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Demonstration of Promising Practices to Increase Proper Bicycle Helmet Use in Middle School Youth

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16. Abstract
This study replicated a promising pilot program to increase bicycle helmet use in middle school students tested in 2005. Based on feedback from the three participating pilot schools, changes were made to enhance the program followed by a demonstration of the program in 12 newly selected schools from three regions of the country. Each school program was supervised by an adult and included student ownership of the program. During the intervention phase, students selected a group goal for increased helmet use by the end of the program. Along with their overall goal, each week the current status for afternoon helmet use for the preceding week was recorded and publicly posted for their school peers to see. Helmet use was counted only if the helmet was worn properly. To be scored as correctly worn, the helmet had to be buckled snugly (the loop formed by the buckle could not form a loop the observer estimated would accommodate more than a few fingers), and the helmet needed to be level (no more than two finger widths visible above the eyebrows). All student participants worked toward a shared reinforcer (a pizza party), if they attained their selected goal. Students were provided helmets with the school logo and given the option to decorate their helmets. Education was provided including the importance of helmet use, how to fit their helmets, and an overview of basic traffic safety principles for riding safely, i.e., ride in the same direction of traffic, obey traffic signs and signals. Time was allocated to allow for discussion about bicycle safety and to ensure student's helmets were properly fitted. Following treatment, correct helmet use increased from 14 percent to 34 percent and helmet use also increased in the morning even though students only collected and posted data on afternoon helmet use. Sampled helmet data collected some distance from the school, by paid and trained adult observers, also indicated that students did not remove their helmets outside the school campus. Results of the study suggest it may be unrealistic to increase helmet use by middle school students by using positive reinforcement and information of the safety benefits of helmet use alone. It is likely that the enforcement component and the level of commitment of adult coordinators may be important variables if high levels of helmet use are to be achieved.

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For those interested in using the videos or products developed as part of the initial pilot or the NHTSA demonstration project, please see the CERS website under the "Bicycle Safety Youth Team Program" Research Project, http://www.cers-safety.com/hsp.htm. The NHTSA funded project focused exclusively on the middle school section.

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EXECUTIVE SUMMARY

BACKGROUND

The vast majority of children 5 to 14 years old ride bicycles, estimated at about 70 percent (Sacks, Kresnow, Houston, & Russell, 1996). Although cycling confers significant health benefits, bicycles are associated with many injuries with 540,000 emergency room visits in 2010 (Consumer Product Safety Commission, 2012). Data from the National Highway Traffic Safety Administration indicates 677 bicyclists were killed and 48,000 were injured in 2011 and 10 percent of those killed and 19 percent of those injured were 16 or younger. This data also shows the fatal crash rate (crashes per 100,000 population) of children killed in bicycle crashes in the 10- to 15-year-old age group is more than 2 times higher than the 5-to-9 age group and the injury rate is 2.7 times greater. Bicycle fatality rates are highest in the state of Florida, which is more than twice the national average.

Megan, Gardner, Smith, and McKenzie (2009) performed a retrospective analysis of data from the National Electronic Injury Surveillance System for injuries to children 18 and younger seen in emergency departments between 1990, and 2005, for injuries received while operating bicycles. There were an estimated 6,228,700 individuals 18 and younger injured over this 16-year period. Children with head injuries had relative risks that were 3.64 times more likely to require hospitalization and 5.77 times more likely to receive injuries that resulted in death.

The use of bicycle helmets has been documented to reduce the risk of head injury (Elvik, in press). A bicycle helmet, when worn properly, is the single most effective piece of equipment to reduce head injury in the event of a crash. Studies show that helmet use is lower among teens than younger children (Dannenburg et al., 1993; Dellinger & Kresnow, 2010; Schieber & Sacks, 2001), making teens excellent targets for a program designed to increase bicycle helmet use.

- **Pilot Project:** Because of the high incidence of bicycle crashes in the 10-to-15 age group, Van Houten, Van Houten, and Malenfant (2007) developed and pilot-tested a program in three Floridia schools, applying behavioral strategies to increase the helmet use of middle school children.

  The program elements consisted of:

  - Peer data collection of correct helmet use in the afternoon but not in the morning;
  - Education on how and why to wear a bicycle helmet correctly;
  - Peer goal setting;
  - Public posting of correct helmet use from peer data collected in the afternoon;
  - Shared reinforcers; and
  - Oversight by school based police officers or persons of authority (referred to as school program coordinators).

  The results of the pilot project were promising. All three schools showed an increase in correct helmet use after intervention. Further, data collected near the three schools, and offsite at a distance by adult collectors, and without the knowledge of student participants, indicated that students did not remove their helmets once they were no longer in close proximity to the school and under direct observation of their peers watching their behavior.

Data collected in the morning at two of the schools showed that the behavior change transferred from the afternoon to the morning. This is important because many children take off their helmets after leaving home when they are out of sight of parents, typically hanging them over the bicycles' handlebars. School based police officers, are referred to as either school resource officers (SROs) or a school resource deputies (SRDs). The SROs at two of the schools enforced helmet use before and after the program was introduced. The SRO at the third school never enforced helmet use. Helmet use increased from 82 percent to 98 percent and from 52 percent to 95 percent at the two schools where the program was added to ongoing enforcement and from 14 percent to 45 percent at the school where helmet use was never enforced. This data suggests the effects of a peer mediated program may work best when enforcement is part of a comprehensive approach to increase correct bicycle helmet use in middle school aged youth.

DEMONSTRATION PROJECT

For the current project, NHTSA funded:

- Revisions to enhance the piloted program and evaluation tools, based on student and adult feedback obtained as part of the pilot; and
- Demonstrations of the enhanced program in three regions of the country. Twelve newly identified schools were selected from three States, representing the south (Florida), the mid-west (Michigan), and the west (Arizona).

No major content changes were made from the original piloted program, and the program elements remained the same. While the pilot project included consistent monitoring and involvement from the research team, this demonstration project was intended to see if the program could be implemented effectively with similar successful outcomes, as a stand-alone program, with limited outside support (from the research team). A school program coordinator was selected for each school. This person was a school staff member who had primary responsibility for carrying out the program. The school program coordinator could have been a SRO, SRD, physical education instructor, or a science teacher. The coordinators were given program material and told they'd get assistance if they requested it (none did). Coordinators also were responsible for overseeing student data collection and for adult data collection.

DEMONSTRATION METHOD AND DESIGN

Researchers selected school districts to represent three different regions of the county based on those expressing an interest in the program and their ability to find schools in their districts willing to participate. For any one school to be selected, researchers required a minimum number of students (25) bicycling to school. Three States were selected, Michigan (four schools), Florida (five schools), and Arizona (three schools).

Program Timeline

Michigan schools were treated first because children were identified as typically riding until the end of October. Florida was treated second, and the Arizona schools were treated last.

Participants and Setting

Participants were middle school children 11 to 14 years old who rode their bicycles to school during the period of the study. They represented 12 different schools located in three regions of the country (the mid-west, the south, and the west.)

Primary Measures

- ***Adult Observers.*** Paid and trained adult data collectors (observers) recorded helmet use at the end of the school day, in the morning, and at a distance from the school in the afternoon at each of the participating 12 schools. At sites away from school grounds, and without the knowledge of students, these observers recorded whether the helmet was on the student's head and whether the helmet was worn correctly. To be scored as correctly worn, the helmet had to be buckled snugly (the loop formed by the buckle could not form a loop the observer estimated would accommodate more than a few fingers), and the helmet needed to be level (no more than two finger widths visible above the eyebrows). Observers collected three type of measures:

    (1) Helmet use in the afternoon were collected on a regular basis by adults either in parked cars or scored from windows with access to the bike parking areas.

    (2) Helmet use among children riding to school in the morning was collected as the students arrived at school by adults either in parked cars or from windows with access to the bike parking areas. Observers were instructed to collect this data at least 2 times during baseline and 2 times when the program was in effect.

    (3) Collectors also collected data on helmet use among children riding home from school at specified distances (approximately half a mile from the school). Observations outside the immediate school zone (0.5 miles) were included to determine if the children removed their helmets after leaving the school area. Observers were instructed to collect this data at least 2 times during baseline and 2 times when the program was in effect.

  This second measure was included because SROs in the pilot study said middle school students often removed their helmets after they thought they were no longer visible to the SRO. We asked adult data collectors to collect morning and distance data at least twice during each condition. Both measures were included to assess whether the treatment generalized over time and was maintained over distance.

- ***Peer Observers.*** The adult school program coordinator at each school selected and trained students to observe and record bicycle helmet use, and correct bicycle helmet use. During the treatment condition, one or two peer observers were assigned to observe afternoon helmet use each day. Helmet use was observed and recorded the same way by student observers as the adult observers. The school supervisor trained observers to record helmet use by demonstrating examples of correct and incorrect helmet use and showed the students a video on correct helmet use.

Experimental Design

A multiple baseline design was used for this study. This design required collecting baseline data for helmet use at all school sites before the treatment was applied. The treatment package that follows was then introduced at a different point in time at each site. Each time a site received the

treatment, additional baseline data was collected at the untreated locations. Because we staged or staggered the introduction of the intervention package across each of the three regions, the untreated sites served as a control for possible confounding variables, since significant changes should only be detected following the introduction of the treatment at each site.

Treatment Package

Implementation of the program required the following steps:

(1) Attending to pre-program details. This included obtaining all required approvals and arranging for data collection on baseline helmet use (done by the research team).

(2) Selecting peer leaders. Two criteria were recommended for selection of peer leaders: leadership qualities and popularity with the student body (selection of peer leaders done by the school adult coordinator).

(3) Organizing and implementing an assembly to explain the program to all students who rode their bicycle to school. A PowerPoint overview of the program was prepared for each school (done by the SRO, SRD, or adult school program coordinator).

(4) Distributing bicycle helmets and helmet fit instruction to those students agreeing to participate in the program. Participants got BMX style bicycle helmets and two stickers of their school mascot to place on their helmets. Students received instruction on helmet fit, assistance on proper helmet fit, and were assessed for proper helmet fit (done by SRO, SRD, or adult school program coordinator with assistance from peer leaders).

Note: BMX style helmets were selected because a survey of students during the pilot testing phase indicated these helmets were preferred over the standard bicycle helmet. Students were told they could decorate or otherwise individualize their helmets as they wished.

(5) Training student data collectors to observe and record correct helmet use on provided forms (done by SRO, SRD, or adult school program coordinator).

(6) Collecting helmet data every afternoon on all bicyclists (done by peer data collectors with periodic assistance from SRO, SRD, or adult school program coordinator).

- Assistance was provided to help ensure the quality and integrity of student data collection.
- School coordinators were instructed to be present after school to provide necessary assistance, answer questions, and praise the data collectors and the bicyclists (Days 1 and 2 only). School coordinators were to meet weekly with student data collectors and assist in posting the percentage of students wearing bicycle helmets at an established high visibility location.

(7) Calculating the previous week's helmet use at the beginning of each week and transcribing the results on the chart provided as part of the program. Two charts were to be hung in high-visibility locations for the project's entirety. One location was near the office and the other in the lunchroom. (Suitable locations were determined at each school based on adult oversight to reduce vandalism of charts.)

