 40,000) in southwest Virginia. Behavioral observations of turn-signal and safety-belt use took place during peak business hours (i.e., 5:00 - 8:00 p.m.), and were recorded using a simple "yes" or "no" coding. Data were collected in hidden positions overlooking the parking area of each pizza store.

Almost 50% of the observations were recorded independently by two research assistants, thus enabling assessment of interobserver reliability.

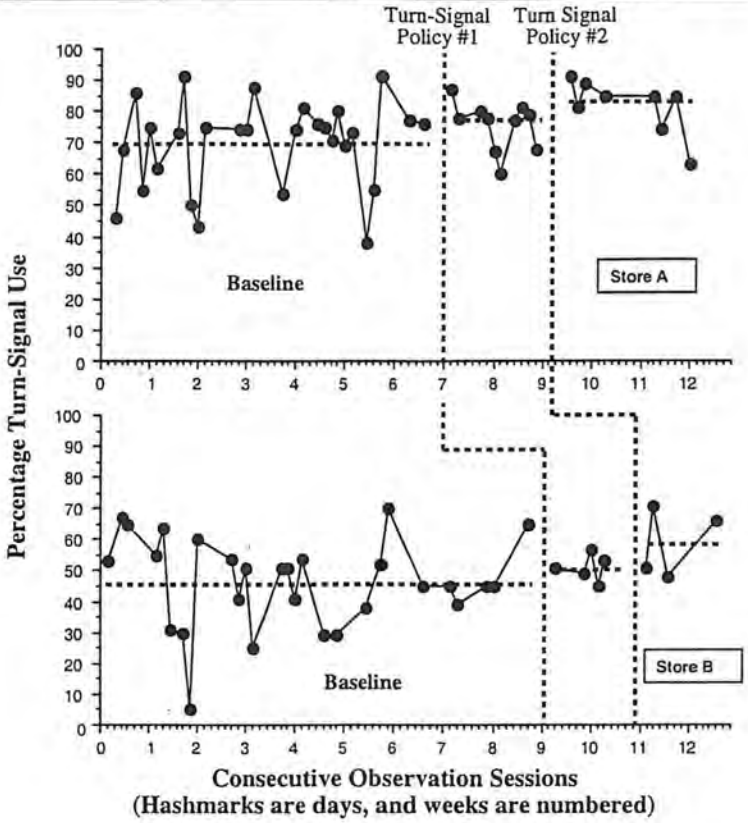
Experimental Design

An ABB multiple baseline design across two stores was used. After 8 weeks of Baseline observations, all employees within Store A received the following turn-signal policy statement in their paychecks on pink paper: "It is the policy of (*name of franchise*) that all drivers use their turn signal at every intersection when making a delivery." The same policy statement appeared a second time two weeks later. Employees in Store B received their first turn-signal policy statement in their paycheck two weeks after Store A received their first statement. They also got a second statement in their subsequent paycheck.

Results

A total of 6,047 vehicle observations were conducted. An average of 74.5 observations occurred in a single observation session. Interobserver agreement percentages were calculated on 36% of the observations by dividing the total number of observations agreed upon for a particular data category by the total number of agreements and disagreements, and multiplying the result by 100. Interobserver agreement averaged 92.4% for belt use, and 92.6% for turn-signal use.

Figure 2 (top panel) depicts daily percentages of turn-signal use by pizza deliverers at the two stores. The mean daily turn-signal use was determined by calculating the mean percentage for each day across all deliverers present that day. The mean for each experimental phase represents the average of all daily means during that phase. At Store A, mean turn-signal use was 70% during Baseline, 78% between the first and second policy statements, and 84% after the final policy statement. At Store B, mean turn-signal use was 46% during Baseline, 51% between the first and second policy statements, and 59% following the second policy statement.



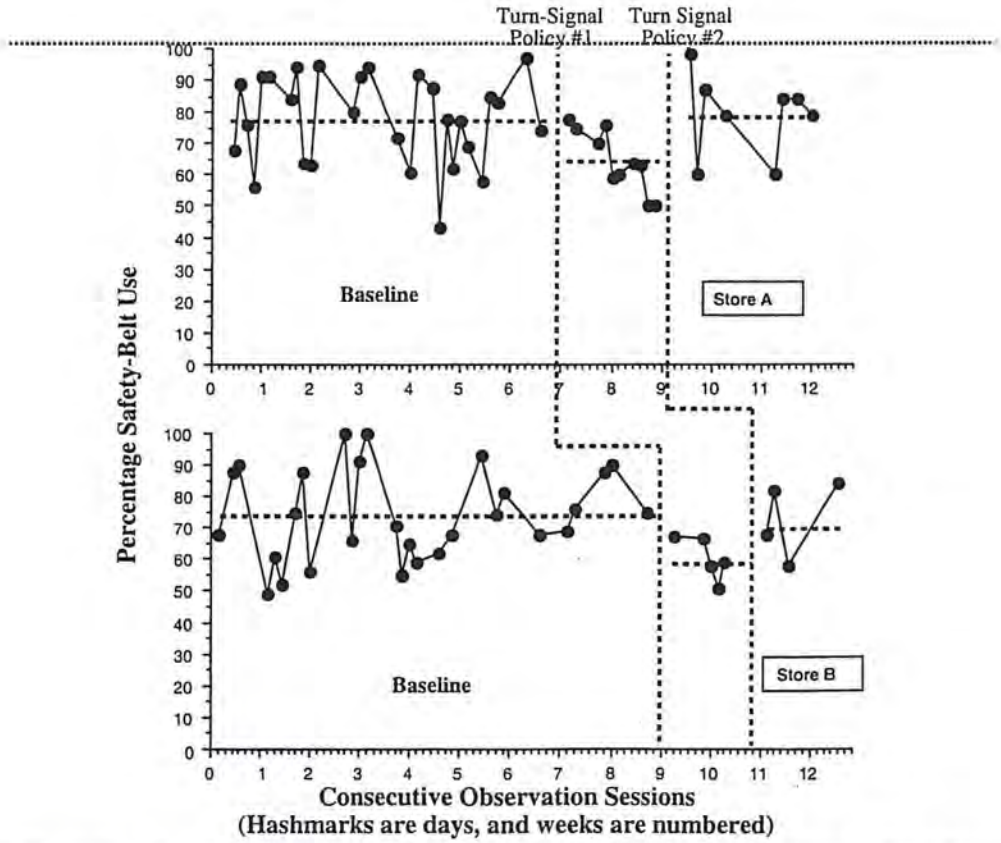


Figure 2. **Percentage turn-signal (top) and safety-belt (bottom) use at the two intervention sites during baseline, and the two turn signal policy interventions.**

Figure 2 (bottom panel) depicts the daily percentages of safety-belt use by pizza deliverers at the two stores. At Store A, mean safety-belt use was 78% during Baseline, 65% between the first and second policy statements, and 79% after the final policy statement. At Store B, mean safety-belt use was 74% during Baseline, 59% between the first and second policy statements, and 70% after the final policy statement.

Discussion

At both stores, turn-signal use increased marginally over the two administrations of the turn-signal use policy. Small but consistent increases in turn-signal use after the first policy statement were followed by further increases after the second policy statement. It is possible a ceiling effect limited the increases in turn-signal use at Store A, but there was plenty of room for more improvement at Store B.

At both stores, concurrent measures of safety-belt use showed prominent decreases after the first turn-signal policy statement. These decreases reversed back to baseline levels after the second policy statement. Thus, while some pizza deliverers might have sought to avoid undesirable consequences of disobeying the policy, some drivers showed a decrease in a related safe-driving behavior not directly mandated by the policy statement.

The increased use of turn signals following the second policy statement was contrary to predictions from the MIL model, that proposes repeated applications of an intervention at the same level of intrusiveness to be ineffective. However, as predicted from the Behavior Change Taxonomy and response generalization theory, behavior-based safety programs that do not involve employees in program implementation and use threats or disincentives may result in little or no behavior change, and can have a negative effect on other, nontargeted behaviors.

Study 2: Involvement in a Community Program

(A more detailed report of this study will be published in Journal of Organizational Behavior Management as given in Appendix D.)

Research in behavior change often makes a clear distinction between the target of an intervention and the agent of change. The target individual is the recipient of a tailored

intervention strategy that focuses on improving a particular behavior. Agents of change are responsible for conducting the intervention and as a result become advocates of specific behavior change. Too often the agents of an intervention are either the researchers conducting empirical studies or an outside agency (Geller, 1996; Geller, Johnson, & Pelton, 1982; Thyer, Geller, Williams, & Purcell, 1987). However, there are numerous examples of successful community-based projects in which indigenous personnel (e.g., police, Rudd & Geller, 1985; naval officers, Kalsher, Geller, & Clarke, 1989; and company employees, Cope & Geller, 1984, Johnson & Geller, 1984; Winett *et al.*, 1991) were enlisted as agents to promote behavior change. The aim of this study was to determine if being an intervention agent for an intervention to increase the safety-belt use of others would have a significant impact on the agent's own safety-belt use, as predicted in our taxonomy of behavior-change interventions (see Table 1).

Method

Participants and Setting

The pizza deliverers for two pizza stores, Store A (n = 51) and Store B (n = 37), were observed departing for and arriving from their deliveries. Both pizza stores were located in a university town of 35,000 in southwest Virginia.

Procedure

Behavioral observations took place during peak business hours (i.e., 5:00 - 8:00 p.m.). The use of safety belts and turn signals by the deliverers were unobtrusively recorded from an automobile parked at a hidden position overlooking the parking area of each pizza store while deliverers departed to and arrived from their deliveries. To assess interobserver reliability, approximately 1/3 of the observations were recorded independently by two research assistants.

A time series ABA design with a non-equivalent control group was employed to evaluate the impact of a community-based intervention. After ten weeks of baseline observations, a communitywide safety belt program was implemented at Store A for six weeks. All pizza deliverers for Store A were enlisted as agents of the safety-belt program in the target town. Store B did not participate in the community program. After the intervention, six weeks elapsed before

follow-up observations were taken for six consecutive weeks. This was followed by an additional five-week break and another seven weeks of follow-up observations.

Community-Based Intervention

The communitywide safety-belt program consisted of:

1) Local radio and newspaper promotions describing the program and stating that "(Store A's) deliverers want to see you buckled-up on (target town's) streets."
2) Safety-belt reminder cards pasted on the boxtops of each pizza sold. These reminder cards were designed with a hang tab so customers could hang the cards on the inside rear-view mirror of the vehicle. If a pizza deliverer spotted a customer with the reminder card, they noted the license number and reported it to the radio station. Local police officers also participated in collecting these license numbers. Customers whose license numbers were announced could come by the radio station, present identification, and receive a voucher for a free pizza.
3) Included in the newspaper adds and boxtop promotions were coupons for $1 off the price of their pizza if, while ordering their pizza, they asked the dispatcher to remind the deliverer to buckle up when the driver left for the delivery. When a patron took advantage of this offer, the dispatchers would print a large "BU" on the receipt attached to the pizza box. Deliverers refer to this receipt for the address of the customer. Therefore, the deliverers saw the customers buckle-up request before delivering the pizza.

