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ACTIVE PROMPTING TO DECREASE CELL PHONE USE AND INCREASE SEAT BELT USE WHILE DRIVING

MICHAEL CLAYTON AND BRIDGETT HELMS

JACKSONVILLE STATE UNIVERSITY

AND

CATHY SIMPSON

HEALTH SERVICES CENTER, INC., BIRMINGHAM

Automobile crashes are the leading cause of death for those aged 3 to 33, with 43,005 (118 per day) Americans killed in 2002 alone. Seat belt use reduces the risk of serious injury in an accident, and refraining from using a cell phone while driving reduces the risk of an accident. Cell phone use while driving increases accident rates, and leads to 2,600 U.S. fatalities each year. An active prompting procedure was employed to increase seat belt use and decrease cell phone use among drivers exiting a university parking lot. A multiple baseline with reversal design was used to evaluate the presentation of two signs: ''Please Hang Up, I Care'' and ''Please Buckle Up, I Care.'' The proportion of drivers who complied with the seat belt prompt was high and in line with previous research. The proportion of drivers who hung up their cell phones in response to the prompt was about equal to that of the seat belt prompt. A procedure that reduces cell phone use among automobile drivers is a significant contribution to the behavioral safety literature.

DESCRIPTORS: active prompting, behavioral safety, cell phones, seat belts, flash for life

In the U.S., vehicle crashes are the leading cause of death for those aged 3 to 33 years, with 43,005 (118 per day) Americans killed in 2002 (the most recent year for which data are available; National Highway Traffic Safety Administration). Worldwide, vehicle accidents result in 1.2 million deaths per year, behind only childhood infections and AIDS as a cause of death among people aged 5 to 30 years (Krug, 2003). The use of safety belts by drivers and front-seat passengers reduces fatalities by 45% for those in cars and by 60% for those in light trucks (Kahane, 2000). Simply being in a moving automobile is a dangerous proposition, but there are many things that drivers do (or do not do) that increase the risk of injury or death. The use of seat belts can significantly reduce the risk of automobile injuries and fatalities.

Prompted by the injury-reduction and life-saving effects of seat belt use, legislators mandated the inclusion of seat belts in all U.S. automobiles sold since 1968 (Stowell & Bryant, 1978). The challenge for public health officials has been getting Americans to use the seat belts that are now available in virtually every vehicle on the road (Geller, Casali, & Johnson, 1980). This problem is compounded by selective recruitment, such that the riskiest drivers are also those least likely to wear seat belts (Evans, 1996; Van Houten & Malenfant, 1988). Most automobile industry attempts to prompt seat belt use have relied on negative reinforcement. For example, lights, bells, and buzzers sound until the seat belt is fastened. Research has shown that many drivers simply disable the systems (Geller et al., 1980), but these negative reinforcement approaches have remained in use by the automobile industry. Punitive measures, such as fines, are in effect in every state.

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Address correspondence to Michael Clayton, who is now at Youngstown State University, One University Plaza, Youngstown, Ohio 44555 (e-mail: mcclayton@ysu.edu).

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Geller et al. (1980) first identified seat belt use as an important dependent variable in applied behavior analysis. They found that 62% of available seat belt interlocks or unlimited buzzer systems had been disabled, but that all drivers with working systems wore seat belts. Geller et al. recommended avoiding the pitfalls of punishment and negative reinforcement by instead focusing on positively reinforcing seat belt use.

Consistent with this suggestion, seat belt use has been addressed with informational campaigns that manipulate antecedent variables by providing performance feedback and often include some type of active enforcement (Hagenzieker, 1991; Williams, Wells, McCartt, & Preusser, 2000). For example, Wells, Malenfant, Williams, and Van Houten (2000) posted feedback signs at mall and shopping center exits displaying rates pf seat belt use by patrons, distributed posters and flyers providing information about the benefits of the ''click it or ticket'' program, and urged patrons to use their seat belts. This procedure resulted in a 10% increase in seat belt use among drivers and passengers (see also Malenfant, Wells, Van Houten, & Williams, 1996; Pastò & Baker, 2001). Several researchers also have introduced ''promise'' cards in which drivers agree to wear belts in the future (Clark et al., 1999; Geller & Lehman, 1991; Ludwig & Geller, 1991). Such feedback procedures have increased seat belt use by 2% to 20%.