(8) Sharing results of helmet use for the week by school principals via weekly e-mails through the school's list-serve. Results were shared with staff, school district officials, and all parents.

(9) Encouraging helmet use and enforcing of helmet law, if it applies. (We asked the SROs or SRDs to enforce helmet use throughout the study but there was no compliance with this request).

Only Florida had a State helmet law (for children under 16). Arizona and Michigan had varying local helmet laws for children, but no schools meeting the criteria for selection had local helmet laws. Law enforcement officers were encouraged to begin with warnings and the information flyer in jurisdictions where police did not have a history of enforcement of bicycle laws.

(10) Convening a final assembly with student participants including the shared reinforce, in this case, a pizza party, to celebrate the increase in helmet use.

RESULTS

Group Means for Each Condition

The introduction of the treatment produced an increase in helmet use in all 12 schools. Follow-up data collected at 11 of the 12 schools indicated the level of correct helmet use was higher in 10 out of the 11 schools.

Explorer school in Arizona failed to collect follow-up data. Adult-collected data showed that increases in helmet use in the afternoon transferred to the morning helmet use even though students never received feedback on morning use. Helmet use was sustained at the distance measuring sites, where adults, unknown to the bicyclists, were looking to see if the student took off their helmets after they were out of view of their peers who were scoring the data on the school property. This is important because it helps to document student buy-in to the goals of the program since they were not aware that the adult data collectors recorded helmet use in the morning or away from the school.

Data for Each School Plotted Against Days

Michigan: Daily data on correct helmet use for each school showed that baseline correct helmet use varied between 0 percent and 28 percent with a mean level of 11 percent. The introduction of the treatment at the Michigan sites was associated with immediate increases in correct helmet use at three of the four sites, and little change at the remaining school. In addition to increases in helmet use as students left the school in the afternoon, data from all three schools showed that helmet use was sustained at distance measurement sites, and proper helmet use transferred to morning arrival of student bicyclists.

Florida: Data from the Florida schools showed that correct helmet use varied between 3 percent and 54 percent with a mean of 27 percent during the baseline condition. Following the introduction of the treatment program, four of the five sites showed clear increases in correct helmet use. At Kanapaha Middle School, correct helmet used increased from 20 to 46 percent and decreased to 30 percent during the follow-up after the program was over at the end of the school year. At Westwood Middle School, correct helmet use increased from 52 percent to 85 percent and decreased to 61 percent during the follow-up period. At Stonewall Jackson Middle

School, correct helmet use increased from 4 to 24 percent and maintained at 23 percent during the follow-up period. At Fort Clark Middle School, correct helmet use increased from 54 percent to 63 percent and maintained at 62 percent during follow-up. At Howard Bishop Middle School, correct helmet use increased from 3 to 16 percent and maintained at this level during the follow-up period. Data collected in the morning when students arrived at school also showed increases in helmet use at three sites. In addition, in the afternoon, students did not remove their helmets after they left the school grounds at the two sites where helmet use was measured.

Arizona: Data from the three Arizona schools show baseline helmet use varied between 0 percent and 10 percent with a mean of 3 percent. Following the introduction of the treatment, two of the three sites showed an increase in helmet use. The remaining school did not show an increase, although the mean level of helmet use was somewhat higher during the treatment condition. The increase in correct helmet use was sustained at one school during follow-up. Morning and distance data collected at all three sites were consistent with the changes observed in correct afternoon helmet use. The degree to which the adult school program coordinators and adult data collectors followed the protocol varied from school to school and appeared to be positively correlated with the magnitude of the results.

Statistical Analysis

Previous work has shown that students often do not wear their helmets correctly. Therefore, we performed a statistical analysis to determine whether the program increased correct helmet use. The results of the statistical analysis found that the changes in correct helmet use between baseline and treatment were statistically significant at 10 of the 12 sites.

DISCUSSION

Overall Results

Baseline helmet use varied across schools in each of the regions with the highest percentage of helmet use at the Florida sites and the lowest overall percentage of helmet use at the Arizona sites. Although the statistical analysis confirmed that the bicycle helmet program increased bicycle helmet use at all three regions, the results varied considerably between regions. On average, the Florida sites were associated with the highest level of correct helmet use during the treatment condition. It is possible the treatment was most effective in Florida because it was the only State with a law requiring those under 16 to wear a bicycle helmet (Florida Statues 316.2065). However it is interesting to note that the officers did not enforce helmet use at the schools participating in this study.

Comparison with Pilot Study Results

Although the program (treatment) increased helmet use, it did not produce the high level of helmet use observed in the pilot study in three Florida schools. There are many possible explanations, but the most likely explanation was the absence of enforcement at all sites, including the new Florida sites. In the pilot study, helmet use increased because of the program, however, only two of the three schools showed a significant increase in the percentage of students wearing their helmets correctly. Since helmet use is only effective if the helmet is worn properly, the demonstration program placed greater emphasis on producing an increase in proper helmet use.

Lessons Learned

There are three primary lessons learned that point to critical components necessary toward behavior change among middle school aged youth:

(1) Enforcement may be necessary to make the peer program work. Results of the study suggest that it may be unrealistic to increase helmet use to very high levels by middle school students by using a peer program and information alone, and by information of the safety benefits of helmet use even when helmets are provided. The results indicate it is possible to significantly increase helmet use with a peer program and information. However, if the goal is to attain and sustain high levels of helmet use, the results of our pilot study and this demonstration study, taken together, suggest that a high level of usage may require adding sanctions for students who fail to observe the helmet law.

Enforcement is one way to give credibility to helmet use. Although one could argue it is essentially a safety issue, students are likely aware that a legal requirement reflects risk. They know that young children need to be in child restraints and older children and adults need to be restrained in seat belts. They also know that police enforce these safety laws. If they can ride by their resource officer repeatedly without helmets with no consequence, it implies there is no safety issue. In jurisdictions with a State statute or municipal code provision requiring bicycle helmets, it is important that the rule be enforced. Where no law exists the school can require students to wear helmets if they ride their bicycle to school. Enforcement need not involve writing citations: It is possible to "impound" bicycles until the owners present helmets and leave school with the helmets on, or the officer can contact the parents.

(2) Both adult and student champions are essential elements of programs that include a high degree of student involvement. Those teachers and SROs/SRDs who were most enthusiastic about their programs obtained the best results.

(3) Student involvement is an important element in programs focusing on middle school children. Having students collect data is an excellent way for them to be involved in the program. Previous work has shown that student data is as reliable as the data collected by paid adult data collectors. When students play a leadership role and assume responsibility for the program, they promote a sense of ownership by all participating students.

Summary

The program produced a significant increase in helmet use at almost all the participating middle schools. However, producing a statistically significant change is not sufficient to warrant implementing this program. The objective of this research was to produce a robust and sustained increase in helmet use to the low to mid 90 percent range achieved in the initial pilot study. The results of the current study taken together with the pilot study suggest that there are five factors required to assure the success of this program:

(1) A school resource officer (SRO), a school resource deputy (SRD), or their equivalent who is interested in working as a mentor or facilitator for the group of bicycling students. We found the program works best when the SRO or SRD selects and recruits student leaders to take responsibility for implementing the program. It is reasonable to assume this component may be key to program success.

(2) The SRO/SRD must have tangible and social reinforcers to reward student leaders who

implemented the program and the entire group of bicycling students when they reach their goal for helmet use. A menu of tangible and social reinforcers that appeals to middle school students is best prepared with their feedback. Some examples include LED bike lights, helmets, school service credit certificates, and a wrap-up pizza party.

(3) Peer training is necessary to ensure consistency in data collection and analysis of helmet fit. In school settings, this data can be collected from school bike racks, preferably after school because students leave in large numbers at one time, versus arrive over a wider time period. Departure time observations consolidate student time needed for observation and is more feasible.

(4) Publicly posting weekly helmet use results on posters and reviewing the use level and record for the preceding week during announcements generates interest in the program and motivates bicycling students to increase helmet use. Support and encouragement by school staff and/or adult supervisors and volunteers are also very helpful.

(5) Perhaps the most important factors include: (a) the existence of a State law, a municipal ordinance, or a written school policy requiring helmet use by bicyclists; and (b) a willingness by the SRO or SRD to issue written warnings (and citations) to the non-compliant student bicyclists with copies to their parents and citations to enforce the State law, local ordinance, or school regulation. Failure to enforce helmet use is counterproductive to this program because it implies the State law, local ordinance, or school policy is not important.

It is important to encourage helmet use and other safe bicycle riding habits by young bicyclists. Safe riding habits are perhaps the most important step in promoting and instilling safe motor vehicle driving habits in our youth.

Products

Please see http://www.cers-safety.com/hsp.htm for the materials developed for and used in this project including the "Play Me First" video, clips under the heading "Middle School Topics," and "Downloadable" materials.

FINAL REPORT

INTRODUCTION

This is the final report of *Increasing Helmet Use-Demonstration of Promising Practices to Increase Proper Helmet Use Among Youth.* This demonstration project was conducted by the Center for Education and Research in Safety under Cooperative Agreement Number DTNH22-09-H-00243 with the National Highway Traffic Safety Administration. The objectives were to:

1) Revise and enhance the pilot program by completing a literature review and obtaining feedback from professionals who work with middle school students to see if anything was new since the pilot program;

2) Document and evaluate the efficacy of the revised program to increase correct bicycle helmet use by middle school students;

3) Replicate the pilot results in multiple school locations in three varying regions of the country; and

4) Create a replicable national program to enhance correct bicycle helmet use among middle school students.

BACKGROUND

About 70 percent of children, 5 to 14 years old ride bicycles (Sacks, Kresnow, Houston, & Russell, 1996). Although cycling confers significant health benefits, bicycles are associated with many injuries with 540,000 emergency room visits in 2010 (Consumer Product Safety Commission, 2012). Data from NHTSA (2010) indicates 618 bicyclists were killed and 52,000 were injured in 2010 and 11 percent of those killed and 25 percent of those injured were under 16. This data also shows the fatal crash rate (per 100,000 populations) of children killed in bicycle crashes in the 10-to-15-year-old age group is more than 2 times higher than the 5-to-9 age group and the injury rate is 2.7 times greater. Bicycle fatality rates are highest in Florida, which has more than twice the national average.

Megan, Gardner, Smith, and McKenzie (2009) performed a retrospective analysis of data from the National Electronic Injury Surveillance System for injuries to children 18 years and younger seen in emergency departments between 1990, and 2005, for injuries received while operating a bicycle. There were an estimated 6,228,700 individuals 18 years and younger injured over this 16-year period. Children with head injuries had a relative risk that was 3.64 times more likely to require hospitalization and 5.77 times more likely to receive injuries that resulted in death.