Social Validity

Random phone interviews were conducted with the residents of the target town in order to assess their awareness of the community intervention, their intentions to use their safety belt, and their attitudes toward the driving practices of pizza deliverers. Those respondents who were aware of the program were asked if they believe it had increased their own safety-belt use.

Results

A total of 7,843 vehicular observations were conducted over the course of this study. At Store A, an average of 68.7 vehicle observations occurred per each observation session, whereas at Store B this average was 40.2.

Manipulation Checks and Interobserver Reliability

At the beginning of the intervention program, the mean percentage of all pizza orders in which the customers asked their deliverers to "buckle up" was 3.2%. After the first ten days, however, the mean percentage of "buckle up" calls increased to 5.6%. No calls were made during Baseline or Follow-Up phases.

Of 7,843 total vehicle observations, 34% were recorded independently by two observers. Interobserver agreement averaged 92.5% for belt use, 92.1% for belt nonuse, 93.4% for turn-signal use, and 87.6% for turn-signal nonuse.

Safety-Belt Use

Figure 3 (top panel) shows the observed safety-belt use for Store A and Store B over the course of the study. Deliverers at Store A showed a baseline mean of 57% safety-belt use (n= 2253 total observations). During the intervention, belt use rose 32% over baseline to a mean of 75% (n= 2076 total observations). Follow-up observations showed that Store A maintained a mean of 74% safety-belt use (n= 2440 total observations). In contrast, pizza deliverers at the control location (Store B) showed a mean belt use of 53% (n= 992) during the baseline, and 58% belt use during the intervention (n= 570) phase at Store A.

Turn-Signal Use

Figure 3 (bottom panel) shows turn-signal use of the pizza deliverers for Stores A and B. Deliverers at Store A showed a baseline mean of 55% turn-signal use (n= 1875 total observations). During the intervention, the use of turn signals increased 20% over baseline to a mean of 66% (n = 7,966 total observations). Follow-up observations showed that Store A maintained a mean of 63% turn-signal use (n = 2,855 total observations). Pizza deliverers at the control location (Store B) showed a mean turn-signal use of 68% during the baseline period (n = 1953 total observations) and 64% during the period of the interventions implemented at Store A (n = 1213 total observations).

Social Validity

Of the 210 phone interviews attempted, 145 individuals were contacted and agreed to be interviewed. Sixty-eight respondents (40%) reported they would be more likely to use the pizza

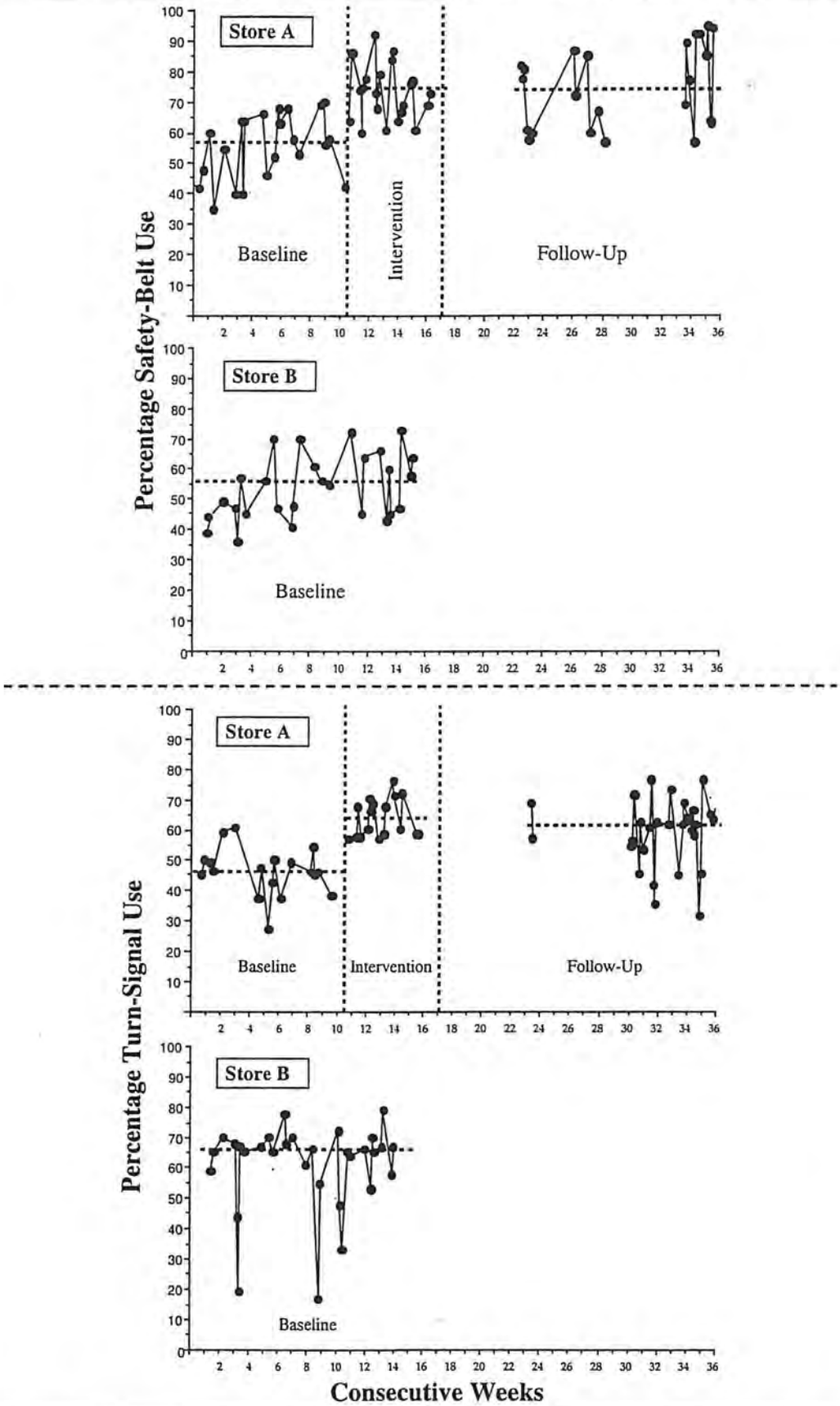


Figure 3. **Daily percentage of safety-belt (top) and turn-signal (bottom) use at the intervention and control stores across the three experimental phases.**

franchise's product because they sponsored a community safety-belt program. When asked to estimate their own percentage safety-belt use and compare that to their estimate of the percentage safety-belt use of pizza deliverers, respondents reported their safety-belt use was, on average, 44% higher than what they estimated pizza deliverers safety-belt use rate to be. This discrepancy was lower (i.e., 32%) among respondents who were aware of the community safety-belt program.

The benefit from the small financial investment in a community-based safety belt campaign was substantial. First, 89% of those interviewed reported they would choose a pizza store over another if they could participate in the community program and get 1$ off their pizza. Second, 40% of these respondents stated they would solely choose a pizza store based on its community service and driving reputation. An additional 42% stated they would be "more inclined" to choose that store. Third and most importantly, the added safety of several deliverers and community participants have its own value, beyond potential discounts in insurance rates and avoidance of legal sanctions.

Discussion

Pizza deliverers who were agents in a community-based safety-belt promotion campaign increased their own safety-belt use 32% over baseline and maintained that increase five months following the end of the program. Such long-term change is one that is generally not seen in this type of intervention research. Instead, target driving behaviors usually regress close to baseline levels once the intervention is removed (cf. Ludwig & Geller, 1991, 1997). However, the intervention-agent approach in the present study seemed to create some lasting change among many deliverers and within the culture of the store itself. Only about 25% of the drivers who participated in the four-week intervention were still employed during the follow-up observations in week 30 and beyond.

The maintenance of the 75% safety-belt use after week 30 suggests the store's culture had incorporated some indigenous prompts and reinforcers separate from the overt intervention implemented in this study. This could be due to the development of cultural practices created by the intervention and maintained by social contingencies after the intervention was terminated.

Only more direct observations of these contingencies in future studies will permit us to draw more definitive conclusions about the determinants of these maintenance effects.

In addition to the increase in safety-belt use, an increase in turn-signal use was also observed at Store A. This increase occurred concurrent with the community safety-belt intervention. We refer to this beneficial side-effect as response generalization. In this study, turn-signal use was the only nontargeted behavior observed. It is possible other nontargeted driving behaviors such as complete intersection stopping, following distance, and speed also changed in desired directions.

The behavior improvement seen among the agents of the community safety-belt program is consistent with predictions from the MIL model (Geller, 1998a; Geller *et al.*, 1990; Ludwig & Geller, 1991). What this study did not uncover, however, was exactly why the agents showed such behavior change. Three possible explanations are suggested: 1) The deliverers reacted to be consistent with the campaign the pizza store was sponsoring; 2) The deliverers became more aware of the public's scrutiny of professional drivers and felt increased public pressure to buckle up and signal turns; or 3) The deliverers were surrounded by prompts to activate belt use. More specifically, they were exposed to: a) "BU" signatures on numerous receipts, b) safety-belt program information on the boxtops of every pizza they delivered, c) newspaper and radio advertisements, and d) their own buckle-up reminder card (from the boxtops) hanging in their cars.

Finally, it's noteworthy that this type of program can be very cost efficient. The total cost of the program to the pizza store was $325, plus approximately 500 $1-off coupons. Since pizza stores usually offered 1$-off coupons weekly in area newspapers, the store was able to leverage their normal discount coupons to reflect their concern for community safety.

Study 3: Assigned vs. Participatory Goal-Setting

(A more detailed report of this study, as published in the Journal of Applied Psychology, can be found in Appendix C.)

Numerous studies have demonstrated the safety benefits of both feedback (e.g., Jonah, 1989; Pettinger, DePasquale, Williams & Geller, 1997; Van Houten & Nau, 1983; Van Houten, Nau, & Marini, 1980) and goal-setting (e.g., Fellner & Sulzer-Azaroff, 1984; Komaki *et al.*, 1978). A review of 500 studies by Locke and Latham (1990) found no appreciable differences in performance between assigned and participatory goal-setting. However, in studies reviewed by Locke and Latham (1990), the impact of goal-setting was always operationally defined as observed changes in the targeted behavior. Thus, the effects of assigned vs. participative goal-setting on nontargeted behaviors has not been previously addressed in the research literature. The aim of this study was to investigate the effects of participative vs. assigned goal-setting and feedback on both targeted and nontargeted behaviors. According to response generalization theory, participative goal-setting and feedback should have a positive affect on both the targeted and nontargeted behaviors, while assigned goal-setting and feedback should only affect the targeted behavior.

Method

Subjects and Settings

Pizza deliverers (n=324) from three different pizza stores (two intervention sites and one control) were observed departing for and arriving from their deliveries.

Observation Procedures and Data Collection

During peak business hours (i.e., 5:00 to 8:00 pm), vehicle observations were unobtrusively recorded from windows of nearby businesses overlooking the store parking lots. Interobserver reliability data were collected on approximately 1/3 of the observation sessions.