A more effective procedure for increasing seat belt use has focused on both active and passive prompting of drivers' behavior (Geller, Bruff, & Nimmer, 1985). Passive prompts are posted on an inanimate object and remain there for the duration, whereas active prompts include human facilitation of the prompt. In general, prompting procedures typically suggest that the driver ''buckle up'' and have increased seat belt use from 12% to 35%. Geller et al. used a front-seat passenger presenting a textual prompt to occupants of adjacent vehicles while both were stopped at traffic lights. The sign read ''Please Buckle Up—I Care'' and was flipped over to present ''Thank You'' when drivers complied. Thyer, Geller, Williams, and Purcell (1987) used the same prompt, but included students standing outside a university parking lot to prompt drivers. Active prompts also have been used to increase compliance with stop signs (Austin, Hackett, Gravina, & Lebbon, 2006; Van Houten & Retting, 2001).

Subsequent research removed the human component and simply placed stationary signs outside parking lots (Berry, Geller, Calef, & Calef, 1992) or provided a stationary textual prompt (''Buckle Up, Avoid Hospitals'') in a retirement community (Cox, Cox, & Cox, 2000). Others have removed the textual prompt altogether and provided a vocal prompt delivered by grocery clerks (''Have a nice day, and remember to wear your safety belt for a safe ride home'') to increase seat belt use (Austin, Alvero, & Olson, 1998; Engerman, Austin, & Bailey, 1997).

Cell phone use is a comparatively recent phenomenon that also affects automobile safety. At present, about 50% of Americans use a cell phone, and about 85% of those use one while driving (Insurance Information Institute, 2004). In addition to taking their eyes of the road while dialing, drivers can become so engrossed in conversation that their ability to concentrate on driving is severely impaired. Currently, about 6% of automobile accidents are caused by cell phone use (Lissy, Cohen, Park, & Graham, 2000).

Automobile safety data on cell phone use is limited but suggests an overlooked problem. A driver's use of a cell phone up to 10 min before a crash is associated with a fourfold increased likelihood of crashing, and risk is raised irrespective of whether a hands-free device is used (McEvoy et al., 2005). Impairment has been found to be at about the same level as someone driving with a 0.08 blood alcohol level (Redelmeier & Tibshirani, 1997). Compared to

drivers who do not use cell phones, drivers talking on cell phones miss twice as many traffic signals, are more likely to swerve into the next lane (46%), tailgate (23%), have close calls (18%), and run red lights (10%) (Wilson, Fang, & Wiggins, 2003). The use of a hands-free phone results in an equal level of distraction, but the radio, passenger conversation, and books on tape do not interfere with driving to the same extent (Strayer, Drews, & Johnston, 2003; Strayer & Johnston, 2001).

Punitive consequences have been put in place in many countries. Drivers caught using a cell phone in England, Wales, or Scotland are fined £30, and drivers in New York, New Jersey, and Washington D.C. are being fined as well (although hands-free phones remain legal). In 2005, Colorado, Delaware, Maryland, and Tennessee banned cell phone use by young drivers (Copeland, 2005). Resistance from the cell phone industry and the difficulty of banning all driver distractions (eating, applying make-up, reading, etc.) make further punitive measures less desirable.

The current study attempted to increase seat belt use and decrease cell phone use while driving. The method was modeled after Thyer, Geller, Williams, and Purcell's (1987) intervention to increase seat belt use by drivers exiting a university parking lot. Our literature review found no attempts to alter cell phone use in automobiles, but it seemed feasible to decrease cell phone use while driving by using a procedure that has increased seat belt use in previous studies.