Bicycle helmets have been documented to reduce the risk of head injury by 85 percent and brain injury by 88 percent (Thompson, Rivara, & Thompson, 1996). Another study by Thomas, Acton, Nixon, Batttistutta, Pitt, and Clark (1994) examined crashes in children and found a 63 percent reduction in the risk of head injury. They also found that the majority of children that receive head injuries were injured in collisions with a motor vehicle, while less serious head injuries

involve crashes or falls that did not involve a motor vehicle. Of particular interest is the finding of Rivara et al. (1999) that children and youth who wore poorly fitted helmets were more likely to be injured than those who wore properly fitted helmets. Foss and Beirness (2000) found that helmet misuse in the 6 to 15 age group was more than double the level observed in the 16 to 30 age group. These data indicate that countermeasures that target helmet use in this age group must also target appropriate helmet use.

Several studies indicate that helmet use is lower among young teens than among younger children (Schieber et al., 1992; Dannenburg et al., 1992). In addition, a number of studies have attempted to determine why middle school aged children are less likely to wear helmets or respond to education programs and helmet giveaways then elementary aged students. One factor that appears in many studies is lack of peer support and unappealing helmet design (Lajunen & Rasanen, 2001; Liller, Morissette, Noland, & McDermott, 1998). Another study (Loubeau, 2000) conducted focus group discussions with young adolescents who reported that bicycle helmets were uncomfortable because they were difficult to fit, and made them "feel dumb," "like a nerd," "you're a loser," "your mother makes you," "your mother is over protective."

Other studies have shown that the introduction of bicycle helmet legislation is associated with both increased helmet use and reductions in bicycle related deaths and injuries (Graitcer, Kellerman, & Christoffel, 1995; Mackinan & Medenorp, 1994; MacPherson et al., 2002; Wesson, Stephens, Parsons, & Parkin, 2008). A study by Thomas, Hunter, Feagues & Foss (2002) concluded that the law in North Carolina, mandating helmet use for children 15 and younger, failed to generate a differential increase in helmet use, and suggested that this law should be combined with enforcement and promotion of the benefits of proper helmet use. These studies suggest that helmet use should be a major intervention target for middle school children.

Currently, two States have laws requiring helmet use for bicyclists under 12, one State has a law for bicyclists under 14, and another State for bicyclists under 15. Another 16 States have laws requiring helmet use for bicyclists under 16, two States require helmet use for bicyclists under 17, and another two States require helmet use for bicyclists under 18 (Bicycle Helmet Safety Institute, 2012). Although helmet use laws have been shown to increase helmet use, enforcement of helmet laws for children is relatively rare. There are several reasons why enforcing bicycle helmet laws is more challenging than enforcing motor vehicle laws:

- Drivers of motor vehicles must have and carry a valid driver's license. This provides identification and loss of the driving permit can be a consequence of not paying fines associated with violations. Young bicyclists often do not possess identification, and are not required to have a permit to operate a bicycle; and
- The person who typically would pay a fine for a child or youth violation is typically the parent rather than the violator.

One program offers an alternative enforcement technique that attempts to overcome these drawbacks is impounding the child's bicycle, and requiring the parent to retrieve it at the police station with their child, at which time, the safety message can be reinforced and helmet ownership verified or provided before releasing the bicycle (Gilchrist, Schieber, Leadbetter, & Davidson, 2000). This program was combined with an educational program and a helmet giveaway program. The program was associated with an increase in helmet use from 0 percent to a mean of 45 percent for children 5 to 12 with a smaller increase from 0 percent to a mean of 18 percent for teens 13 to 15. Overall, 650 helmets were given away and 167 bicycles were

impounded. The presence of education and the helmet giveaway program makes it difficult to determine the overall impact of the bicycle impoundment because it is impossible to subtract the impact of the education program and the helmet give-away given that the program components were implemented simultaneously. It would be useful to evaluate the efficacy of bicycle impoundment alone on helmet use. Impounding a bicycle would be a more practical approach then attempting to ticket parents for their child's infraction. Ticketing parents for their child's helmet infraction could lead to court challenges and would likely compromise public support.

Experts in the field are finding that it is challenging to pass State bicycle helmet laws and that local jurisdictional laws may be a more practical way to increase coverage in areas with significant bicycle use. However, the number of States and other jurisdictions with bicycle helmet laws has shown a large increase recently (Bicycle Helmet Safety Institute, 2012).

The most commonly employed countermeasures to increase bicycle helmet use other than legislation include helmet give away programs and education programs. Two studies evaluated the effects of a helmet giveaway program on helmet use (Logan et al., 1997; Parkin et al., 1995). They found an extensive helmet giveaway program failed to produce an increase in helmet use among low-income students. Logan et al. (1997) found that a helmet giveaway program increased bicycle helmet use in elementary aged students from 3 percent to 38 percent, but had no effect on bicycle helmet use of middle school students. This data suggests that giving middle school students helmets alone will not increase their helmet use. Parkin et al. (1993) evaluated the effects of an educational program on bicycle helmet use at 18 Canadian schools. They found an increase in helmet use from 3.4 percent to 16 percent following the introduction of the educational intervention. It is interesting to note that a meta-analysis of non-legislative interventions to increase helmet use among children and young people found stronger evidence for effectiveness for studies with short-term follow-up than those with longer-term follow-up (Royal, Kendrick, & Coleman, 2007). They recommended that future studies should assess long term helmet use and whether adults maintain helmet use when outside areas under supervision. One of the few studies examining whether helmet use is maintained when outside the range and time frame when data is typically collected is the Van Houten, Van Houten, and Malenfant study (2007).

Behavior strategies to change transportation safety behaviors related to the use of safety equipment have typically focused on seatbelt use. Some interventions employed to increase safety-belt use are posted feedback (Malenfant, Wells, Van Houten, & Williams, 1996), enforcement (Van Houten, Malenfant, & Rolider, 1985), peer monitoring (Cooper & Phillips, 2004), and incentives and rewards (Geller, Kalsher, Rudd, & Lehman, 1989).

Van Houten et al. (2007) applied these behavioral strategies to increase the helmet use of middle school children 11 to 14. A program that consisted of peer data collection of correct helmet use, education on how and why to wear a bicycle helmet correctly, peer goal setting, public posting of the percentage of correct helmet use, and shared reinforcers, all of which were implemented by the school resource officer, increased afternoon helmet use and afternoon correct helmet use in all three schools. Probe data collected at a distance from all three schools indicated that students did not remove their helmets once they were no longer in close proximity to the school, and probe data collected in the morning at two of the schools showed that the behavior change transferred to the morning. Two of the target schools had a history of helmet enforcement in the past while the third school had no history of enforcement. Helmet use increased from 82 percent to 98 percent and from 52 percent to 95 percent at the two schools with a history of enforcement

and from 14 percent to 45 percent at the school with no history of enforcement. The data from the pilot study suggest that the effects of enforcement as part of a comprehensive approach to increase helmet use can lead to higher use levels then when enforcement is absent.

Focus Group Interviews

Before beginning the study, pre-baseline, we conducted a simple focus group in a middle school that did not have a helmet safety program, in New Brunswick, New Jersey, a jurisdiction with a helmet use law, but one in which enforcement is relatively nonexistent. It became very clear that inaction on the part of school personnel, support staff, and school volunteers resulted in a generalized disregard for the law, low numbers of students bicycling to school and missed opportunities to promote the benefits of safe bicycling.

One meeting with a group of five middle school boys, who had not participated in a bicycle safety helmet or helmet safety program, revealed that bicycle safety is not one of their concerns. All of these students rode bicycles in their immediate neighborhoods, none wore helmets, and they admitted riding on the road against the traffic. They did not use reflective tape or lights on their bicycles. Although one of their friends broke a collarbone riding his bicycle during the summer, there was an attitude of nonchalance regarding bicycle safety. They responded that "It was an accident and accidents happen," when asked if the bike crash could have been prevented.

During the focus group discussion, we learned that although most of the boys rode bicycles, none rode their bicycles to school. Three of the five were driven to school by their parents and lived 1.86 miles (3 km) from school; one lived about half a mile from school (less than a kilometer) and was also driven to school. When the focus of the questions turned to bike helmets, only three had helmets; their response to why they did not wear them was, "I don't know," and "I only ride my bike in the neighborhood to see my friend." It appeared to be a non-issue for them. They did not have strong feelings against wearing bicycle helmets. They did not seem to think that it was necessary. It appears they do not think crashes happen close to home. This data resembles that for seat belt use when seat belts were first introduced, where drivers reported that there was less need to wear seat belts when driving close to home (Campbell, Waller, & Council, 1967; Waller & Barry, 1969).

Comments by the group of boys were more encouraging when the discussion turned to the elements of the program. They reacted well on the prospect of actively participating in a fun program where interested students would have the chance to set goals, collect data, post data in a public location, and attend assemblies to review their progress and celebrate their successes. The idea of a final pizza party was very well received and they reacted well to the prospect that they would in large measure be running the program with the assistance of an adult coordinator.

A meeting to discuss the issue with the vice principal of the school revealed that bicycle safety was not on a list of priorities. Nevertheless, we were left with the impression that the school administration would be supportive of our program if:

- The program did not unduly disrupt classroom instruction; and
- The 8- to 10-week program was under the supervision of a trusted coordinator.

The focus group and administrative interview were productive because we learned the students would actively participate in the program we described to them, not because of their interest in bicycle safety and helmet use, but mostly because of the possibility of actively participating in a

program where they could assume responsibility, have a sense of ownership combined with fun activities culminating with a final pizza party to celebrate their successes. We learned that students can be motivated to embrace a cause if we can make it clear to them that with a little effort and a well-structured program, they can produce desired changes in their milieu.

Expert Interviews

Interviews were conducted with willing Safe Routes to School (SRTS) State coordinators, those involved in the SRTS programs at the local levels, and SROs through available list-serves, and through NHTSA's regional offices across the country. (Experts were also asked to reach out to their States for interest in participation in the helmet use demonstration.) Revisions to the program, based on feedback from experts working with youth traffic safety issues, are summarized in the section that follows.

PROGRAM REVISIONS

While the pilot project yielded recommendations to improve the program, there was a significant lapse of time between receiving these recommendations and the start-up of the new project with NHTSA to enhance and then demonstrate the program. Therefore, as a part of the revision process, the researchers considered new findings from the focus group interviews, the expert interviews, and a literature review for anything new. Input from focus group and expert interviews provided valuable suggestions and recommendations to improve the program without compromising the objectives and the six guiding requirements of the proposed program. The following summarizes suggestions and ideas and were either incorporated into the NHTSA Helmet Safety Program for middle schools or were seriously considered for a second-generation program more adapted for high school students. There were 36 suggestions obtained from the following four sources:

- Helmet safety literature review - 13 suggestions;
- Adolescent behavior change literature - 7 suggestions;
- Experts in the field (safe routes to school, and bicycle safety) - 15 suggestions; and
- Focus group conducted with middle school students - 1 suggestion.

Recommendations for Revisions Prior to the NHTSA Demonstration

Recommendations for improving the program were obtained and considered prior to the program launch.

TREATMENT - SPECIFIC COUNTERMEASURE PROGRAM

The following seven elements represent the "treatment" for the program:

1. **Education.** At the start of the helmet program, the SROs/SRDs called all of the students who rode their bicycles to school to an assembly. During this assembly the SROs/SRDs explained the importance of helmet use, and reviewed the reasons for wearing a bicycle helmet. The SROs/SRDs also showed a video on the correct fitting of bicycle helmets.