Experimental Design

The quasi-experimental design was multiple baseline across settings with a nonequivalent control group. After an initial observation period of six weeks (i.e., Baseline Phase), deliverers in the Participative Group received an intervention consisting of a discussion-based meeting,

participative goal-setting, and four weeks of group feedback. One week after the Participative Group's initial meeting, employees in the Assigned Group received an intervention consisting of a lecture-based meeting, assigned goal-setting, and four weeks of group feedback. The control site received no intervention. After the group feedback was removed from the stores, approximately four to five weeks of observations were conducted (i.e., Withdraw Phase). After a seven to eight-week hiatus, field observations continued for ten to eleven weeks (i.e., Follow-Up Phase).

Experimental Conditions

The Participative and Assigned interventions were designed to be similar in all aspects except for the participation variable. Both groups attended a one-hour meeting, received the same information, left with the same behavioral goal, and received identical group feedback displayed at similar locations in the store. Planned differences between the interventions were: 1) the Participative Group generated the information in a discussion format, whereas the Assigned Group had the same information lectured to them; and 2) the Participative Group participated in the goal-setting, whereas the Assigned group was given this goal (as set by the Participative Group).

The employees in both intervention groups were shown a poster on which percentages of complete stops would be displayed every four days for the following month. The current percentage of complete stops (i.e., ostensibly 55%) was marked with a data point and a horizontal line was drawn across the graph at the 75% level.

Group feedback. After the all-employee meeting, the managers at each store continued observing their deliverers' complete intersection stops. Complete stop percentages were graphed every four days on the large in-store poster. To assure both intervention stores received the same feedback, the complete stop percentages posted were <u>not</u> a calculation of actual field observations. Instead, the percentages posted every four days at each store were randomly chosen from percentages ranging from 78% to 90% with a mean of 83%. The percentages posted for the Assigned Group were identical to the percentages posted for the Participative Group one week earlier.

Results

Inter-Observer Reliability and Manipulation Checks

Overall reliability (or percentage agreement) was 86% for observations of complete stops, 91% for observations of safety-belt use, and 87% for turn-signal use.

There was a significant relationship between the type of intervention meeting (i.e., Participative or Assigned) and whether the meeting was described as a "Discussion" or "Lecture" in the post-meeting questionnaire completed by employees, χ^2 (1, n = 31) = 10.4, $p < .01$. Furthermore, attendees of the Participative meeting felt they "participated in the goal-setting" significantly more than did the attendees of the Assigned meeting, t (29) = 2.25, $p < .05$.

Repeated Measures Analysis

The results presented in the repeated measures analysis represents only the data observed from pizza deliverers observed at least six times in each of the Baseline, Intervention, and Withdraw phases. The data of 40 subjects met these criteria (Participative Group, n = 20; Assigned Group, n = 11; Control Group, n = 9). Data from the Follow-Up phase were not used in this data analysis due to the low total number of subjects meeting the criteria in this phase (n=29). Percentages observed during the Follow-Up phase, however, are presented in accompanying figures.

Complete intersection stops. Figure 4 depicts group means of complete intersection stops over four experimental phases. Subjects in both the Participative and the Assigned groups increased their percentage of complete intersection stops across the intervention phases, showed some maintenance during the Withdrawal phase, and returned to Baseline levels during the Follow-Up phases. The control site maintained an average of 46% complete intersection stops throughout the study.

Results of a 3 Group (Participative vs. Assigned vs. Control) x 3 Phase (Baseline vs. Intervention vs. Withdrawal) repeated measures ANOVA indicated the Group x Phase interaction was not significant, F (4, 78) = 1.90, $p > .10$. Separate ANOVAs for the two intervention groups showed significant main effects of Phase (Participative: F (2, 38) = 3.12, $p < .05$; Assigned : F (2, 20) = 3.35, $p < .05$).

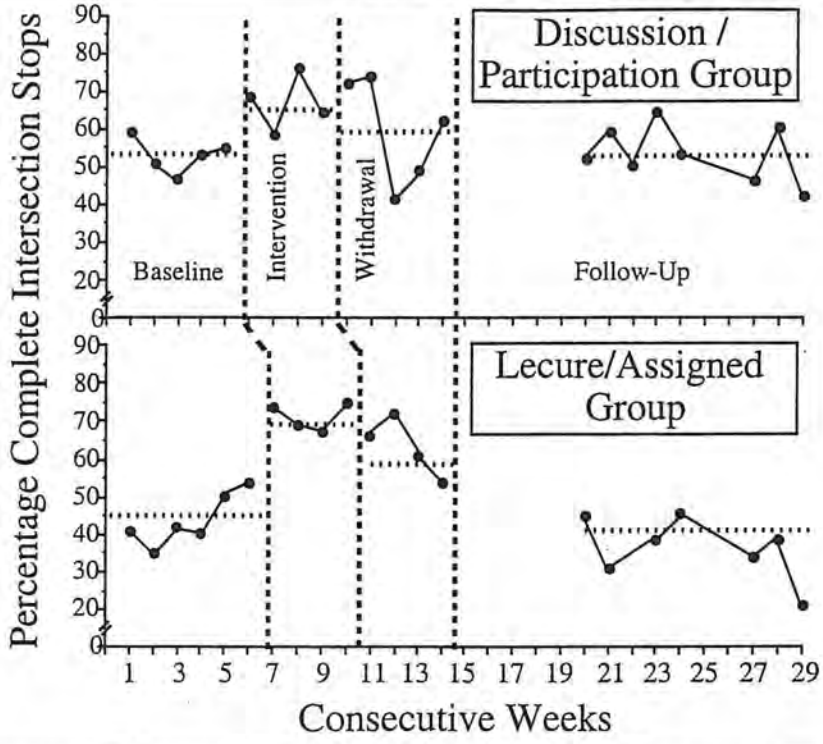


Figure 4. **Percentage of complete stops (targeted behavior) at the two intervention stores, across four experimental phases.**

Turn-signal use. Figure 5 (top panel) depicts group means of turn-signal use over four experimental phases. The Participative group showed an increase in turn-signal use between the Baseline and Intervention phases, and a continued increase during the Withdrawal phase. The Assigned group showed no prominent changes in turn-signal use across phases, although there seems to be a general decreasing trend. The control site showed no marked changes in turn-signal use across phases.

Results of a 3 Group (Participative vs. Assigned vs. Control) x 3 Phase (Baseline vs. Intervention vs. Withdrawal) repeated measures ANOVA on turn-signal use indicated a significant Group x Phase interaction, $\underline{F}$ (4, 78) = 3.38, $\underline{p} < .05$. A 2 Group (Participative vs. Assigned) x 3 Phase repeated measures ANOVA indicated a significant Group x Phase interaction, $\underline{F}$ (2, 56) = 5.69, $\underline{p} < .05$. Separate one-way repeated measures ANOVAs per intervention group indicated a significant main effect of Phase for the Participative group, $\underline{F}$ (2, 38) = 6.30, $\underline{p} < .05$, but not for the Assigned group, $\underline{F}$ (2, 18) = 1.69, $\underline{p} > .20$.

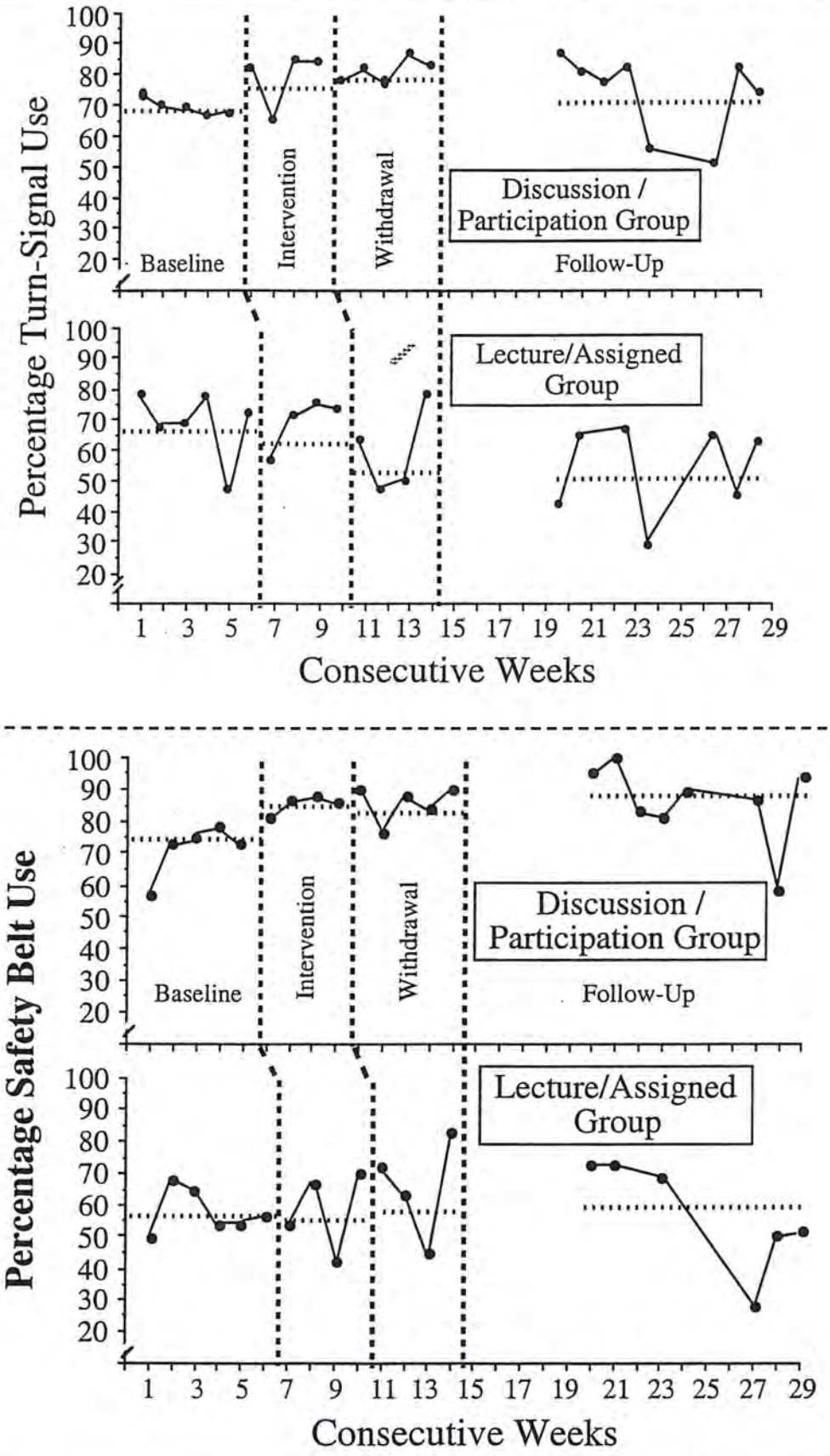


Figure 5. **Percentage of turn-signal and safety-belt use (nontargeted behaviors) at the two intervention stores, across the four experimental phases.**

Safety-belt use. Figure 5 (bottom panel) depicts group means of safety-belt use over four experimental phases. The Participative group showed an increase between Baseline and Intervention phases, and maintenance during the Withdrawal phase. The Assigned and Control groups showed no changes in safety-belt use across phases, ps > .05.