METHOD

Setting and Participants

The current study was conducted at a four-way intersection at a medium-sized state university located in the southeastern United States. The focus of the intervention was on a two-lane road exiting a large parking lot used by faculty, staff, and students (Figure 1). Approximately 110 vehicles, on average, exited the parking lot per hour during data-collection sessions over the course of the study. One student delivered the treatments, and two students collected independent observations of the target behaviors during all sessions. Students stood on the passenger side (as indicated in Figure 1 by the figure holding a clipboard). During the second season of the study, two additional observers were stationed about one block away (secondary setting) from the primary setting, so that they could observe the subsequent behaviors of left-turners from the primary location.

Materials

The materials used in this study included a data-collection sheet (available from the first author), two walkie-talkies, and a two-sided poster that served as both a prompt and a potential conditioned reinforcer. The poster was white posterboard (51 cm by 61 cm) with black lettering about 7.6 cm in height. During the first intervention (prompting sign for cell phone use), one side of the poster read "Please Hang Up—I Care" and the other side read "Thank You." During the second intervention (prompting sign for seat belt use), the poster read "Please Buckle Up—I Care" and "Thank You."

Procedure

The two treatments were delivered using a multiple baseline across behaviors (with reversal) design. The entire study took place over 2 years, with the interventions occurring each spring and lasting for 6 to 7 weeks.

Observer pairs in the primary setting recorded seat belt and cell phone use of drivers exiting the parking lot. If the driver had a cell phone in either hand, that qualified as engaging in the target behavior. Observers also recorded whether the driver buckled up or hung up in response to the prompt (defined as completing the behavior any time between when the driver approached the observers and passed through the intersection). The sessions were conducted

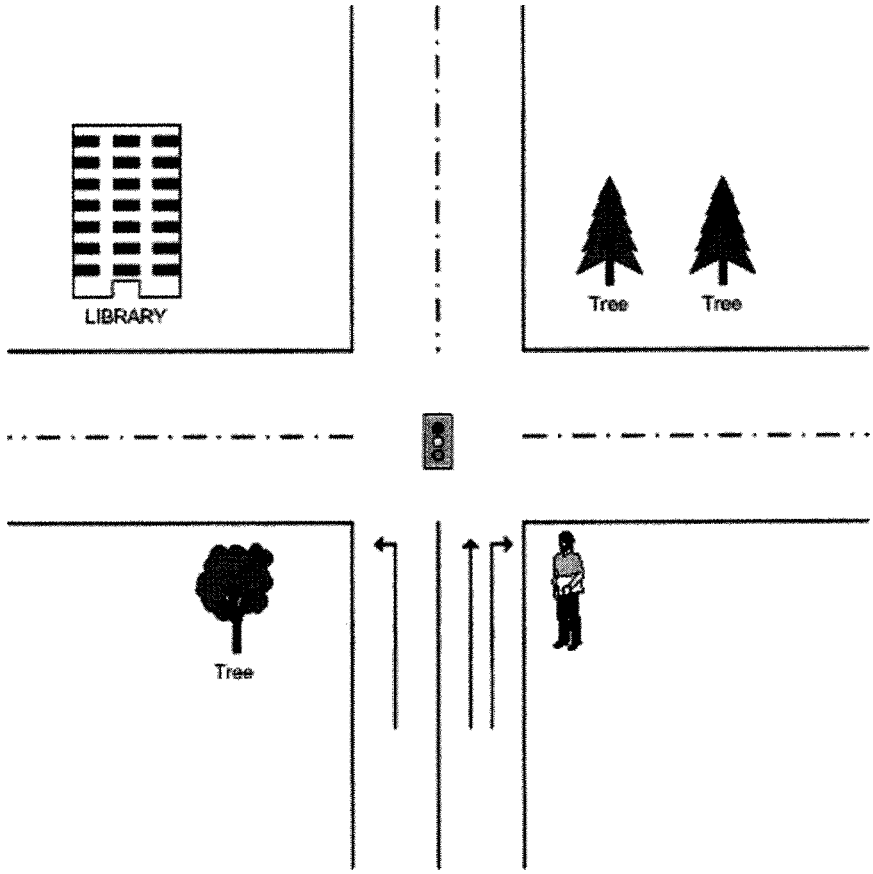

Figure 1. The intersection where the study was conducted.

every weekday from 11:00 a.m. until 12:00 p.m. Interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. Interobserver agreement was assessed on 100% of sessions and was consistently over 95%.