2. **Feedback.** Students were told peers would be collecting data on helmet use, and the percentage of correct helmet use each week would be posted on a chart in the cafeteria along with the record, and another displayed at the administrative office at the school entrance. The peer data collection procedure was initiated during the afternoon of the assembly, and the charts were put up showing the baseline mean level of correct helmet use. An example of the feedback chart is shown in **Appendix A**.
3. **Goal Setting.** Students were then asked to select a helmet-use goal for the school. Students set the goal by consensus. If they initially suggested too low a goal, the officer would suggest to the students that they were selling themselves short.
4. **Shared Reinforcers.** Students were told that if they met their goal they would celebrate their success with a party with pizza, ice cream, soda and small prizes. They were also told a bicycle had been donated and it would be raffled off at the party. With the exception of the bicycle, all prizes were safety related promotional materials such as LED lights
5. **Helmet Distribution.** At the end of the meeting, free helmets were given to students who did not have helmets and helmet fit was taught and assessed by the SROs/SRDs for proper fit. Each week the SROs/SRDs met briefly with the peer observers to collect their data sheets. After this meeting the percentages displayed on the charts were changed based on data collected by the student observers. All participating students received two stickers of their school mascot to apply to their helmets. **Appendix B** shows a picture of a helmet with a sticker attached.
6. **Community Service Credit.** The school coordinators were encouraged to arrange for the awarding of community service credits and certificates to students who participated in data collection or took on extra activities. An opportunity for earning credit was announced to students.
7. **Student Ownership.** Student observers were also given black T-shirts with the program logos. See **Appendix C** for an artist's proof of the front and back print on the T-shirt.

Note - See videos, clips, and downloadable pieces for the middle school project including the "Play Me First" video, clips under the heading "Middle School Topics," and "Downloadable" materials at: http://www.cers-safety.comm/hsp.htm.

METHOD AND DESIGN

1. Site Selection

Varying school districts were considered for this project to represent different demographic regions of the United States. Districts selected expressed an interest in the program and found schools in the district that agreed to participate. It is important to note that the participating schools did not apply to participate, but were asked to participate.

The following site selections were made in order to ensure a broad sampling of regions:

- Three school districts in the Midwest (Michigan);
- Two school districts in the Southeast (Florida); and

- One school district in the Southwest (Arizona).

Michigan:
- Portage West Middle School and Portage North Middle School;
- Parchment Middle School; and
- Mona Shores Middle School.

Florida:
- Gainesville's Kanapaha Middle School, Westwood Middle School, Fort Clark Middle School, and Howard Bishop Middle School; and
- Orange County's Stonewall Jackson Middle School.

Arizona:
- Phoenix School District's Paseo Hills Middle School, Amberlea Middle School, and Explorer Middle School.

2. Program Timeline

The four schools in Michigan were treated first because the riding typically only occurred until the end of October. The Florida schools were treated second and the Arizona schools were treated last. Data collection started on September 7, 2010, in Michigan and the treatment was introduced September 20-26, 2010. Data collection began October 5-12, 2010, in Gainesville and the treatment was introduced October 27-November 9, 2010. Data collection at Stonewall Jackson Middle school began on February 22, 2011, and the treatment began on March 11, 2011. Data collection began between October 12, 2010, and January 6, 2011, at the Phoenix schools and treatment began January 15-March 24, 2011.

3. Participants and Setting

Participants were middle school students who rode their bicycles to school from the 12 schools.

4. Primary Measures

- **Adult Observers.** A paid adult observer/data collector recorded helmet use at the end of the school day at each of the 12 schools. Observers recorded whether the helmet was on the student's head and whether the helmet was worn correctly. To be scored as correctly worn, the helmet had to be buckled snugly (the loop formed by the buckle must not form a loop the observer estimated would accommodate more than a few fingers), and the helmet needed to be level (no more than two finger widths above the eyebrows exposing the forehead.

  The percentage of students wearing bicycle helmets each day was computed by dividing the number of children wearing helmets by the total number of children bicycling. The percentage of helmets worn correctly was calculated by dividing the number of children wearing helmets correctly by the total number of children bicycling. The school coordinator trained all adult and student observers by illustrating each of the possible response outcomes for correct helmet use. The school coordinator was referred to the module in the training program to train them on how to score helmet use and correct helmet use. A member of the research team verified that they could correctly score helmet use after completing the module.

- **Peer Observers.** The school coordinator (SROs/SRDs or other adult school staff personnel) at each school selected and trained students to observe and record bicycle helmet use, and correct bicycle helmet use. During the treatment condition, one or two peer observers were assigned to observe helmet use each day. Helmet use was observed and recorded the same way by student observers as the adult observers. The school coordinators trained observers to record helmet use by demonstrating examples of correct and incorrect helmet use and showing the children a video on correct helmet use from the on line program. Student observers were taken outside as a group on the first day of the intervention and observed and checked on their recording of helmet use of students departing school on bicycles. The school coordinator reviewed whether each helmet was scored correctly or incorrectly. Students were trained to use the same definitions for target behaviors employed by adult observers. A peer observation data sheet is presented in **Appendix D.**

- **Additional Measures.** Paid and trained adult data collectors (observers) recorded helmet use at the end of the school day, in the morning and at a distance from the school in the afternoon at each of the participating 12 schools. These observers recorded whether the helmet was on the student's head and whether the helmet was worn correctly at sites away from school grounds, and without the knowledge of students. To be scored as correctly worn, the helmet had to be buckled snugly (the loop formed by the buckle could not form a loop the observer estimated would accommodate more than a few fingers), and the helmet needed to be level (no more than two finger widths visible above the eyebrows). Adults collected three type of measures:

  (1) Helmet use in the afternoon were collected on a regular basis by adults either in a parked car or scored from a window overlooking the bike parking area.

  (2) Helmet use among children riding to school in the morning was collected as the students arrived at school by adults either in a parked car or scored from a window overlooking the bike parking area. Observers were instructed to collect this data at least 2 times during baseline and 2 times when the program was in effect.

  (3) Adult data collects also collected data on helmet use among children riding home from school at specified distances (approximately half a mile from the school). Observations outside the immediate half-mile school zone determined if the children removed their helmets after leaving the school area. Observers were instructed to collect this data at least 2 times during baseline and 2 times when the program was in effect.

This second measure was included because SROs in the pilot study indicated the middle school students were often observed removing their helmets after they thought they were no longer visible to the SRO. We asked adult data collectors to collect morning and distance data at least twice during each condition. Both measures were included to assess whether the treatment generalized over time and was maintained over distance.

5. Experimental Design

A multiple baseline design was used for this study. This design required collecting baseline data at all school sites before the treatment was applied. The treatment was introduced at a different point in time for each site. Each time a site received the treatment, additional baseline data was collected at the untreated locations. The untreated sites served as a control

for possible confounding variables, since significant changes should only be detected following the introduction of the treatment at each site.

This design controlled for changes in economic factors, weather, local publicity or other factors that could be confounded with the treatment because the treatment was sequentially introduced across regions. Therefore, this design allows for a comparison between the first treated sites with its own baseline as well as the baseline for the remaining two regions that have not yet received the treatment. Table 1 illustrates this design. By selecting jurisdictions that implemented the program at different points in time, we demonstrated that the changes in helmet use and correct helmet use only occurred following the implementation of the school helmet program.

Table 1: Staged Implementation of the Bicycle Helmet Program					
	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Southeast (FL)	Baseline	Treatment	Treatment	Baseline	Follow-up
Midwest (MI)	Baseline	Baseline	Treatment	Treatment	Follow-up
Southwest (AZ)	Baseline	Baseline	Baseline	Treatment	Follow-up

6. Program Methodology

The following steps were used in setting up and implementing the program:

Step One: The research team obtained all required approvals and arranged for data collection of baseline helmet use.

Step Two: School coordinators at each school were instructed to select peer leaders and create a peer leadership committee with criteria for selection being those students with leadership qualities and popularity with the student body. Coordinators were to describe the role and responsibilities of the peer leader in the project which included recording data on helmet use and reminding other students to wear their helmets; informing them that by agreeing to participate they would earn a service credit for their work; that they would be asked to assist in posting the percentage of bicyclists wearing their helmets each week on charts located in the school.

Step Three: School coordinators were instructed to assist in organizing an initial assembly to explain the program to all students who rode their bicycle to school. A PowerPoint presentation was provided for use at the assembly. At schools with an SRO or an SRD, the officer made the assembly presentation. At schools, without an SRO or SRD, the school coordinator made the presentation. This presentation took an average of 40 minutes, and included: (1) discussing bicycle safety and the importance of bicycle helmets in preventing head injuries and the risks of riding without a properly worn helmet; (2) viewing a video presentation on proper helmet use; (3) selecting a target goal for helmet use; (4) providing a hands-on peer demonstration and practice of proper helmet fit and use; (5) reviewing supplemental written materials; (6) discussing how the program will work including, peer data collection, weekly publicly posted percent of helmet use and proper helmet use; and (7) selecting celebration of group success, such as a pizza party and small prizes, at the end of the study.

Step Four: Those agreeing to participate, and wanting helmets were given one along with two stickers showing the school mascot designed to be placed on the helmet. Students were then given assistance in fitting their bicycle helmets.

Step Five: Student data collectors collected data on correct helmet use. The school coordinators were instructed to be present after school to provide necessary assistance, answer questions, and praise the data collectors and the bicyclists (Days 1 and 2 only). School coordinators were also instructed to meet weekly with student data collectors and assist in posting the percentage of students wearing a bicycle helmet each week. In one case, a member of the school staff collected the data.

Step Six: The weekly helmet use was calculated by the peer observers and posted on the charts at the beginning of each week.

- The school principal was asked to send out weekly emails via the school's list serve to inform the staff, school district officials and parents.
- The SRO or SRD assigned to the school was asked to encourage bicycle helmet use and to enforce the bicycle helmet law. Law enforcement officers were encouraged to begin with warnings and an information flyer in jurisdictions where police did not have a history of enforcement of bicycle laws. Unfortunately officers did not use the warnings or information flyers. Officers were also encouraged to stop about 10 middle school students a week for properly wearing their helmets to praise them, and hand bicyclists a card prepared by the research team, signed and dated by the officer. The card read "Caught Riding Your Bicycle Safely by the _____ Police Force. Keep it up and encourage your friends to do the same! Thank you." SROs and SRDs were reluctant to enforce helmet use and it was not possible for the researchers to demand that they do. The SRD at Kanapaha Middle school did indicate he did implement this component but stopped because students were embarrassed because other students may have thought they did something wrong. We have no evidence whether it was done at any of the other schools.

Step Seven: A final assembly was held to celebrate the increase in helmet use.