A 3 Intervention Group (Participative vs. Assigned vs. Control) x 3 Phase (Baseline vs. Intervention vs. Withdrawal) repeated measures ANOVA on safety-belt use indicated a significant Condition x Phase interaction, F (4, 68) = 2.87, $p < .05$. A 2 Group (Participative vs. Assigned) x 3 Phase repeated measures ANOVA for the two intervention groups showed a trend albeit nonsignificant interaction between Groups and Phase, F (2, 50) = 1.91, $p = .15$. One-way repeated measures ANOVAs per group showed that the Participative intervention influenced a significant change in deliverers' safety-belt use across phases, F (2, 32) = 6.10, $p < .05$, while the Assigned goal-setting intervention did not, F (2, 18) = .23, $p > .20$.

Discussion

The data analysis showed that both variations of the goal-setting and feedback intervention increased occurrences of the target behavior—safe intersection stopping. These findings are consistent with the experimental literature on the efficacy of goal-setting as a robust research finding (Locke & Latham, 1990). This study also supported the conclusions of Locke and Latham (1990) and Latham and Lee (1986), in that it provided no evidence that goals set participatively by subjects improved target performance any more than goals which were assigned.

Response Generalization

By observing two behaviors in addition to the behavior targeted by the intervention, the current study investigated generalized intervention impact across behaviors (Stokes & Baer, 1977). Response generalization was operationally defined as a change in a nontargeted behavior (i.e., turn-signal and/or safety-belt use) during an intervention that targeted another behavior (i.e., complete intersection stopping). Although they were not directly targeted, both turn-signal and safety-belt use increased concurrently with intersection stopping during the Participative

intervention. In contrast, the Assigned intervention site showed sustained decreases in these nontargeted behaviors over the same period of time.

The functional control (cf. Kazdin, 1903) of the participative goal-setting (i.e., targeting complete intersection stops) on each nontarget behavior was evident, and implies a causal relationship between the intervention and the nontargeted behaviors. According to statistical analysis, response generalization occurred only at the site which received the Participative intervention. These results suggest that a beneficial side-effect of the Participative intervention was a desirable change in related, nontargeted behaviors, whereas the Assigned intervention may have actually influenced undesired side-effects in nontargeted behaviors. This finding has provocative implications worthy of substantial follow-up research.

Participative vs. Assigned Goals Revisited

The generalization of effect in the Participative intervention supported our hypotheses. It is possible the Participative intervention facilitated the activation of implicit rules which, in turn, influenced behavior beyond the external consequences of the intervention. Streff, Kalsher, and Geller (1993) used a similar explanation to interpret their observation of an increase in a nontargeted behavior (i.e., vehicle safety-belt use) after a participatory intervention increased workers' use of safety glasses on the job.

In contrast, during the Assigned intervention, the deliverer may have been motivated to come to a complete stop by the external contingencies provided by the mandated goal, feedback, and managerial observations. The deliverers in the Assigned group may have actively sought to avoid probable undesirable consequences of disobeying their manager. However, some drivers seemingly showed reactance to the overt control by decreasing related safe-driving behaviors not directly associated with the manager's mandate. This is consistent with the theory of psychological reactance (Brehm & Brehm, 1981) and the notion of countercontrol (Skinner, 1953).

Study 4: Additive Effects of Group and Individual Feedback

(A more detailed report is currently under editorial review as included in Appendix F.)

Locke and Latham (1990) concluded in their review of the literature that pairing goal-setting with feedback results in the greatest amount of behavior change. In the safety literature we have seen numerous variations of goal-setting and feedback strategies, depending on whether these strategies targeted individuals or groups.

While group feedback has been shown to be inexpensive and effective, not all participants in such an intervention show positive changes in safety behaviors (cf. Ludwig & Geller, 1991). Indeed, the lack of change in the behaviors of some participants can be masked by the positive change in peers' behavior within group feedback. While a group shows notable changes following feedback displays, significant numbers of individuals might not be affected. The Multiple Interventions Level (MIL) model proposed by Geller *et al.* (1990; see also Geller, 1998), suggests that an intervention will be more effective if it is more intrusive (or more focused on individuals). Therefore, individual feedback is predicted to change the behavior of individuals who may otherwise "fall through the cracks" of a group feedback strategy. This hypothesis was tested in this study.

Method

Participants and Settings

Pizza deliverers at five pizza stores (two intervention sites and three control) were observed departing for and arriving from their deliveries. Three participating stores were located in a town of 35,000 in northwest North Carolina. These stores were franchises of three different national pizza companies that offer delivery. Two of these stores (Store A and Store B) served as intervention sites. The third store (Store C) served as an in-town control. Two additional stores were located in a town of 40,000 in southwest Virginia. These stores (Store D and Store E) represented the same national chains as Store A and Store B respectively, and served as same-company controls. Additionally, behavioral observations of civilians (i.e., non-pizza deliverers driving in the vicinity of the pizza stores) were conducted at all five observation sites.

Observation Procedure

Behavioral observations of safety-belt use, turn-signal use, and complete stops took place during peak business hours (i.e., dinner time, 5:00-8:00 p.m.; lunch time, 11:30-1:30p.m.; and evening, 9:00 - 11:00 p.m.). Data were collected by trained observers using a behavioral checklist. During the Feedback phase, obtrusive observations were conducted from locations in the stores. This helped to protect the anonymity of the observers collecting research data from hidden external locations. Only data collected from hidden positions outside the store were used for the data analysis. Almost 50% of the observations were recorded independently by two research assistants, thus enabling frequent assessment of interobserver reliability.

Experimental Design

The design of this study was a multiple baseline across two stores with non-intervention control stores (i.e., within-town and within-company) and civilian population controls. The time series design contained four phases in an ABCA format. Analysis of the five-week baseline data revealed turn-signal use was much lower than the other behaviors. Thus, turn-signal use was selected as the target behavior. After the baseline phase, implementation of the intervention was staggered across the two experimental stores. Obtrusive in-store observations began one week before the intervention phase to provide an ostensive source of behavioral feedback. Thus, data were collected by trained observers sitting directly inside the store near the window.

Intervention. The first phase of the intervention (Group Goal + Group Feedback) was initiated in Store A, and began one week later in Store B. The intervention began with an employee meeting attended by all deliverers. The benefits of using turn signals were discussed for 10 minutes and the group was asked to come up with a group goal for their turn-signal use to reach over the following 8 weeks. Participants were then introduced to the group feedback poster and their current group turn-signal use mean was graphed on the appropriate date. The group goal was represented by a straight line across the graph. The employees were then dismissed. Every 4 days thereafter the group turn-signal mean was calculated and posted in time series format on the store's group feedback graph.

After 4 consecutive weeks, the second phase of the intervention (i.e., Public Individual Feedback) began. During this phase, a new feedback poster was placed in the stores which still provided group turn-signal mean information along with the goal level. In addition, each deliverer's weekly turn-signal mean was posted along with his or her name concurrent to that week's group mean. Individual feedback was graphed weekly for 4 consecutive weeks. At this point, data collection ended and all store graphs were removed. After a hiatus of 5 1/2 weeks, data collection continued during an 8-week Follow-Up phase.

Results

A total of 36,599 behavioral observations were collected. An average of 94 behavioral observations per session were collected at the five observation sites. A total of 95 different pizza deliverers were observed at least six times per phase (Store A, $\underline{n} = 24$; Store B, $\underline{n} = 20$; Store C, $\underline{n} = 13$; Store D, $\underline{n} = 20$; Store E, $\underline{n} = 18$). Also, a total of 13,598 observations of civilian driving behaviors were observed across all observation sites.

Interobserver Reliability

Reliability data were collected for 225 observation sessions, representing 48% of all sessions. Overall reliability (or percentage agreement) was 87% for observations of complete stops, 95% for safety-belt use, and 90% for turn-signal use.

Turn-Signal Use

Figure 6 depicts turn-signal use at the two intervention stores across Baseline (Store A, $\underline{M} = 6.0\%$; Store B, $\underline{M} = 33.0\%$), Group Feedback (Store A, $\underline{M} = 21.0\%$; Store B, $\underline{M} = 52.7\%$), Individual Feedback (Store A, $\underline{M} = 31.5\%$; Store B, $\underline{M} = 59.1\%$), and Follow-Up (Store A, $\underline{M} = 21.4\%$; Store B, $\underline{M} = 35.7\%$) phases. Store A had an extremely low rate of turn-signal use during Baseline, and showed an increase of 250% above Baseline in the Group Feedback phase and an additional increase of 50% in the Individual Feedback phase (a 425% increase over baseline). Mean turn-signal use dropped to 256% above Baseline levels during the Follow-Up phase.

Store B showed an increase of 60% above Baseline in the Group Feedback phase and an additional increase of 12% from the Group Feedback to Individual Feedback phase (a 79% increase over baseline). Mean turn-signal use returned within 8% of Baseline during the Follow-

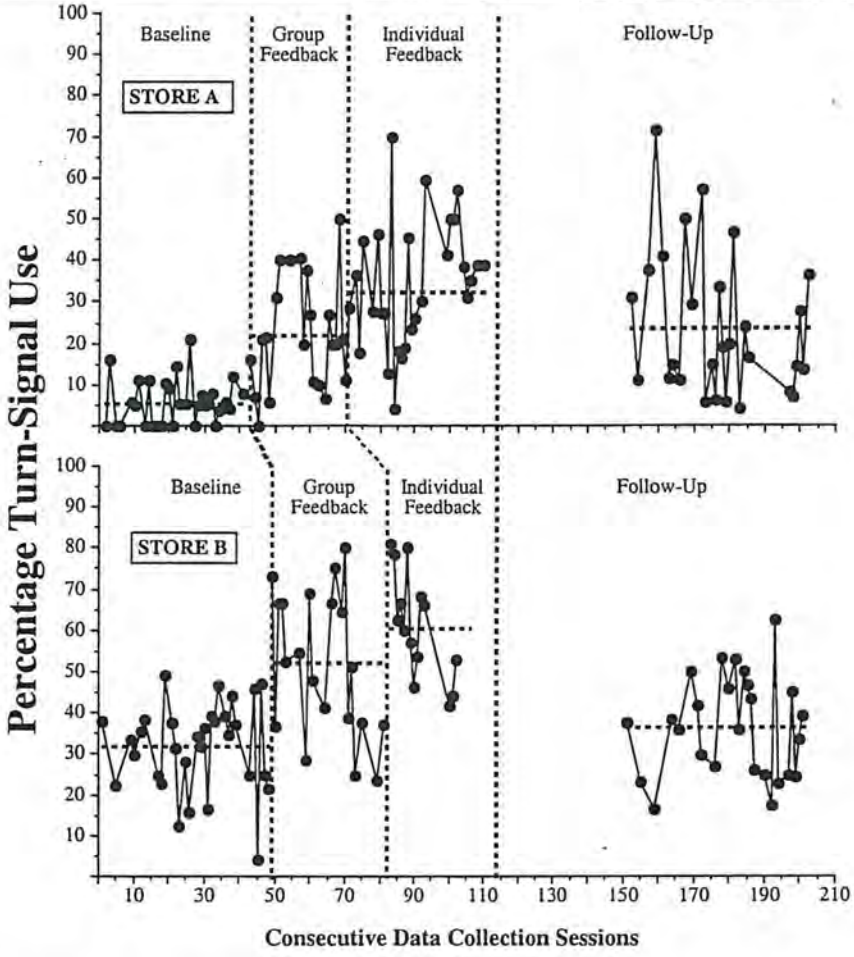


Figure 6. **Percentage of turn-signal use across stores and experimental phase.**

Up phase. Turn-signal use did not vary across the experimental phases for the same town control (M = 45.8%), same-corporation controls (M = 48.7% and M = 26.9%), and civilian sample (M = 37.9%).