During the interventions, a student displayed the poster to drivers exiting the parking lot. The prompt was held at chest height (120 cm to 155 cm above the ground) for the duration of the driver's presence. The distance between the prompting sign and the automobile ranged from 1 to 3 m, depending on which lane the vehicle was in. All drivers were prompted with the "Please …" side, and drivers who complied were then shown the "Thank You" side of the poster for approximately 10 s.

During the second season of the study, observers in a secondary location observed specific vehicles as instructed by the observers in the first setting. Their task was to observe whether the driver in a targeted vehicle was wearing a seat belt or using a cell phone. Communication was accomplished using a pair of walkie-talkies. These observers sat on a wall (1.3 m high) 3 m from the roadway facing each other to give the appearance of engaging in conversation. Interobserver agreement also was assessed on 100% of these sessions and was consistently over 95%.

When a driver was observed buckling up or hanging up in response to the prompt in the first setting, the observers waited until the car turned left and then communicated the color and type of vehicle to the observers in the

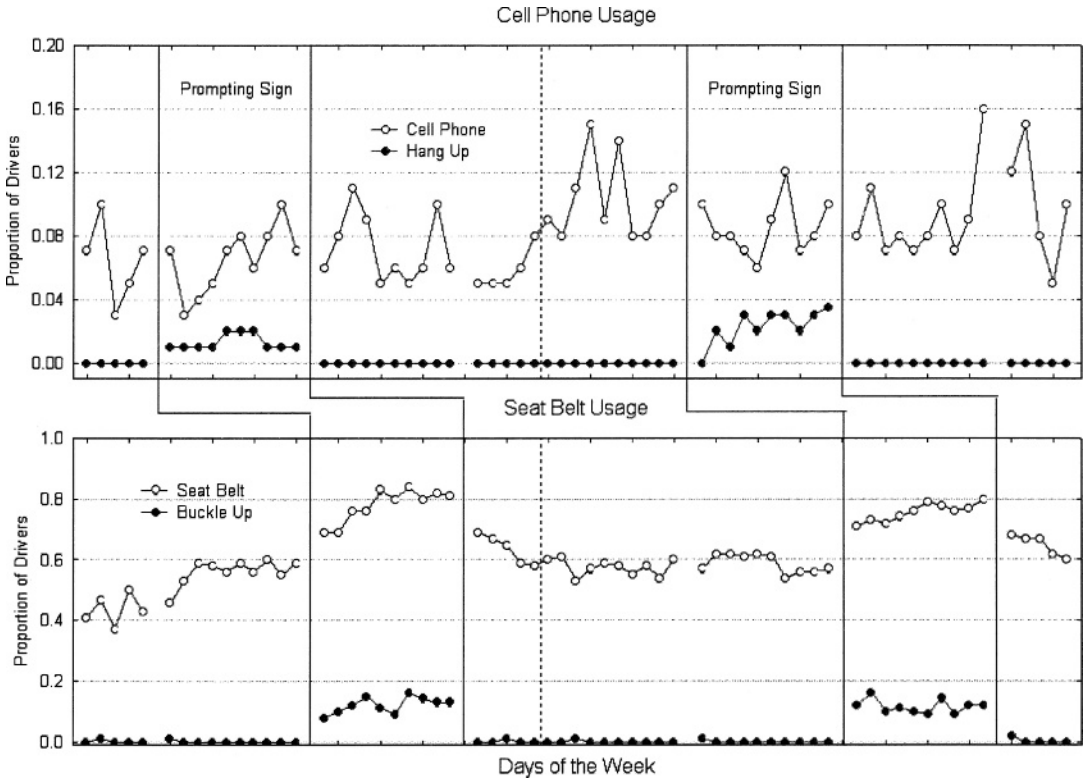

Figure 2. Proportion of drivers using cell phones and hanging up, and drivers wearing seat belts and buckling up during the study. The broken phase line at the midpoint indicates when the second season began, about 1 year later. Open circles: proportion of drivers using a cell phone upon approaching the observers (top) and proportion of drivers wearing a seat belt (bottom). Closed circles: proportion of drivers hanging up upon approaching the observers (top) and proportion who fastened their seat belts (bottom). Open circles represent a change in behavior over time, and closed circles represent an immediate response to the displayed prompt.

second setting. This occurred only during the second season of the study and only for drivers turning left. Left-turners were chosen because most (M = 64%) vehicles turned left, and limits on student resources did not allow observers in all three possible directions.