RESULTS

Group Data

Group data on correct helmet use at all three regional locations is presented in Table 2. This data included: (1) all students with helmets on their heads regardless of whether the helmets were buckled; (2) the helmet straps were sufficiently tight; and/or (3) the helmets sat level on their heads. The introduction of the treatment led to an increase in student helmet use at all sites. Helmet use was significantly higher than baseline at all but one site (see Table 3 for mean levels during each condition), Fort Clark Middle School, which had the highest baseline level of helmet use prior to treatment. Follow-up data was not collected at one site, Explorer Middle School. The treatment at this school was not introduced until late in the year and the promised data, scheduled to be collected at the end of school year, was never received for analysis. Baseline level and the magnitude of the effect varied across sites.

Table 2: Percentage of School Bicycle Helmet Use at Varying Stages of Experimentation

Michigan						
Middle School	**Mona Shores**	**Parchment**	**Portage West**	**Portage North**		**MEAN**
Baseline Phase	**2**	**0**	**38**	**20**		**15**
Treatment Phase	**38**	**28**	**50**	**26**		**36**
Follow-up Phase	**32**	**6**	**25**	**20**		**21**
Florida						
Middle School	**Kanapaha**	**Westwood**	**Stonewall Jackson**	**Fort Clark**	**Howard Bishop**	**MEAN**
Baseline Phase	**21**	**54**	**6**	**73**	**3**	**31**
Treatment Phase	**54**	**85**	**25**	**76**	**16**	**51**
Follow-up Phase	**30**	**61**	**20**	**62**	**16**	**38**
Arizona						
Middle School	**Amberlea**	**Explorer**	**Paseo Hills**			**MEAN**
Baseline Phase	**0**	**0**	**11**			**5**
Treatment Phase	**38**	**14**	**24**			**25**
Follow-Up Phase	**25**	**NA**	**22**			**24**

Table 3 shows the percentage of correct helmet use. The percentage of correct helmet use was somewhat lower on average than the level of helmet use. The introduction of the treatment produced an increase in helmet use in all 12 schools and the level of correct helmet use during the follow-up condition was higher in 10 out of the 11 sites that collected follow-up data. Probe data showed that increases in helmet use, produced by the program, which only focused on afternoon helmet use, transferred to morning helmet use, and that helmet use was sustained at the distance measuring sites that were off school grounds. Transfer to morning and distance sites was most evident at sites that showed a large treatment effect.

Table 3: Percentage of Correct Bicycle Helmet Use per School During Each Experimentation Phase

Michigan						
Middle School	**Mona Shores**	**Parchment**	**Portage West**	**Portage North**		**MEAN**
Baseline Phase	**2**	**0**	**36**	**19**		**14**
Treatment Phase	**33**	**18**	**50**	**26**		**32**
Follow-up Phase	**32**	**0**	**25**	**20**		**19**
Florida						
Middle School	**Kanapaha**	**Westwood**	**Stonewall Jackson**	**Fort Clark**	**Howard Bishop**	**MEAN**
Baseline Phase	**21**	**54**	**6**	**73**	**3**	**31**
Treatment Phase	**51**	**85**	**25**	**76**	**16**	**51**
Follow-up Phase	**30**	**61**	**23**	**62**	**16**	**38**
Arizona						
Middle School	**Amberlea**	**Explorer**	**Paseo Hills**			**MEAN**
Baseline Phase	**0**	**0**	**14**			**5**
Treatment Phase	**37**	**15**	**24**			**25**
Follow-Up Phase	**25**	**NA**	**22**			**24**

Individual Data

Individual data for correct helmet use are presented for all sites in Figures 1, 2 and 3.

Figure 2: Individual data from each of the four Michigan middle schools.

- Baseline correct helmet use in Michigan varied between 0 percent and 36 percent with a mean level of 14 percent.
- The introduction of the treatment at the Michigan sites was associated with an immediate increase in helmet use at three of the four sites, West Portage, Mona Shores, and

Parchment, and little change at the North Portage. At all three of these sites morning helmet use also increased and helmet used was sustained at distance measurement sites. Data at the Parchment site showed more day-to-day variability than the other two responsive sites. The data at Mona Shores initially showed a large increase in helmet use to near 50 percent followed by a decline to a sustained lower level that was higher than baseline. The increase at Portage West also increased to 50 percent but them declined toward the end of the treatment period.

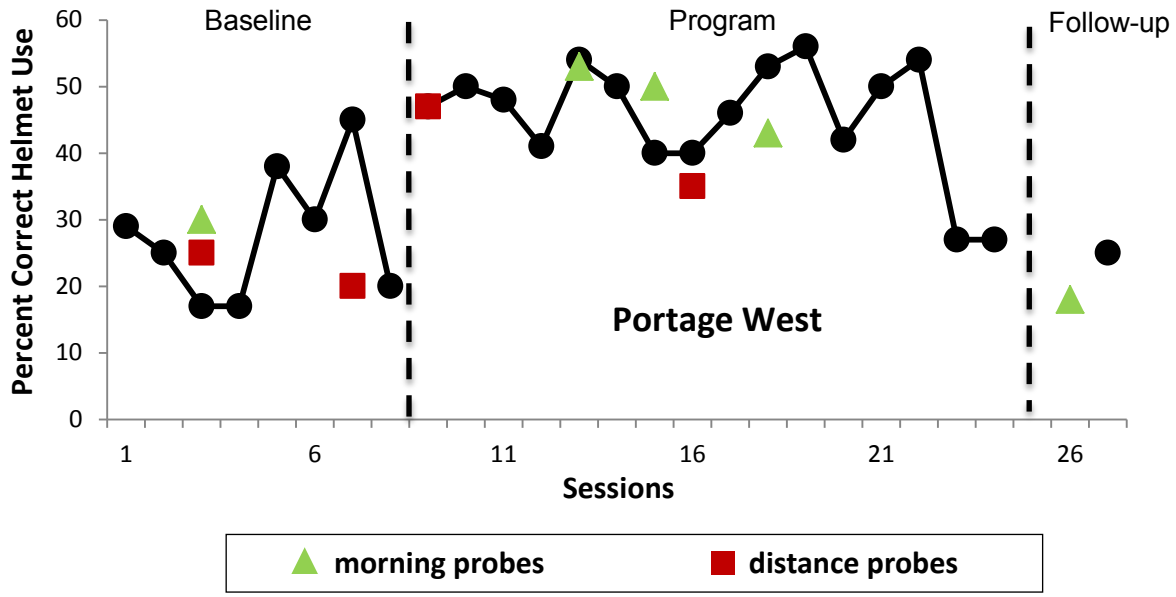
Figure 3: Individual data from each of the five Florida middle schools.

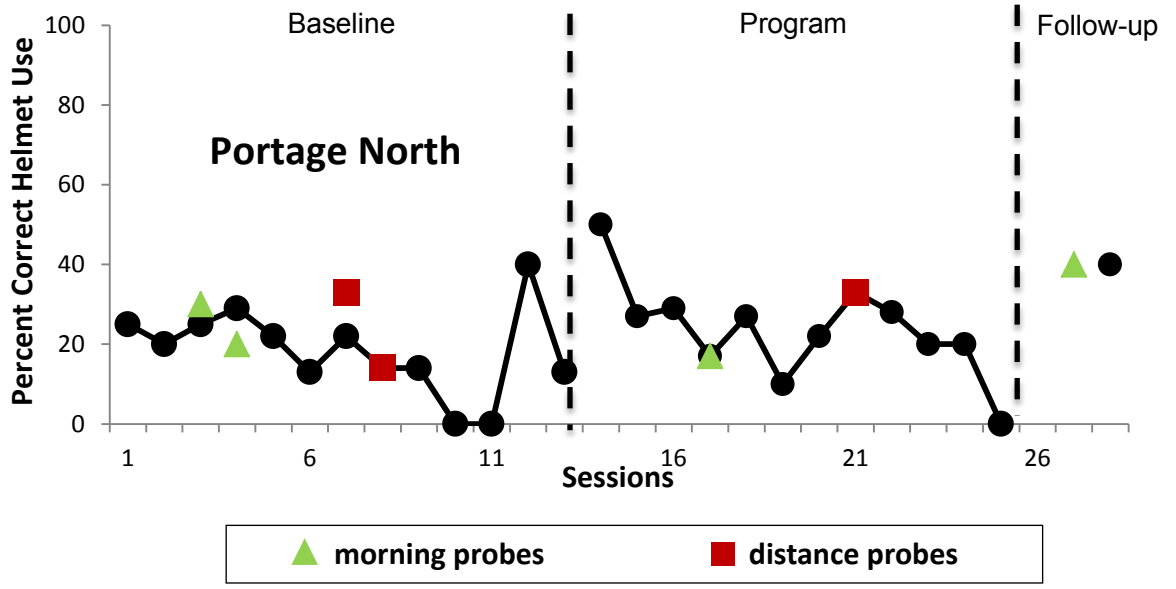
- Baseline helmet use varied between 3 percent and 73 percent with a mean of 31 percent.
- Following the introduction of the treatment program four of the five sites showed an increase in helmet (Kanapaha, Westwood, Stonewall Jackson and Howard Bishop).
- Helmet use at Westwood was sustained during the treatment condition and declined somewhat during the follow-up condition.
- Probe data also shows increases in morning helmet use, at three sites with probe morning data (Kanapaha, Westwood, and Stonewall Jackson), and increases sustained helmet use at a distance at two sites with probe distance measures (Kanapaha and Westwood). The treatment produced a more modest increase at Stonewall Jackson that was sustained during follow-up.

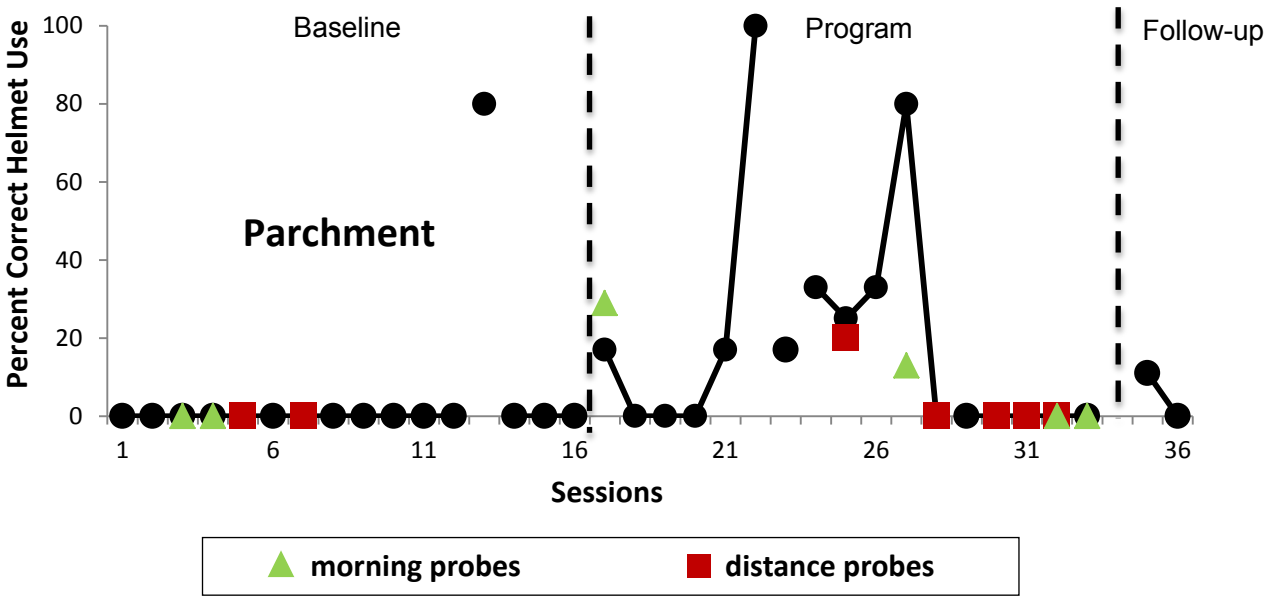
Figure 4: Individual data from each of the three Arizona middle schools.