Response Generalization

Overall, there were no overall differences in safety-belt use or complete intersection stops as a result of the turn-signal intervention. However, when traffic was present at the time of the turn, there was a notable increase in complete intersection stops during the intervention phases at both Stores A and B. Figure 7 depicts the percentage of complete intersection stops in the traffic and non-traffic conditions. At Store A, complete stops increased 25% from the Baseline (M = 18%) to Individual Feedback (M = 34%) phase when there was vehicle traffic. In contrast, there was no notable changes in complete stops at Store A when there was no vehicle traffic. At Store

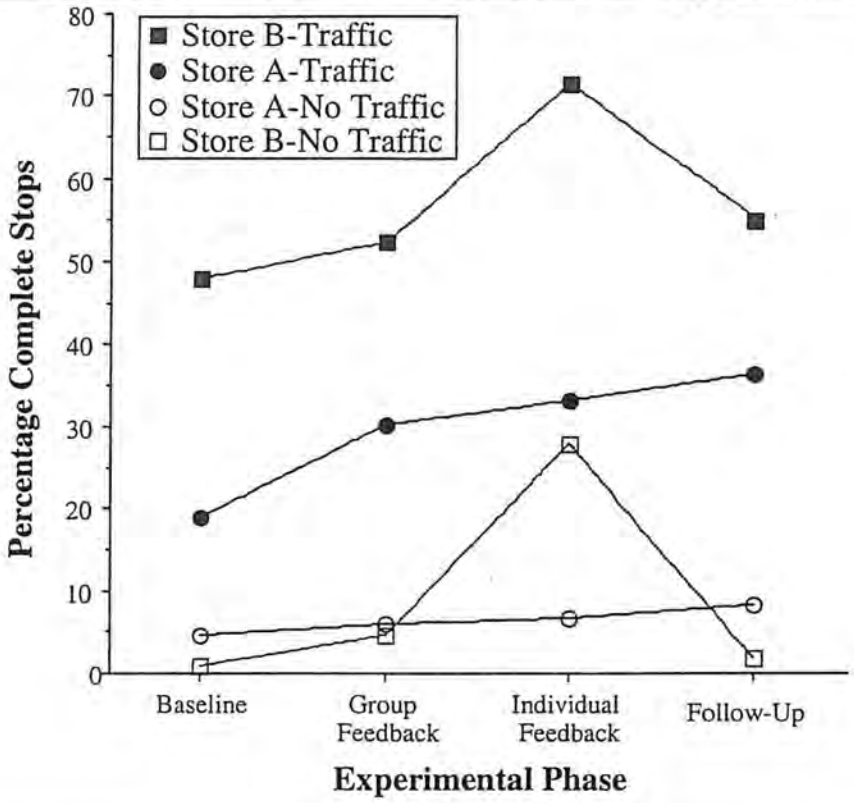


Figure 7. **Percentage of complete stops across experimental phases at the two intervention sites.**

B there were large increase in complete stops from the Baseline to Individual Feedback phases in both traffic (50% increase from Baseline, $\underline{M}$ = 48%, to Individual Feedback, $\underline{M}$ = 72%) and no-traffic conditions (1250% increase from Baseline, $\underline{M}$ = 2%, to Individual Feedback, $\underline{M}$ = 27%).

Discussion

The impact of the group goal and feedback on turn-signal use replicated the findings of Ludwig and Geller (1997) who targeted stopping behavior. Additional increases in turn-signal use occurred when public individual feedback was added to the group goal and feedback condition. Turn-signal use at Store B showed a reversal to the baseline level after the feedback graphs were removed, but there was no reversal at Store A. No systematic changes in turn-signal use occurred for the civilian, corporate, and same-town controls.

For the public individual feedback intervention, the individual deliverers' names appeared on the posted feedback graphs. Identifying each data point with a name held individuals

accountable and provided a normative reference to other deliverer's behavior, as well as the groups' behavior.

Response Generalization

This study showed some increases in complete stops (a nontargeted behavior) concurrent with increases in turn-signal use, but the amount of generalization was less that in earlier research at pizza stores (Ludwig & Geller, 1991, 1997, in press). During conditions when traffic was present, modest increases of 10 to 15 percentage points in complete stopping were observed at Store A during the intervention phases. A more dramatic increase in complete stopping occurred during the individual feedback phase at Store B during both traffic and non-traffic conditions.

It is noteworthy that the greatest response generalization occurred during the individual feedback stage when one would expect the target behavior to be more differentiated. Public individual feedback may have made the deliverer actively engage in not only the targeted behavior but also other safe driving behaviors. Ludwig and Geller (1997) argued that individuals refer to personal rules when driving a vehicle. These rules maintain a number of behaviors in a response class, which were shaped over time and are functionally related to safe driving. The public individual feedback in this intervention seemed to have activated these rules to a greater extent than did the group goal and feedback intervention, and therefore activated other similar safe-driving behaviors.

Study 5: Publicly Displayed Individual Feedback and Rewards

(A more detailed report of this study is currently under revision for journal review; a draft is included in Appendix G.)

Most incentive-based programs for safety-belt promotion have involved the direct and immediate delivery of small prizes to vehicle occupants observed using their safety belts (see review by Geller, 1984); and most of these programs targeted adults in vehicles at entrances/exits to industrial complexes (e.g., Geller, 1983; Stutts, Hunter, & Campbell, 1984), at the exchange windows of banks (Geller, Johnson, & Pelton, 1982), and at the entrances to the parking lots of

high schools (Campbell, Hunter, & Stutts, 1984), a university (Geller, Paterson, & Talbott, 1982), and a shopping mall (Elman & Killebrew, 1978). Also, Roberts and his colleagues have successfully applied immediate reward strategies to increase children's use of child safety seats and safety belts (e.g., Roberts & Fanurick, 1986; Roberts & Turner, 1986; Roberts & Layfield, 1987). Whether targeting adults or children, when reward programs were withdrawn, safety-belt use declined significantly, but usually remained prominently higher than the pre-intervention baseline levels.

This field study investigated whether an incentive program could boost the occurrence of a targeted behavior beyond its current level, as predicted by the intervention taxonomy discussed earlier (see Table 1). This model also predicts a return to baseline following a withdrawal of the incentive program, because of an absence of intrinsic motivation (Deci & Ryan, 1985, 1987).

Method

Participants and Settings

Pizza deliverers at five stores (two intervention sites and three control) were observed departing for and arriving from their deliveries. Three participating stores were located in a town in the southeastern United States with a population of 35,000. Stores A and B received the intervention. Two additional stores were located in another town in southeastern United States with a population around 40,000. Store D and Store E were franchised from the same national chains as Store A and Store B respectively, and served as same-company controls. Behavioral observations of civilians (i.e., non-pizza deliverers) were also conducted at all five observation sites.

Observation Procedure

Behavioral observations of safety-belt use, turn-signal use, and complete stops took place during peak business hours (i.e., dinner time, 5:00 - 8:00 p.m.; lunch time, 11:30 - 1:30p.m.; and evening, 9:00 - 11:00 p.m.) from hidden positions overlooking the parking area of each pizza store. To assess interobserver reliability, observations were recorded independently by two research assistants for approximately 30% of the observation sessions.

Experimental Design

This study used an ABA multiple baseline design across two stores with non-intervention control stores and civilians. Baseline observations of pizza deliverers' complete intersection stops, turn-signal use, and safety-belt use were conducted for 5 weeks. After an analysis of the baseline data, it was determined that intersection stopping was the lowest and showed the most stable baseline at Store A, and turn-signal use was the lowest and most stable at Store B. Therefore, complete stopping was selected as the target behavior at Store A, whereas turn-signal use was selected as the target behavior at Store B.

In-store observations. Because individuals would be provided feedback on a driving behavior, the source of that feedback had to be conspicuous. Therefore, in addition to ongoing external observations, data were also collected obtrusively within the intervention stores near the front store window.

Intervention. The beginning and the end of the intervention phase was staggered across the two experimental stores, initiated first at Store A and then one week later at Store B. Individual feedback was posted once a week for four weeks, and one person received a reward certificate per week at each store. The individual pizza deliverer who had the highest percentage occurrence of the targeted behavior for the week received a reward certificate worth approximately $25.

Posted next to the weekly individual feedback graph was a cumulative graph which displayed pizza deliverers' overall performance, based on occurrence percentages of the targeted behavior over the course of the four-week intervention. This graph converted pizza deliverers' weekly average target behavior into points that were added to each subsequent week. The deliverer at each store who had the most cumulative points by the end of the four-week intervention received a grand prize valued at approximately $50.

At the end of the four-week intervention all feedback graphs were removed from Store A and B, and the in-store data collection ended. The unobtrusive data collection outside the store continued during a Follow-Up phase for a period of four weeks.

Results

An average of 50.9 behavioral observations were collected per session on a total of 82 different pizza deliverers who were observed at least six times per phase (Store A, $\underline{n} = 24$; Store B, $\underline{n} = 21$; Store C, $\underline{n} = 10$; Store D, $\underline{n} = 14$; Store E, $\underline{n} = 13$). Also, a total of 3,757 observations of civilian driving behaviors were recorded across all sites. Unless otherwise noted, only data obtained from hidden positions outside the store were used for the analysis.

Interobserver Reliability

Reliability data were collected for 99 observation sessions, representing 29% of all sessions. Overall reliability (or percentage agreement) was 89% for complete stops, 96% for safety-belt use, and 88% for turn-signal use.

Behavioral Correlations

Correlations among safety-belt use, turn-signal use, and complete intersection stops were calculated for baseline observations at Stores A and B. The correlation between safety-belt use and turn-signal use was $\underline{r} = .30$, $\underline{p} < .05$, and the correlation between complete intersection stops and turn-signal use was $\underline{r} = .34$, $\underline{p} < .05$.

Turn-Signal Use

Figure 8 (left panel) depicts daily turn-signal use at Stores A and B. At Store A, where the intervention targeted turn-signal use, turn-signal use increased 61% above Baseline (35.8%) during the public feedback/reward intervention (57.6%), and returned to 48% above Baseline during the Follow-Up phase (52.8%). Turn-signal use did not vary as a function of the experimental phases at Store B (21.9%), at the same town control (45.4%), at the two same-corporation controls (29.6% and 38.2%), nor the civilian sample (34.3%).