RESULTS AND DISCUSSION

The proportion of drivers who engaged in prompted behaviors is shown in Figure 2. The proportion of drivers observed hanging up a cell phone or buckling their seat belt is separate from those drivers observed using a cell phone or wearing a seat belt.

During the first baseline, the percentage of seat belt use averaged about 44% and cell phone use averaged 6%. During prompting for cell phone use, use remained about the same, but the proportion of drivers hanging up their cell phones when prompted to do so increased. Seat belt use during this phase rose as well and averaged 56%. The presence of the prompter and observers implied monitoring, and because nonuse of a seat belt is an unlawful behavior, drivers may have buckled up to avoid a presumed aversive consequence. During prompting for seat belt use, cell phone use averaged about 7%, and hang-ups dropped to zero. Seat belt use averaged 78% during this phase. Two weeks after the last data point of prompting for seat belt use, a 1-week reversal was conducted. Seat belt use dropped to an average of 64%, and cell phone use remained about the same.

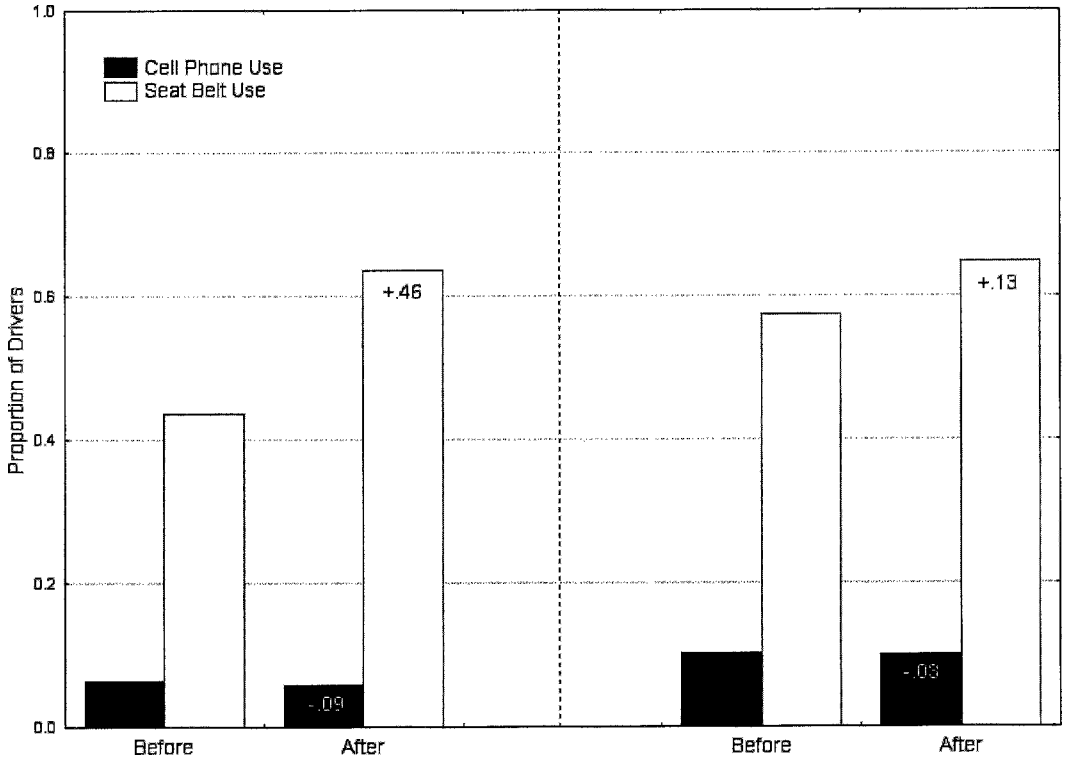

Figure 3. Proportion of drivers using a cell phone or wearing a seat belt both before and after the interventions. The broken phase line at the midpoint indicates when the second season began, about 1 year later.