- Baseline helmet use at these sites varied between 0 percent and 14 percent with a mean of 5 percent.
- Following the introduction of the treatment, two of the three sites show an increase in helmet use (Amberlea and Explorer).
- The remaining school (Paseo Hills) does not show an increase although the mean level of helmet use is somewhat higher during the treatment condition).
- The changes in correct helmet use were sustained at Amberlea.
- Morning and distance probe data collected at all three sites is consistent with the changes observed in correct afternoon helmet use.

Figure 1 (Michigan). Shows the percentage of students wearing their helmets correctly each day at the four Michigan schools. Green triangles are morning probes and red squares are distance probes.






Baseline
Program
Follow-up
Parchment
Percent Correct Helmet Use
100
80
60
40
20
0
1
6
11
16
21
26
31
36
Sessions
morning probes
distance probes

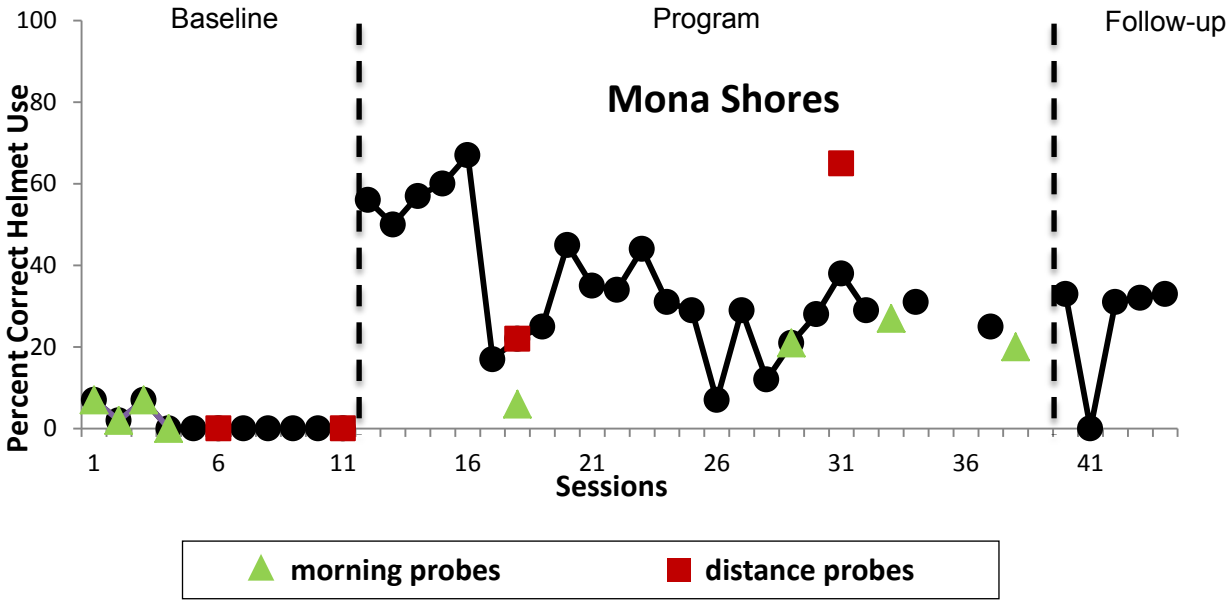
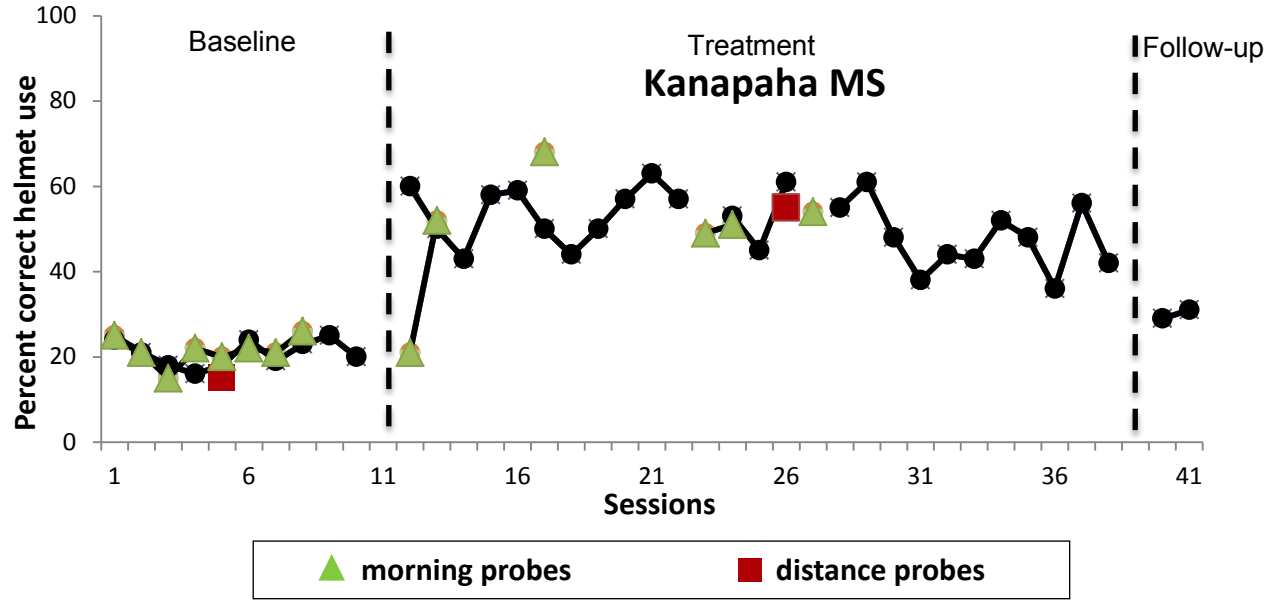
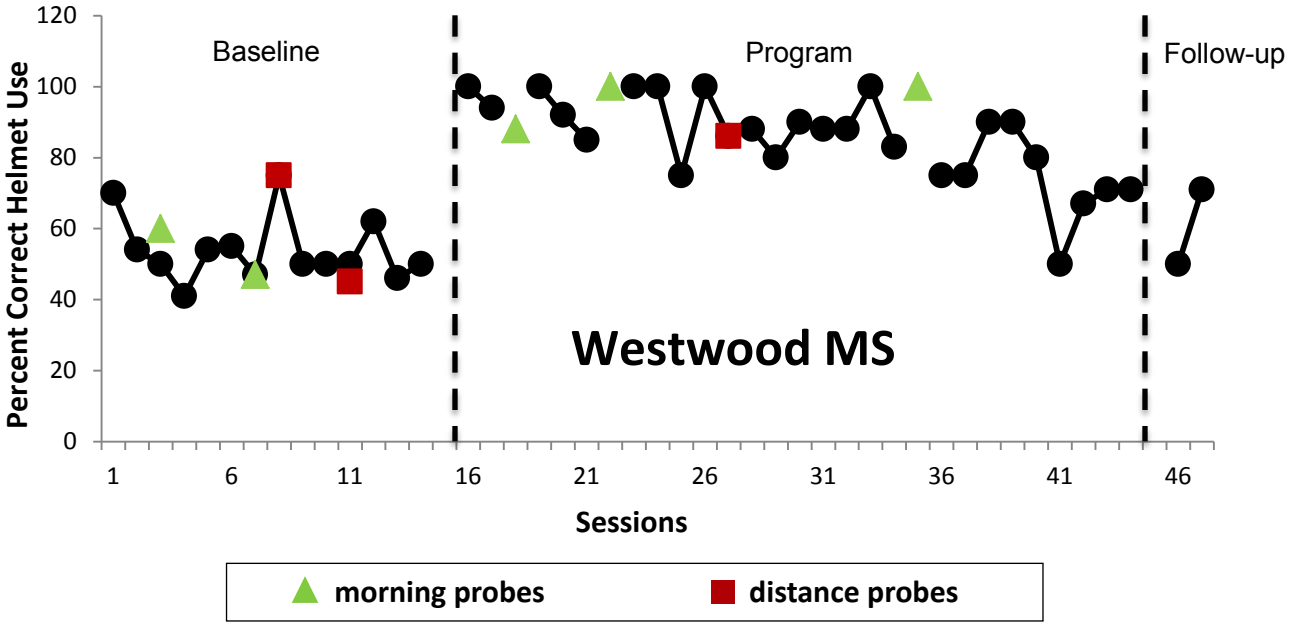
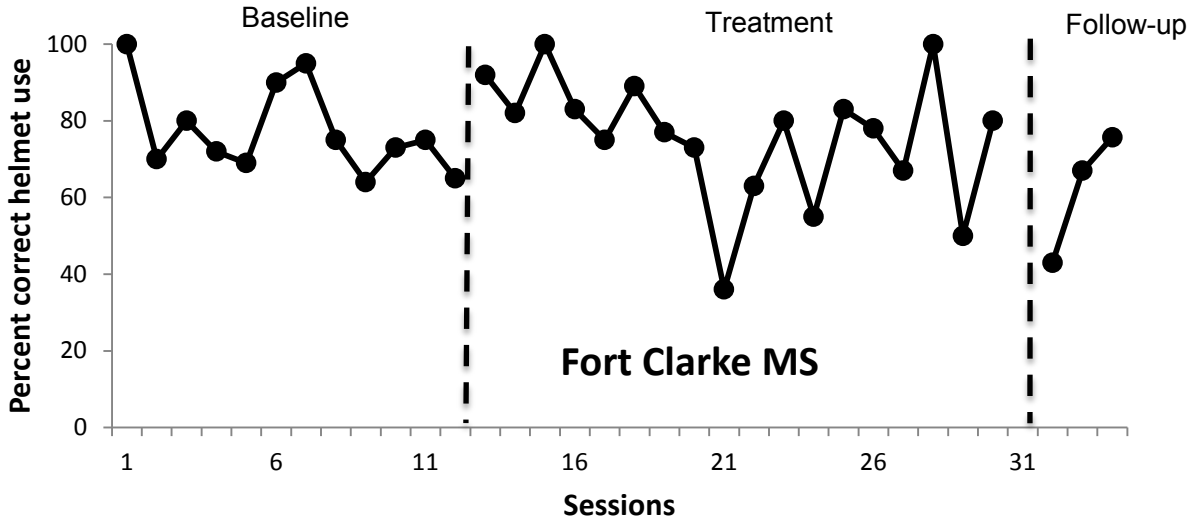
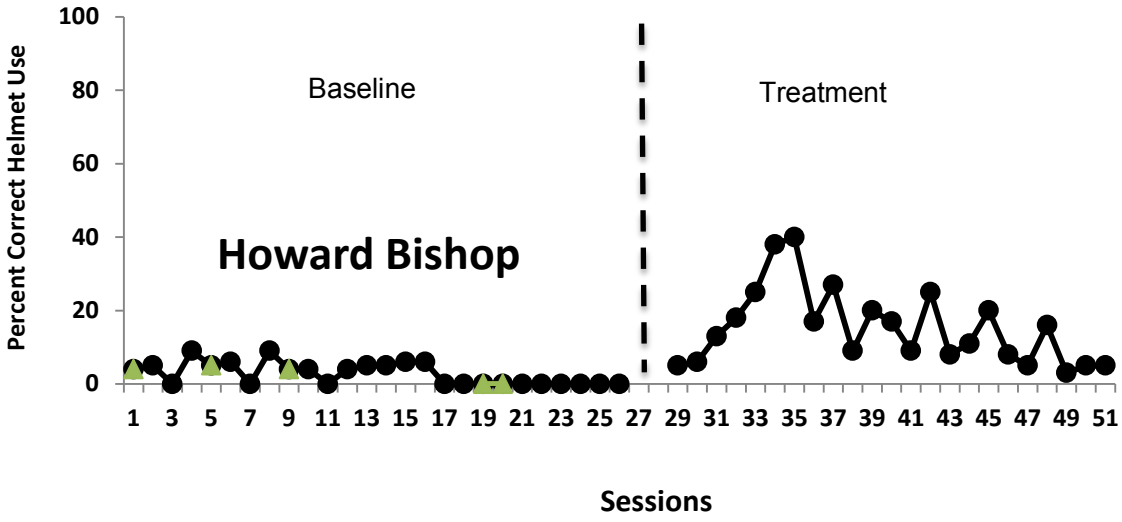