Complete Intersections Stops

Figure 8 (right panel) depicts daily complete intersection stopping at Stores A and B. Store A where the intervention targeted complete intersection stopping, complete intersection stopping increased 117% above Baseline (14.1%) during the public feedback/reward intervention (30.6%), and returned to 48% above Baseline during the Follow-Up phase (20.9%). Complete intersection stopping did not vary as a function of the experimental phases at Store A (37.9%), at

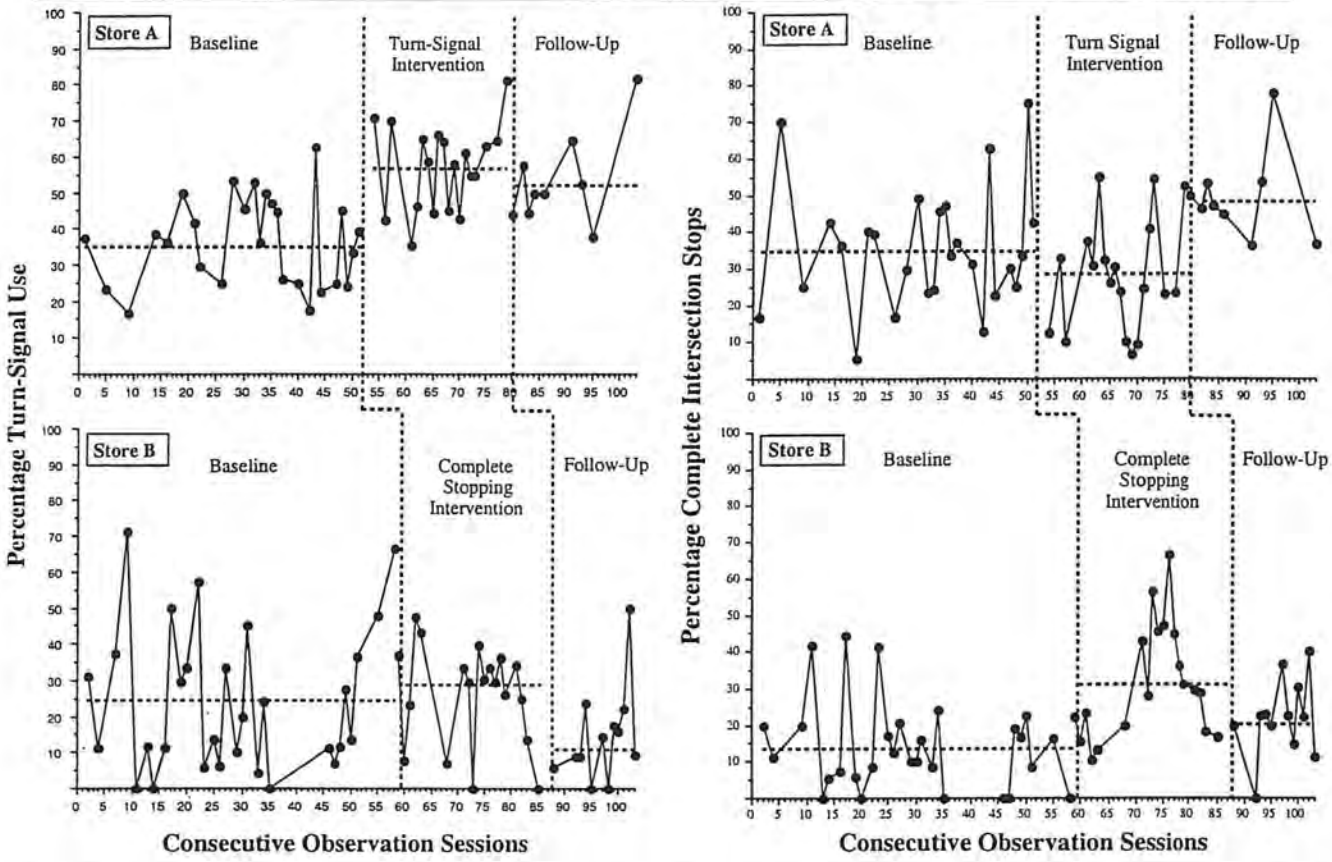


Figure 8. **Percent turn-signal use (left panel) and complete intersection stops (right panel) at the two intervention sites, across experimental phases.**

the same town control (46.8%), at the two same-corporation controls (14.2% and 13.1%), nor among the civilian sample (33.7%).

Safety-Belt Use

At Store A, safety-belt use increased 23% above Baseline (59.3%) during the public feedback/reward intervention (72.7%), and returned to 44% above Baseline during the Follow-Up phase (85.5%). Safety-belt use did not vary as a function of the experimental phases at Store B (57.8%), at the same town control (67.1%), at the two same-corporation controls (41.6% and 45.2%), nor among the civilian sample (59.8%).

In-Store Observations

At Store A (turn-signal use targeted), the mean percentage of turn-signal use was 76.5% for in-store observations during the intervention. This represents a 19 percentage point difference from the external observation mean of 58%. The mean percentage of complete intersection stops

was 41.5% for in-store observations during the intervention. This represents an 11 percentage point difference from the external observation mean of 30.6%. The mean percentage of safety-belt use was 70.6% for in-store observations during the intervention, representing a 13.5 percentage point difference from the external observation mean of 57%.

At Store B (complete intersection stops targeted), the mean percentage of turn-signal use was 34.1% for in-store observations during the intervention. This represents a 5.4 percentage point difference from the external observation mean of 28.7%. The mean percentage of complete intersection stops was 33.6% for in-store observations during the intervention. This represents a 5 percentage point difference from the external observation mean of 29%. The mean percentage of safety-belt use was 63.1% for in-store observations during the intervention. This represents a –9.6 percentage point difference from the external observation mean of 72.7%.

Discussion

An immediate increase in turn-signal use occurred from baseline to the publicly posted individual feedback and reward intervention at Store A. This increase was sustained over the course of the intervention and maintained after the intervention was withdrawn. In contrast, complete intersection stops did not increase immediately at the beginning of the public individual feedback-reward intervention at Store B. Instead, a rapid increase in complete intersection stops was not realized until after the second week of the intervention.

Turn-signal use at Store B showed a reversal to the baseline level after the feedback graphs were removed. No systematic changes in turn-signal use occurred for the civilian or same-town controls. Complete intersection stopping then spiked at 50 percentage points above baseline levels, and afterwards returned to baseline levels near the end of the intervention where it stayed during the Withdrawal phase. In contrast to Store A where the rewards were won by many different employees, all of the rewards at Store B were won by one deliverer. This may have lowered people's appreciation for the incentive program, thus accounting for the drop-off in complete intersection stopping toward the end of the phase.

Response Generalization

The only potential evidence of nontargeted behaviors increasing with the intervention was an increase in safety-belt use at Store A concurrent with and after the turn-signal intervention. However, safety-belt use did not increase concurrent with the intervention at Store B. In the experimental stores we discovered the common correlation between turn-signal and safety-belt use (Ludwig & Geller, 1991). However, complete stopping did not correlate with safety-belt use. Perhaps increases in safety-belt use were only seen at Store A because the behavior covaried with the targeted driving behavior, turn-signal use, during baseline. In contrast, no correlation existed between complete intersection stops and safety-belt use during baseline at Store B, thus safety-belt use did not increase at this site.

Observation Effect

Since the Hawthorn studies (Roethlisberger & Dickson, 1939), many have argued that the behavior changes found in intervention studies may have been due (at least partly) to individuals suspecting they were being observed. The in-store observations set up in this study to provide an ostensive origin for the posted feedback provided an opportunity to study the impact of reactivity to an obtrusive observation procedure. In every case (i.e., Stores A and B during both phases), the in-store observations showed an approximate 15% higher turn-signal use mean than the external observations conducted at the same time. Apparently, there was some minimal effect of the obtrusive observations.

Study 6: Development of a Critical Behavior Checklist for Driving

(A more detailed report of this study is under editorial review as included in Appendix H.)

As recommended by a number of reviewers of our original grant application, we extended our research beyond pizza deliverers. More specifically, we evaluated a behavior-based driving safety intervention with short-haul drivers at two local beverage distribution outlets of a major bottling company. In order to collect driving behaviors on these drivers it was necessary to ride with each driver. In preparation for these "ride-alongs," we developed an instrument for

observing driving behaviors—a critical behavior checklist for driving (CBCD). This instrument was developed with the cooperation of two local driving schools.

This study developed and evaluated a Critical Behavior Checklist for Driving (CBCD) as a means of collecting driving behaviors and providing behavioral feedback on safe driving practices. Members of the research team developed a preliminary checklist and training manual which was used to observe college students' driving behavior. After field-testing the instrument, a final version of the CBCD and training manual were created. This instrument was then used to evaluate the driving performance of novice drivers during their practice sessions with a driving instructor at local driving schools.

Method

Participants and Setting

Participants were 50 students (26 men and 24 women) taking driver education classes at two driving schools in southwest Virginia.

Experimental Design

Each student completed six one-hour driving sessions. The first three sessions served as a baseline measure of driving performance, and three sessions occurred after the implementation of the feedback and awareness interventions. Participants were assigned to one of four conditions: 1) a Control condition in which drivers were never given feedback regarding their driving behaviors, 2) a Pre-Session Global feedback condition in which drivers received a global percent safe score before each of their four intervention driving sessions, 3) a Post-Session Specific feedback group in which drivers received feedback on each of the driving measures immediately *after* each of the intervention driving sessions, and 4) a Pre-Session Specific feedback group in which drivers received specific feedback on each of the driving measures (from the prior session) immediately *before* each of the intervention driving sessions.

Procedure

Trained research assistants rode in the back seat of the driver-training car to make observations. The following driving behaviors were recorded as either "safe" or "at-risk:" 1) safety-belt use, 2) turn-signal use, 3) complete intersection stops, 4) safe lane changes, 5)

stopping at yellow and red lights, 6) obeying the posted speed limit, and 7) maintaining adequate headway with the preceding vehicle. Because only one observer was allowed to ride in the vehicle, the reliability of the checklist was evaluated independently using the same observers.

To determine the reliability of the checklist, two observers rode in the back seat of a vehicle while a third research assistant drove. Each observer independently recorded the behavior of the driver and percentage agreement was calculated. Interobserver agreement for all observers and driving behaviors was above 85%. The mean percentages of interobserver agreements were 95% for speed, 95% for lane change, 98% for following distance, 100% for turn-signal use, 93% for complete stops, and 94% for safe lane changes.

Results

Overall Driving Safety

For each session, the CBCD results were used to calculate a percent safe driving score for each target behavior per subject. An overall percent safe score was also calculated. A 2 Phase (baseline vs. intervention) x 3 Session x 4 Condition (control vs. pre-session global feedback vs. pre-session specific feedback vs. post-session specific feedback) analysis of variance (ANOVA) was performed. As depicted in Figure 9, results indicated a significant Phase x Condition interaction, $F(3, 111) = 2.90$, $p < .05$.