The results for the second season of the study closely resembled those of the first season, except that the proportion of cell phone users who hung up after being prompted to do so increased over the first season's proportion. Also, the observers in the second setting collected data on the proportion of drivers using cell phones and seat belts after hanging up or buckling up in the first setting. The percentage of drivers using cell phones one block after hanging up averaged 36%, whereas the percentage of drivers who buckled their seat belts following the prompt and then unbuckled one block away was zero.

The data shown in Figure 2 indicate that cell phone use was relatively low. The inclusion of data on drivers who hung up in response to the prompt shows an average rate of compliance of 28% during the first season and 33% during the second season. At no other time did drivers hang up when they approached the prompt. These rates approximate what previous researchers have found when using similar interventions for other driving behaviors. Further, when comparing baseline to prompting for seat belts during the first season, there was a 34% increase in seat belt use. During the second season compliance was 25%.

Figure 3 shows the proportion of drivers using seat belts and cell phones, both before the intervention began and after it concluded, during both seasons of the study. During Season 1, cell phone use declined 9% from its initial rate, and during Season 2 it declined 3%. Seat belt use increased 46% in the first season and 13% in the second season.

With respect to seat belt use, the effect of prompting seemed to carry over into Season 2. Seat belt use during baseline was over 40% and increased to over 60% at the end of Season 1.

Baseline percentages during Season 2 were higher, suggesting possible carryover from Season 1. Although the baseline proportion of seat belt use was higher in Season 2, the intervention resulted in about the same effect as Season 1. Some drivers, for whatever reason, may be more resistant to using seat belts. The ceiling effect seen in Figure 3 suggests that active prompting did not reach these drivers.

GENERAL DISCUSSION

Overall, the findings of the present study support the use of an active prompting intervention to increase drivers' seat belt use and decrease cell phone use. Seat belt use increased markedly from baseline, with about a third of unbuckled drivers buckling up when prompted across the 2 years of the study. Similar success was shown for a condition that prompted drivers to hang up cell phones. Postprompting observations suggested that behavior change was highly durable for seat belt use, with no drivers unbuckling a block away from the initial prompting site. Conversely, about a third of drivers had reengaged in cell phone use within a block of the initial prompt and hang-up compliance, suggesting differential effectiveness of the intervention across behaviors.

The current study used two procedural innovations. First, data were collected on compliance with the textual prompts. This allowed for differentiation between behaviors that were immediate responses to the prompt and acquisition of safe behaviors over time. The percentage of drivers buckling up or hanging up shows responding to the prompts, whereas the percentage of drivers engaging in the target behaviors shows acquisition. Behavior change was more obvious in the case of seat belts, for which both immediate responses and acquisition over time seemed to occur. Cell phone use, on the other hand, appeared to be sensitive to the prompts, but the percentage of users did not decline. This may have been a result of more drivers acquiring cell phones, although there is no way to substantiate this possibility.

An additional innovation, the use of observers in the second postprompt setting, occurred during Season 2. This procedure allowed analysis of the longer term effects of the intervention. Although initial compliance rates with the "hang up" prompts were promising, it seemed likely that drivers might have put the other party on hold and then resumed their conversation momentarily. Direct observation indicated that about a third of drivers did so one block later. Conversely, no drivers were observed to remove their seat belts after buckling up.

There are several issues pertaining to the current study that should be addressed. First, the rate of cell phone use during the study was relatively low (6% initially). Currently, it is estimated that about 10% of drivers on the road at any one time are using some type of phone (Glassbrenner, 2005). Future work in more urban environments is needed to further evaluate the procedure while minimizing this floor effect.