Baseline
Program
Follow-up
Mona Shores
Percent Correct Helmet Use
100
80
60
40
20
0
1
6
11
16
21
26
31
36
41
Sessions
morning probes
distance probes

Figure 2 (Florida). Shows the percentage of students wearing their helmets correctly each day at the five Florida schools. Green triangles are morning probes and red squares are distance probes.






Baseline
Treatment
Follow-up
Percent correct helmet use
100
80
60
40
20
0
Fort Clarke MS
1
6
11
16
21
26
31
Sessions


Percent Correct Helmet Use
100
80
60
40
20
0
Baseline
Treatment
Howard Bishop
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51
Sessions

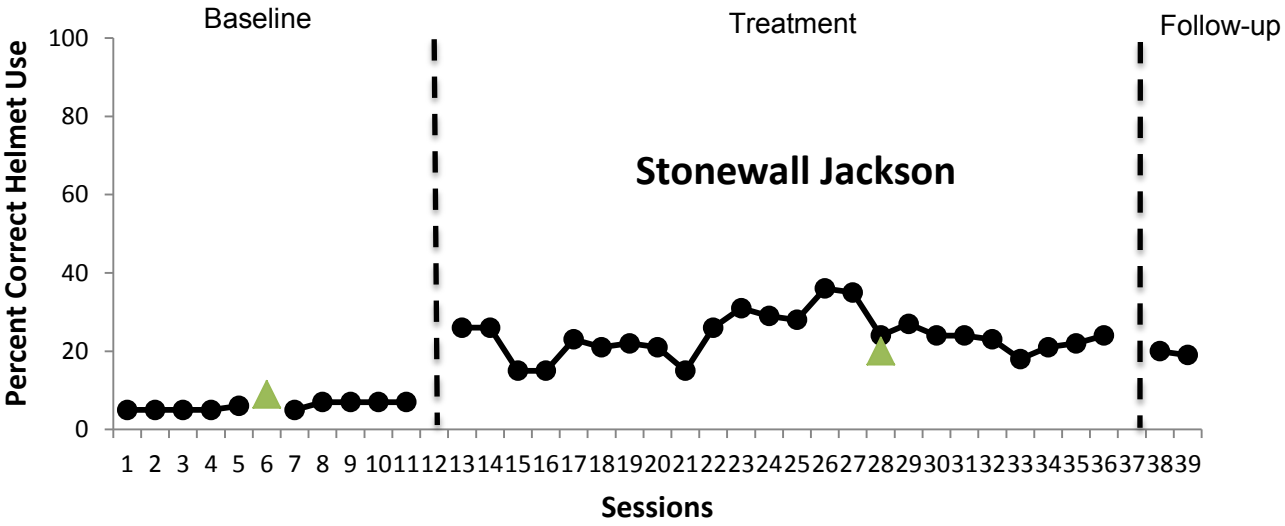
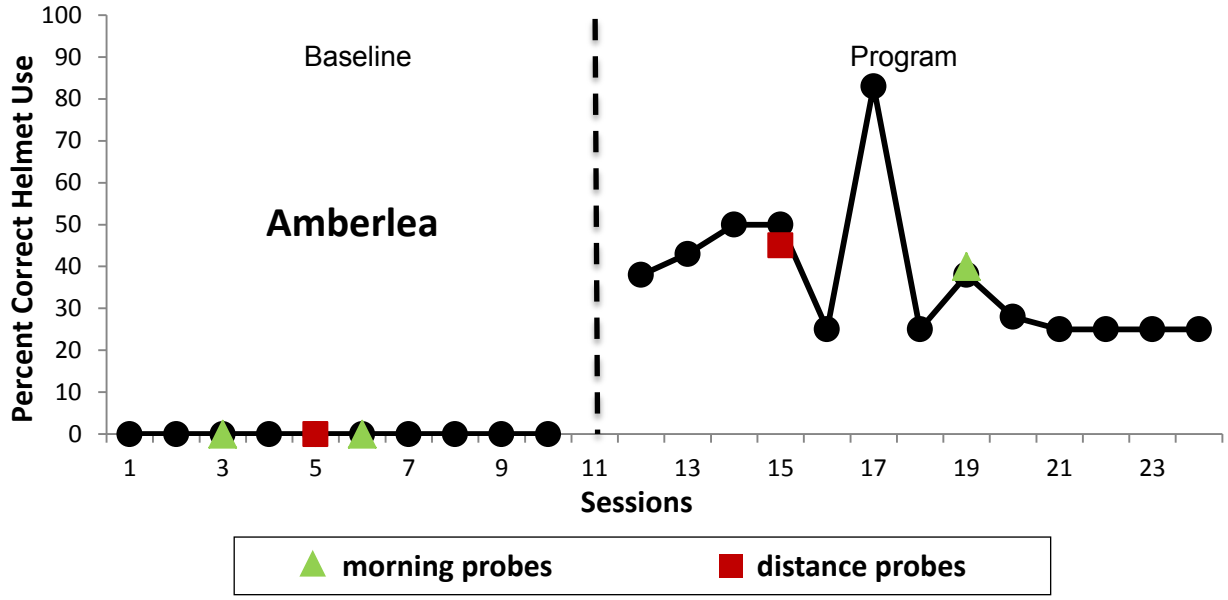
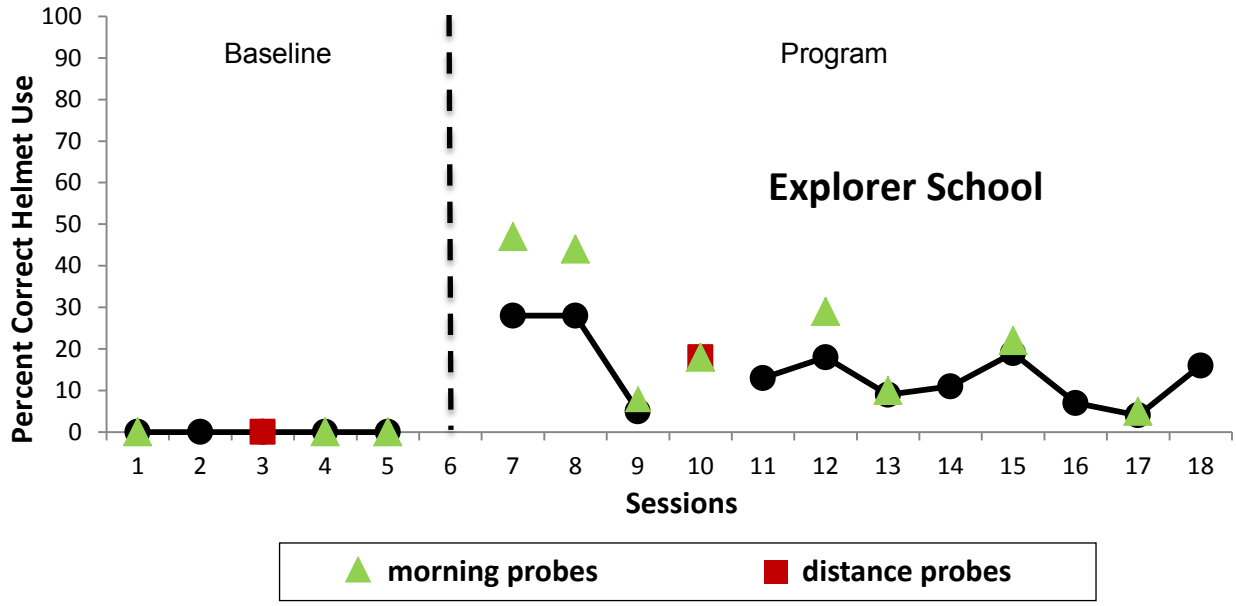
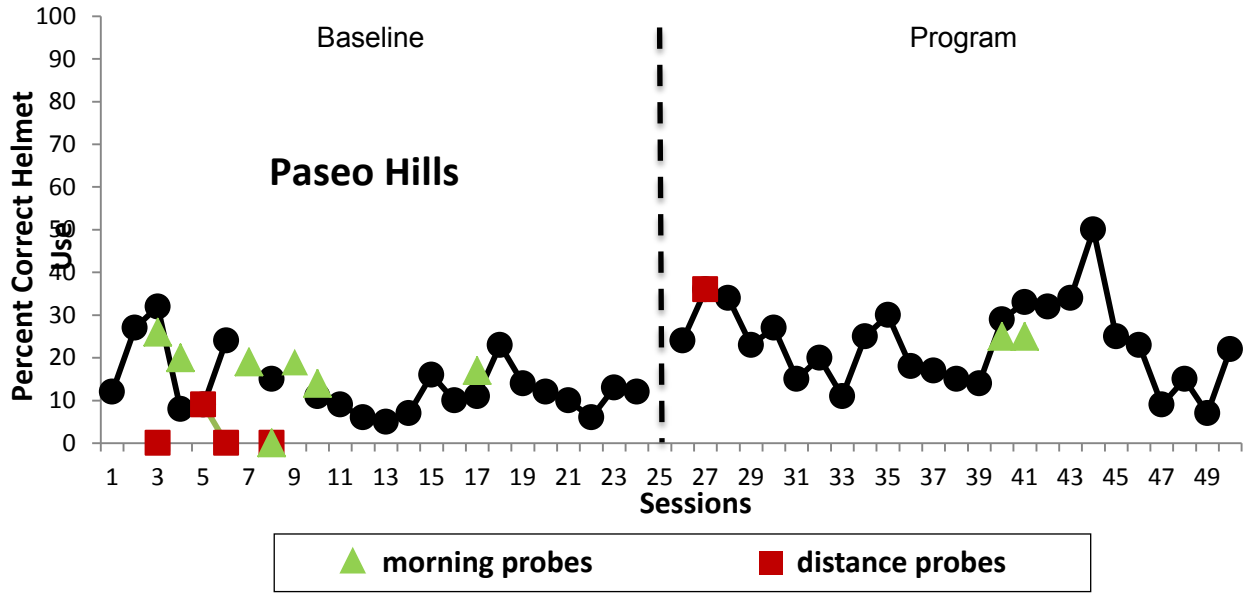

Baseline
Treatment
Follow-up
Percent Correct Helmet Use
100
80
60
40
20
0
Stonewall Jackson
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39
Sessions

Figure 3 (Arizona). Shows the percentage of students, wearing their helmets correctly each day at the three Arizona schools. Green triangles are morning probes and red squares are distance probes.