Planned t-tests were performed to assess changes in percent safe driving for each experimental condition. Results indicated a significant increase in safe driving behavior from baseline ($M = 84.1\%$) to intervention ($M = 91.9\%$) for the Pre-Session Specific feedback condition, $t(32) = 4.40$, $p < .05$. There were no significant changes in safe driving behaviors for the Control condition (from 84.8% to 85.9%), Pre-Session Global feedback condition (from 84.3% to 84.9%), nor for the Post-Session Specific feedback condition (from 84.5% to 86.0%), $ps > .05$.

Specific Driving Behaviors

Since only drivers in the Pre-Session Specific feedback condition demonstrated significant improvement in overall percent safe driving, an analysis of specific driving behaviors was confined to this condition. Table 2 illustrates the impact of the feedback intervention for this

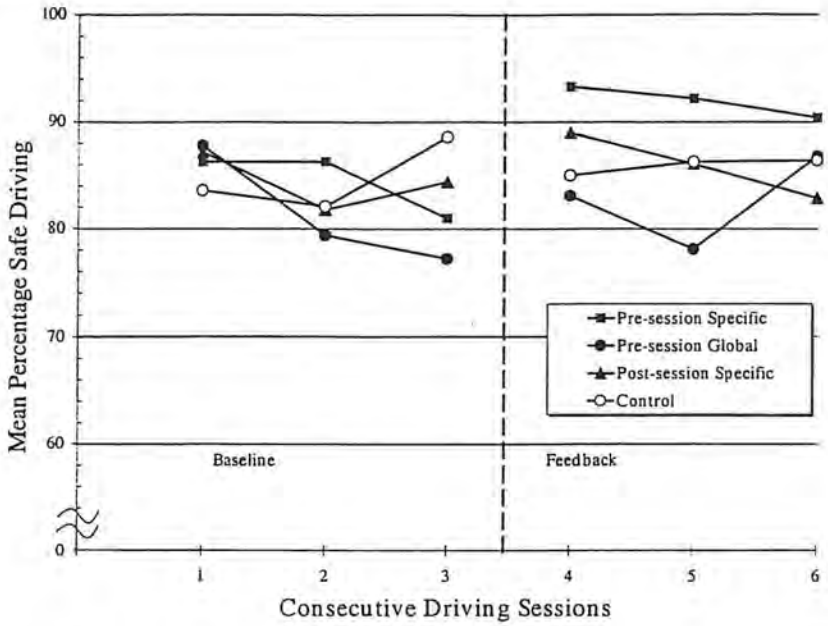


Figure 9. **Percent safe driving per consecutive training sessions for the four experimental conditions**

group for each of the six target behaviors. Results of follow-up t-tests indicated significant improvements in safe lane changes, $t(17) = 2.60$, $p < .05$, and traffic-light behaviors, $t(16) = 2.25$ $p < .05$.

Discussion

The CBCD allowed observers to record driving behaviors systematically, and provide reliable and objective behavior-based feedback to student drivers. Thus, the CBCD can be used provide objective evidence of a student's progress, perhaps showing what behaviors to pinpoint for special instruction. And when this feedback information was given prior to a driving session, it offered specific direction the students could use to improve.

	BASELINE		INTERVENTION	
BEHAVIOR	Percent Safe	N	Percent Safe	N
Lane Change*	56.9	95	84.3	89
Traffic Light*	81.5	95	97.1	79
Speeding	91.4	329	95.3	424
Stop Sign	74.6	149	81.7	155
Following	89.3	166	96.6	177
Turn Signal	91	260	93.2	319

* $p < .05$

Table 2. **Change in Safety of Each Target Behavior as a Function of Pre-Driving Specific Feedback.**

Study 7: Effects of Safety Self-Management on Driving Practices

(A more detailed report of this study can be found in Appendix I)

While a variety of procedures have been developed to improve safety performance (i.e., reward systems, goal-setting, and behavioral feedback), most rely on the interpersonal observation of behavior by supervisors or coworkers. While these techniques have been effective in increasing the occurrence of safety-related behaviors, effective behavior-change techniques are needed for solitary workers and for infrequent safety-related behaviors (such as lockout-tagout) which are not likely to be observed in a typical interpersonal coaching session.

Self-management techniques have been shown to be effective at identifying and changing behavior within clinical psychology (see also Geller & Clarke, in press which can be found in Appendix J). To date there has been little research on the use of self-management to improve individual behaviors in work settings, and more specifically, the safety of driving. The aim of the current study was to determine the viability of self- management technology for increasing the safe driving behaviors of short-haul truck drivers.

Method

A subsample of 12 male drivers from Site A (self-management) and 11 male drivers from Site B (control) were randomly selected to evaluate a safety self-management intervention. During the week prior to implementing the self-management intervention, trained research assistants observed the driving behaviors of participants while riding in the passenger seat of a participant's delivery truck. All employees at Site A (n = 30) were then asked to complete a self-management checklist each day for a two-week period (see back of Appendix H for a copy of this checklist).

While on their sales routes, participants recorded the following behaviors after arriving at each of their accounts: a) use of running/head lights, b) safety-belt use, and c) walking around the vehicle before leaving account. At the end of the day, participants estimated their percent safe on the following behaviors: a) following distance, b) lane change, c) traffic lights, d) complete stops at stop signs, and e) vehicle speed.

Self-monitoring forms were collected and results graphed on a daily basis. These graphs were posted in a break room where employees gathered before and after their routes each day. Self-monitoring occurred on ten consecutive work days. During the week following the intervention, research assistants again observed the driving behaviors of the deliverers during a ride-along. Since only one observer was permitted to ride with each participant, reliability (interobserver agreement) of the driving measures was assessed in an alternative setting using the same observers. (Pairs of independent observers recorded the driving behaviors of a random sample of five drivers while riding in the back seat of the vehicle. Results indicated that all reliabilities for each observer were above 85% agreement.)

Results

A percent safe score was calculated for each participant's driving behavior by dividing the number of safe occurrences of a given behavior by the number of safe and at-risk occurrences. A total percent safe score was calculated based on the total number of safe behaviors (collapsed across all driving behaviors). A 2 Phase (pre- vs. post-intervention) x 2 Group (self-observation vs. control) mixed model ANOVA was calculated for following

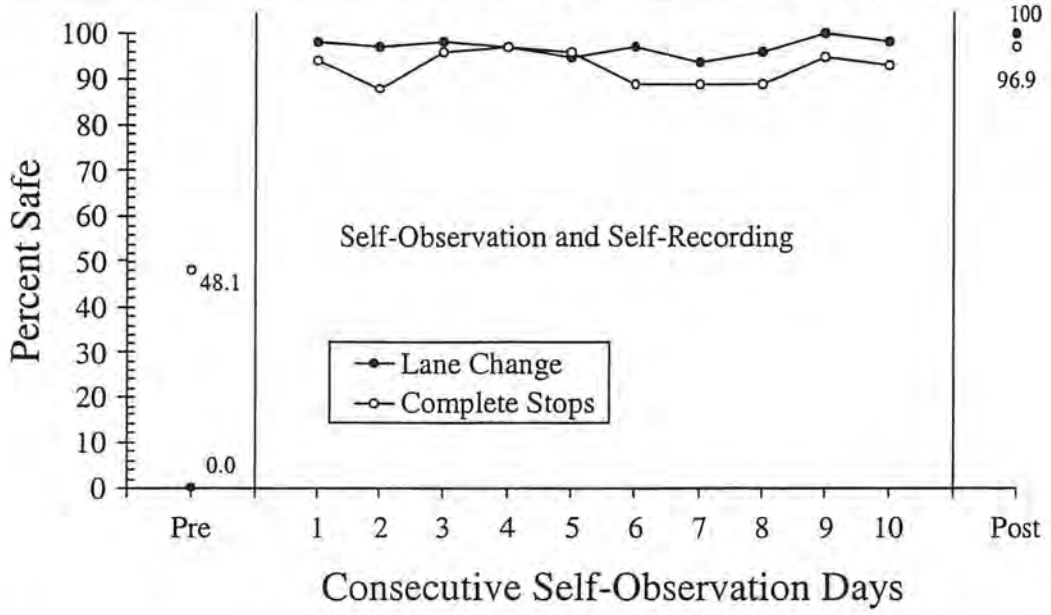


Figure 10. **Percent safe before (Pre) and after (Post) the self-management intervention and as reported by the drivers on self-monitoring forms (1 - 10).**

distance, lane change, traffic lights, complete stops, and vehicle speed. Results indicated a significant Phase x Group interaction for overall percent safe, $p < .05$. Follow-up analyses indicated that overall safety did not improve in the control group (from 71.5% to 75.4%), $p > .05$. In contrast there was a significant increase in the overall safety of the self-management group (from 66.8% to 87.8% safe), $p < .05$.

Based on the overall analysis, each driving behavior was examined separately. The sample sizes varied for each analysis because sometimes there was no opportunity to observe certain behaviors for some drivers on either the first or second ride-along. Thus, n-sizes are reported for each analysis. As depicted in Figure 10, results indicated a significant Phase x Group interaction for lane changes and following distance, $ps < .01$. Follow-up analysis indicated that safe lane changes and following distances *did not* improve in the control group (from 94.3% to 81.9% for lane changes, $n = 5$; from 64.4% to 75.0% for following distance, $n = 5$), $ps > .05$. In contrast, a significant increase was found for both lane changes (from 0.0% to 100.0%, $n = 5$) and following distance (from 48.1 to 96.9%, $n = 7$) in the Self-Management group, $ps < .05$. No other effects were significant for the remaining driving behaviors, but all means were in the expected direction.

Discussion

Overall, these results suggest that self-management may be an effective technique for improving driving safety. While these findings are encouraging, further research is obviously needed in the domain of safety self-management. For example, in the current study, self-monitoring occurred on ten consecutive work days over a two-week period. While effective, daily self-monitoring may not be practical as an everyday activity in many work settings.

The behavior change taxonomy in Table 1 predicts that self-management may be one of the most effective behavior change techniques in situations where social support is not available. In fact, it is the only technique that can be used by solitary workers whose behaviors cannot be monitored nor supported by supervisors and coworkers. Self-management is non-invasive, simple, and effective. If self-management activities can be integrated with other job activities, safety practitioners will have an effective tool for improving safety-related behaviors in situations where there is little or no opportunity for interpersonal observation and feedback. In addition, the successful integration of self-management techniques into daily work routines is useful for the maintenance of safe work practices.

SUMMARY AND CONCLUSIONS

Overall, the result of these studies indicate that a wide variety of behavior-based safety interventions can be used to decrease at-risk driving in organizational settings. With the exception of the policy intervention targeting turn-signal use, all of the interventions investigated showed significant improvement in the various driving behaviors targeted, including safety-belt use, turn-signal use, and complete stops. Table 3 presents a summary of our research findings.