A second issue relates to the nature of the two behaviors (cell phone and seat belt use). It is legal to talk on a cell phone while driving in the state in which the study was conducted, but it is not legal to drive without a seat belt. It also is reasonable to assume that drivers have had considerably more practice buckling up and have received more education with respect to the safety benefits of seat belts.

Finally, the present procedure may increase the risk to drivers in another way. When prompted to buckle up or hang up, drivers frequently began to fumble around for their seat belts or attempted to hang up their cell phones. These are risky behaviors that could lead to accidents. Fortunately, driving speed when leaving a parking lot and negotiating a four-way intersection tends to be relatively slow, but the risk is real.

Anecdotal evidence suggests that the social validity of these interventions was high. Many drivers gave a ''thumbs up'' or a polite wave and smile, usually in response to the cell phone prompt. There also were many ''seat belt salutes'' (using a hand to lift the belt from the body and gesture to the observers that they are wearing their seat belts) performed by drivers as they passed the prompter. Over the course of the study approximately 6,500 vehicles were prompted, with only one rude gesture observed.

Several aspects of the current intervention make it attractive for future safety programs. The procedure is effective, easy to carry out, and very low cost when volunteers are available. Given the statistics on automobile accidents, the procedure is worth far more than it costs to implement. Students enjoyed being outside and interacting with drivers, and the drivers did not seem to mind the intrusion. In future applications, it would be easy and rewarding for various collegiate groups (teams, sororities, clubs) to perform similar active prompting interventions around campus focusing on seat belts, cell phones, stop signs, turn signals, and so on. The combined low cost, easy presentation, and high effectiveness and acceptability of the procedure suggest that it should be carried out more often and could save lives.

REFERENCES

Austin, J., Alvero, A. M., & Olson, R. (1998). Prompting patron safety belt use at a restaurant. *Journal of Applied Behavior Analysis*, *31*, 655–657.

Austin, J., Hackett, S., Gravina, N., & Lebbon, A. (2006). The effects of prompting and feedback on drivers' stopping at stop signs. *Journal of Applied Behavior Analysis*, *39*, 117–121.

Berry, T. D., Geller, E. S., Calef, R. S., & Calef, R. A. (1992). Moderating effects of social assistance on verbal interventions to promote safety belt use: An analysis of weak plys. *Environment and Behavior*, *24*, 653–669.

Clark, M. J., Schmitz, S., Conrad, A., Estes, C., Healy, M. M., & Hiltibidal, J. (1999). The effects of an intervention campaign to enhance seat belt use on campus. *Journal of American College Health*, *47*(6), 277–281.

Copeland, L. (2005, June 2). States to drivers: Hang up, look out. *USA Today*, Retrieved June 2, 2005, from http://usatoday.com

Cox, B. S., Cox, A. B., & Cox, D. J. (2000). Motivating signage prompts safety belt use among drivers exiting senior communities. *Journal of Applied Behavior Analysis*, *33*, 635–638.

Engerman, J. A., Austin, J., & Bailey, J. S. (1997). Prompting patron safety belt use at a supermarket. *Journal of Applied Behavior Analysis*, *30*, 577–579.

Evans, L. (1996). Safety-belt effectiveness: The influence of crash severity and selective recruitment. *Accident Analysis & Prevention*, *28*, 423–433.

Geller, E. S., Bruff, C. D., & Nimmer, J. G. (1985). ''Flash for life'': Community-based prompting for safety belt promotion. *Journal of Applied Behavior Analysis*, *18*, 309–314.

Geller, E. S., Casali, J. G., & Johnson, R. P. (1980). Seat belt usage: A potential target for applied behavior analysis. *Journal of Applied Behavior Analysis*, *13*, 669–675.

Geller, E. S., & Lehman, G. R. (1991). The buckle-up promise card: A versatile intervention for large-scale behavior change. *Journal of Applied Behavior Analysis*, *24*, 91–94.

Glassbrenner, D. (2005). *Driver cell phone use in 2005—Overall results*, Research Note DOT HS 809 967. Retrieved January 11, 2006, from http://www.nhtsa.dot.gov

Hagenzieker, M. P. (1991). Enforcement or incentives? Promoting safety belt use among military personnel in the Netherlands. *Journal of Applied Behavior Analysis*, *24*, 23–30.

Insurance Information Institute. (2004, March). *Cell phones and driving*, Retrieved March 13, 2004, from http://www.iii.org

Kahane, C. J. (2000). *Fatality reduction by safety belts for front-seat occupants of cars and light trucks: Updated and expanded estimates based on 1986–1999 FARS data.* (NHTSA Report No. DOT HS 809 199)

Krug, E. (2003). Road traffic injuries. *World Health Organization*, Retrieved July 5, 2006, from http://www.who.int/world-health-day/2004/en/traffic_facts_en.pdf

Lissy, K., Cohen, J., Park, M., & Graham, J. D. (2000). Cellular phones and driving: Weighing the risks and benefits. *Harvard Center for Risk Analysis*, *8*(6), 1–6.

Ludwig, T. D., & Geller, E. S. (1991). Improving the driving practices of pizza deliverers: Response generalization and moderating effects of driving history. *Journal of Applied Behavior Analysis*, *24*, 31–44.

Malenfant, L., Wells, J. K., Van Houten, R., & Williams, A. F. (1996). The use of feedback signs to increase observed daytime seat belt use in two cities in North Carolina. *Accident Analysis & Prevention*, *28*(6), 771–777.

McEvoy, S. P., Stevenson, M. R., McCartt, A. T., Woodward, M., Haworth, C., & Palamara, P., et al. (2005, July 12). Role of mobile phones in motor vehicle crashes resulting in hospital attendance: A case-crossover study. *British Medical Journal*, doi:10.1136/bmj.38537.397512.55

National Highway Traffic Safety Administration. (n.d.). Retrieved July 11, 2005, from http://nhtsa.gov/people/crash/LCOD/index.htm

Pastò, L., & Baker, A. G. (2001). Evaluation of a brief intervention for increasing seat belt use on a college campus. *Behavior Modification*, *25*(3), 471–486.

Redelmeier, D. A., & Tibshirani, R. J. (1997). Association between cellular-telephone calls and motor vehicle collisions. *New England Journal of Medicine*, *336*(7), 453–458.

Stowell, C., & Bryant, J. (1978). *Safety belt usage: Survey of the traffic population.* Technical Report DOT H56-01340. Washington, DC: Kirschner Associates, Inc.

Strayer, D. L., Drews, F. A., & Johnston, W. A. (2003). Cell phone-induced failures of visual attention during simulated driving. *Journal of Experimental Psychology: Applied*, *9*(1), 23–32.

Strayer, D. L., & Johnston, W. A. (2001). Driven to distraction: Dual-task studies of simulated driving and conversing on a cellular telephone. *Psychological Science*, *12*(6), 462–466.

Thyer, B. A., Geller, E. S., Williams, M., & Purcell, E. (1987). Community-based ''flashing'' to increase safety belt use. *Journal of Experimental Education*, *55*, 155–159.

Van Houten, R., & Malenfant, L. (1988). The effects of nighttime seat belt enforcement on seat belt use by tavern patrons: A preliminary analysis. *Journal of Applied Behavior Analysis*, *21*, 271–276.

Van Houten, R., & Retting, R. A. (2001). Increasing motorist compliance and caution at stop signs. *Journal of Applied Behavior Analysis*, *34*, 185–193.

Wells, J. K., Malenfant, L., Williams, A. F., & Van Houten, R. (2000). Use of a community program to increase seat belt use among shopping center patrons in Charlotte, North Carolina. *Journal of Safety Research*, *31*(2), 93–99.

Williams, A. F., Wells, J. K., McCartt, A. T., & Preusser, D. F. (2000). ''Buckle Up NOW!'' An enforcement program to achieve high belt use. *Journal of Safety Research*, *31*(4), 195–201.

Wilson, J., Fang, M., & Wiggins, S. (2003). Collision and violation involvement of drivers who use cellular telephones. *Traffic Injury Prevention*, *4*(1), 45–52.

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