Multiple Intervention Level Model

According to the Multiple Intervention Level (MIL) model (Geller, 1998a; Geller *et al.*, 1990; Ludwig & Geller, 1991), when an intervention becomes more individual-focused in its operation, the likelihood of behavior change increases. This was demonstrated in the current set of studies. All licensed drivers are presumed to have taken a driver training course where turn-signal use was emphasized. Also, most states, including the two in which this study took place,

have a law requiring safety-belt use, turn-signal use, and complete stops at intersections controlled by a stop sign. These legislative interventions, while applying to most of the population, are not very intrusive at the individual level. Thus, further "higher-level" intervention is necessary to increase compliance.

Study 4 (group goal-setting/feedback, followed by public individual feedback) clearly demonstrates that increasing the individual focus (or accountability) of an intervention can result in greater behavior change. While the group goal-setting/feedback intervention resulted in substantial increases in turn-signal use, the addition of publicly posted individual feedback resulted in further increases in turn-signal use. In addition, the more intrusive intervention resulted in greater response generalization than group feedback/goal-setting alone.

Response Generalization

Response generalization was demonstrated in most of the studies, with as much as 53% increases over baseline for nontargeted behaviors. In general, studies which relied on extrinsic control without soliciting involvement (i.e., policy and assigned goal-setting) showed either no change or decreases in the safety of nontargeted behaviors, suggesting that drivers showed reactance against the overt controlling operations. It is also notable that those interventions with a larger degree of intrinsic control (as in participative goal-setting) and social support showed the greatest amount of long-term maintenance of behavior change in targeted behaviors and the most generalization to nontargeted behaviors.

Response generalization seems to be a special benefit of programs that facilitated employee participation (or empowerment) in the design, development, and implementation of the intervention. For example, employees who a) implemented the community safety-belt program (Study 2 in Table 3), b) participated in goal-setting to increase complete stops (Study 3a), and c) received individual feedback with rewards to increase complete stops or turn-signal use (Study 5), also increased the safety of nontargeted behavior. In contrast, employees who experienced the policy intervention (Study 1) and assigned goal-setting (Study 3b) actually decreased their safe performance of the nontargeted driving behavior.

The community program directly prompted and reinforced safety-belt use among the pizza deliverers. And response generalization was found because turn-signal use also increased. In addition, the program promoted deliverers' active participation in helping others drive more safely. It is possible some deliverers internalized their role of "change agent" for community safety, as delivers at the pizza store showed substantial and long-term positive changes in their own driving behavior. Thus, when employees got involved in the development and implementation of a community safety program, they increased their safe performance of other driving behaviors.

The studies of participatory goal-settings (Study 3a) and individual feedback/rewards (Study 5) further demonstrate the need to involve employees in the safety process. Participation in the selection of the target behavior (complete stops) and in setting a group goal in Study 3a resulted in significant increases in both safety-belt and turn-signal use. In contrast, assignment of the target behavior and group goal, while producing equivalent increases in the target behavior, had no effect on nontargeted behaviors.

While the policy intervention was effective at increasing and maintaining significant increases in turn-signal use, a negative side-effect of this intervention was a concomitant decrease in safety-belt use. In addition, assigned goal-setting was successful at increasing and maintaining complete stops, but failed to influence response generalization. Thus, "top-down" safety interventions (such as disincentive programs and assigned goal-setting) may have a detrimental effect on nontargeted safety behaviors. As a result, behavior-based safety initiatives which do not involve employees in the design and/or implementation of the program may not influence an overall reduction in vehicle crashes and resulting injuries.

Despite the urging of some researchers to take a greater ecological perspective in applied research, response generalization has seldom been studied in applied psychology research. Perspectives on social validity have called for an evaluation of "unpredicted side-effects" (Schwartz & Baer, 1991) or the undesired behaviors which occur concurrent with an intervention program (Geller, 1987; 1991). The issue of response generalization has important ramifications for external validity. Too often applied researchers only measure a specific target behavior and

thereby fail to investigate the rich information available from a more ecological approach. Behavioral ecology (Rogers-Warren & Warren, 1977) directs the researcher to ask specific questions about the target behavior, related behaviors, and setting events which could naturally support the target behavior. In fact, Wahler and Fox (1981a, b) asserted that prolonged naturalistic observation of behavior and setting events is a must for applied research.

Conclusion

The results of these studies contribute to the behavior-based safety literature by: a) introducing new field methodologies which can be used to study the direct and indirect effects of behavior-based safety interventions, and b) demonstrating that investigating response generalization can lead to important insights on the ecological validity of behavior-based safety. The research exemplified the need to venture beyond demonstration projects which are short-term and focus on a single behavioral outcome.

Our findings indicate that empowerment is an important component in the maintenance of long-term behavior change and can facilitate positive changes in safety behaviors not directly targeted by an intervention. This issue is of particular importance for injury prevention because interventions that target a single behavior, but have indirect beneficial effects on other desired behaviors, will be particularly cost-effective at reducing unintentional injury.

While we have made significnat gains in knowledge concerning the development of effective driving safety programs, there are a number of areas that deserve further attention. First, our understanding of the mechanism of response generalization is still in its beginning phases. While current research indicates that increasing employee involvement is one of the primary ingredients for response generalization, further research is needed to determine how other factors might impact response generalization. Secondly, although most of the safety interventions we tested had a positive impact on driving safety, the institutionalization of safe driving interventions is still a significant challenge. For example, our research indicates that observation and feedback are key factors in behavior change, and the interventions studied involved the joint efforts of our research staff and persons indigenous to the organization. In order for behavior-based safe driving interventions to be successfully implemented and maintained, however, we

must find ways for companies to institutionalize cost-effective observation and feedback systems. Our review of the research indicates that the self-management of driving behaviors is a promising technique for institutionalizing observation and feedback inherent to a work system. In fact, safety self-management is probably necessary for workers who operate trucks and other vehicles alone as a significant aspect of their job duties.

Self-management (Mahoney, 1971, 1972) is an improvement process whereby individuals change their own behavior in a goal-directed fashion by: 1) manipulating behavioral antecedents, 2) observing and recording specific target behaviors, and 3) self-administrating rewards for personal achievements (Kazdin, 1993; Watson & Tharp, 1997). The practical benefits of self-management processes have been demonstrated in numerous clinical settings, including the reduction of alcohol consumption (Garvin *et al.*, 1992; Sitharthan, Kavanagh, & Sayer, 1996; Sobell & Sobell, 1995), weight control (Baker & Kirschenbaum, 1993), and smoking cessation (Curry, 1993; Shiffman, 1984). Unfortunately, the potential benefits of using self-management techniques to improve work safety have not been evaluated. In fact, our review of the research literature indicated no published studies which investigated the efficacy of using self-management to improve safe work behaviors, including driving behaviors. This is the theme of our proposed programatic continuation of the research reported here.

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Research, National Highway Traffic Safety Administration, U.S. Department of Transportation.

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service
Centers for Disease Control
and Prevention (CDC)

Memorandum

Date: March 3, 2003

From: Michael J. Galvin, Ph.D., Program Official
Office of Extramural Programs, NIOSH, E-74

Subject: Final Report Submitted for Entry into NTIS for Grant 5 R01 OH003397-02.

To: William D. Bennett
Data Systems Team, Information Resources Branch, EID, NIOSH, P03/C18

The attached final report has been received from the principal investigator on the subject NIOSH grant. If this document is forwarded to the National Technical Information Service, please let us know when a document number is known so that we can inform anyone who inquires about this final report.

Any publications that are included with this report are highlighted on the list below.

Attachment
cc: Sherri Diana, EID, P03/C13

List of Publications

Ludwig TD, Geller ES: Behavioral Impact of a Corporate Driving Policy: Undersirable Side-Effects Reflect Countercontrol. Journal of Organizational Behavior Mgmt, Vol. 19(2), 1999

Ludwig TD, Geller ES: Behavior Change Among Agents of a Community Safety Program: Pizza Deliverers Advocate Community Safety Belt Use. Journal of Organizational Behavior Mgmt, Vol. 19(2), 1999

Title:	Industry-Based Intervention to Increase Safety Driving
Investigator:	E. Scott Geller, Ph.D.
Affiliation:	Virgiinia Polytechnic Institute & State University
City & State:	Blacksburg, VA
Telephone:	(540) 231-6223
Award Number:	5 R01 OH003397-02
Start & End Date:	start–5/31/1998
Total Project Cost:	$349,293
Program Area:	NORA
Key Words:	

Final Report Abstract:
The primary aim of this two-year project was to assess the relative effectiveness of specific behavior-focused interventions designed to increase safe driving. The following safe driving interventions were evaluated: a) a policy statement mandating turn-signal use, b) a community-based program that involved pizza delivery employees as intervention agents promoting safety-belt use among their customers, c) a comparison of participatory vs. assigned goal-setting, d) the addition of individual feedback to a group goal-setting and feedback intervention, e) the addition of extrinsic rewards to an individual feedback intervention, and f) a safety self-management program for short-haul truckers.

All studies included control sites and used multiple baseline designs, staggering the introduction of interventions at different sites to show functional control of the target behavior. Overall, the result of these studies indicate that a wide variety of behavior-based safety interventions can be used to decrease at-risk driving in organizational settings. With the exception of the policy intervention targeting turn-signal use, all of the interventions investigated showed significant improvement in the various driving behaviors targeted, including safety-belt use, turn-signal use, and complete stops.

The research supported various predictions made from: a) the Multiple Intervention Level (MIL) model (Geller, 1998a; Geller et al., 1990), and b) response generalization (Bandura, 1969; Carr, 1988). With regard to the MIL model, research findings indicate that as an intervention becomes more individual focused in its operation, the likelihood of behavior change increases. For example, while a group goal-setting/feedback intervention resulted in substantial increases in turn-signal use, the addition of publicly posted individual feedback resulted in further increases in turn-signal use. In addition, the more intrusive interventions resulted in greater amounts of response generalization, or improvement in non-targeted safe driving behaviors.

Response generalization was demonstrated in most of the studies, with as much as 53% increases over baseline for non-targeted behaviors. In general, studies which relied on extrinsic control without soliciting involvement (i.e., policy and assigned goal-setting) showed either no change or decreases in non-targeted safe driving behaviors, suggesting reactance against the over controlling operations. It is also notable that those interventions with a large amount of intrinsic control (as in participative goal-setting) and

social support showed the greatest amount of long- term maintenance of behavior change in targeted behaviors and the most generalization to non-targeted behaviors.

Response generalization seems to be a special benefit of programs that facilitated employee participation (or empowerment) in the design, development, and implementation of the intervention. Thus, while "top-down" safety interventions (such as disincentive programs and assigned goal-setting) may improve the targeted behaviors, they can have a detrimental effect on non-targeted safety-related behaviors. As a result, behavior-based safety programs which do not involve employees in the design and/or implementation of the program may not result in an overall reduction in vehicle crashes and resulting injuries.

Publications

Ludwig TD, Geller ES: Behavior Change Among Agents of a Community Safety Program: Pizza Deliverers Advocate Community Safety Belt Use. Journal of Organizational Behavior Mgmt, Vol. 19(2), 1999

Ludwig TD, Geller ES: Behavioral Impact of a Corporate Driving Policy: Undersirable Side-Effects Reflect Countercontrol. Journal of Organizational Behavior Mgmt, Vol. 19(2), 1999