Statistical Analysis

T-tests were performed for each site. Included in the following tables are the means listed under group statistics for both baseline and treatment as well as the Levene's test for homogeneity of variance needed in order to determine which t value to use. Additionally, the overall effect for each State was calculated. The results indicated that the increase in correct helmet use was statistically significant at all but two schools. Further, the effects for each State were also statistically significant.

Michigan Results

The results for three of the four Michigan schools were significant. In Table 4, the group statistics and independent samples test for correct helmet use for West Portage Middle School in Michigan show a significant effect for an increase in helmet use (t score of 3.878, p = .001.

The results for correct helmet use at North Portage Middle School are not significant because the p value is .131, p = .05. This is one of the 2 schools out of the 12 that did not show significant increases in correct bicycle helmet use in response to the program.

At Mona Shores Middle School, equal variances were not assumed; therefore, we used the second t value of 9.908, p = .000. This site showed a large increase in correct helmet use that was sustained.

The results for Parchment Middle School were significant, with equal variances not assumed, with a t score of 3.108, p = .005.

Table 4: Statistical Analysis for Michigan Middle Schools							
West Portage (Michigan School)							
Group Stats	N	Mean	Standard Deviation	Standard Error Mean			
Baseline	11	36	0.11112	0.0335			
Treatment	19	50	0.09233	0.02118			
Independent sample test			Levene's test		t test for equality of means		
			F	Significance	t	df	Sig 2 tail
Equal variance assumed			0.422	0.521	3.878	28.0	0.001
Equal variance not assumed					3.686	17.995	0.002
North Portage (Michigan School)							
Group Stats	N	Mean	Standard Deviation	Standard Error Mean			
Baseline	15	19	0.10683	0.02758			
Treatment	14	26	0.12809	0.03423			
Independent sample test			Levene's test		t test for equality of means		
			F	Significance	t	df	Sig 2 tail
Equal variance assumed			0.26	0.614	1.556	27.0	0.131
Equal variance not assumed					1.546	25.413	0.135
Mona Shores (Michigan School)							
Group Stats	N	Mean	Standard Deviation	Standard Error Mean			
Baseline	15	2	0.03114	0.00804			
Treatment	28	33	0.1565	0.02958			
Independent sample test			Levene's test		t test for equality of means		
			F	Significance	t	df	Sig 2 tail
Equal variance assumed			15.805	0.000	9.804	41.0	0.000
Equal variance not assumed					9.908	30.813	0.000
Parchment (Michigan School)							
Group Stats	N	Mean	Standard Deviation	Standard Error Mean			
Baseline	14	0	0.00000	0.00804			
Treatment	25	18	0,28573	0.02958			
Independent sample test			Levene's test		t test for equality of means		
			F	Significance	t	df	Sig 2 tail
Equal variance assumed			15.208	0.000	2.312	37.0	0.026
Equal variance not assumed					3.108	24.0	0.005

Florida Results

The results for four of the five schools in Florida were statistically significant. The results of the statistical analysis for the five Florida middle schools are presented in Table 5.

- Westwood Middle School, with equal variances assumed, resulted in a t of 8.077, p = .000. The treatment produced a large increase at this site.

- Stonewall Jackson Middle School, equal variances not assumed, resulted in a t value of 11.030, p = .000 level. The treatment produced an effect at this site that was sustained at follow-up.
- Kanapaha Middle School, with equal variances not assumed, yielded a t value of 16.230, p = .000. This site showed a robust effect.
- Fort Clarke Middle School, with equal variances assumed, had a t score of 0.419, p = .05. This was the second of the two sites that did not show a significant increase in correct bicycle helmet use.
- The change in correct helmet use at Howard Bishop Middle School is significant with equal variance assumed yielded a t score of 5.618, p = .000.

Table 5: Statistical Analysis for Florida Middle Schools							
Westwood School							
Group Stats	N	Mean	Standard Deviation	Standard Error Mean			
Baseline	16	54	0.08976	0.02244			
Treatment	31	85	0.13852	0.02488			
Independent sample test			Levene's test		t test for equality of means		
			F	Significance	t	df	Sig 2 tail
Equal variance assumed			3.307	0.076	8.077	45.0	0.000
Equal variance not assumed					9.232	42.462	0.000
Stonewall Jackson							
Group Stats	N	Mean	Standard Deviation	Standard Error Mean			
Baseline	11	6	0.01328	0.00400			
Treatment	16	25	0.0647	0.01618			
Independent sample test			Levene's test		t test for equality of means		
			F	Significance	t	df	Sig 2 tail
Equal variance assumed			11.482	0.002	9.235	25.0	0.000
Equal variance not assumed					11.030	16.8	0.000
Kanapaha							
Group Stats	N	Mean	Standard Deviation	Standard Error Mean			
Baseline	20	21	0.0317	0.00709			
Treatment	31	51	0.0933	0.01676			
Independent sample test			Levene's test		t test for equality of means		
			F	Significance	t	df	Sig 2 tail
Equal variance assumed			9.788	0.003	13.615	49.0	0.000
Equal variance not assumed					16.230	39.691	0.000
Fort Clark							
Group Stats	N	Mean	Standard Deviation	Standard Error Mean			
Baseline	15	73	0.13695	0.03536			
Treatment	18	76	0.16669	0.03929			
Independent sample test			Levene's test		t test for equality of means		
			F	Significance	t	df	Sig 2 tail
Equal variance assumed			0.483	0.492	0.419	31.0	0.678
Equal variance not assumed					0427	30.998	0.673
Howard Bishop							
Group Stats	N	Mean	Standard Deviation	Standard Error Mean			
Baseline	28	3	0.03037	0.00574			
Treatment	21	16	0.16669	0.02274			
Independent sample test			Levene's test		t test for equality of means		
			F	Significance	t	df	Sig 2 tail
Equal variance assumed			20.167	0.000	5.618	47.0	0.000
Equal variance not assumed					5.618	22.56	0.000

Arizona Results

The results for the three Arizona schools are presented in Table 6. The increases in correct bicycle helmet use at all three schools in Arizona were found to be statistically significant.

- The results for Paseo Hills Middle School, with equal variances assumed, were significant at the .000 level of significance; the treatment mean was 24 percent and baseline mean was 14 percent.
- Amberlea Middle School, with equal variances not assumed, yielded a t value of -8.536, p = .000 with a baseline mean was 0 and treatment mean was 37 percent.
- At Explorer Middle School, equal variances were not assumed, and the t value was -6.312, p = .000. The baseline mean was 0 percent and a treatment mean was 15 percent.

Table 6: Statistical Analysis for Arizona Middle Schools							
Paseo Hills							
Group Stats	N	Mean	Standard Deviation	Standard Error Mean			
Baseline	29	14	0.0737	0.01369			
Treatment	26	24	0.10028	0.01967			
Independent sample test			Levene's test		t test for equality of means		
			F	Significance	t	df	Sig 2 tail
Equal variance assumed			2.348	0.131	4.229	53.0	0.000
Equal variance not assumed					4.159	45.541	0.000
Amberlea							
Group Stats	N	Mean	Standard Deviation	Standard Error Mean			
Baseline	11	0	0	0.00000			
Treatment	14	37	0.16281	0.04351			
Independent sample test			Levene's test		t test for equality of means		
			F	Significance	t	df	Sig 2 tail
Equal variance assumed			12.752	0.002	7.532	23.0	0.000
Equal variance not assumed					8.536	13.0	0.000
Explorer							
Group Stats	N	Mean	Standard Deviation	Standard Error Mean			
Baseline	6	0	0	0.00000			
Treatment	12	15	0.08049	0.02324			
Independent sample test			Levene's test		t test for equality of means		
			F	Significance	t	df	Sig 2 tail
Equal variance assumed			13.147	0.002	4.395	16.0	0.000
Equal variance not assumed					6.312	11.0	0.000

Degree of Adult Coordinator Effort

There was considerable variability in effort displayed by different adult coordinators, and these efforts seem to be reflected in the magnitude of the effects produced at the various schools. Some coordinators appeared to do the bare minimum while others were more enthusiastic and willing to follow the program materials with greater fidelity. Because the purpose of the study was to determine if the materials could be effective without support from the researchers, the research team did not intervene to correct these problems, with the exception of contracts to ensure they sent the required data.

DISCUSSION

Overall Results

Baseline helmet use varied across schools in each of the regions with the highest percentage of helmet use at the Florida sites and the lowest overall percentage of helmet use at the Arizona sites. It is possible the treatment was most effective in Florida because it was the only State with a bicycle use law. Although the statistical analysis confirmed that the bicycle helmet program increased bicycle helmet use in all three regions, the results varied considerably between sites. On average, the Florida sites were associated with the highest level of correct helmet use during the treatment condition.

Comparison with Pilot Study Results

Although the treatment increased helmet use, it did not produce the high level of helmet use observed in the pilot study in three Florida schools. There are many possible explanations but the most likely explanation was the absence of enforcement at all sites, including the Florida sites. In the pilot study, officers at two of the middle schools vigorously enforced helmet use by citing drivers that did not wear helmets, and sometimes impounding bicycles until the parents picked them up during the baseline condition. Helmet use increased to near 100 percent and correct helmet use increased from 30 percent and 64 percent to 78 percent and 80 percent at these two schools after the helmet program was added to enforcement carried out by the school resource officers (SROs). At the remaining school, the SRO did not conduct helmet enforcement before or after the program was introduced. At this school, correct helmet use only increased from 9 percent to 40 percent. At all three schools, the SRO was committed to the program and met regularly with the students recording helmet use each week for 5 minutes. These three officers carried out the program with a high degree of fidelity. At some of the sites, in the current study, helmet use changes were similar to those obtained at the pilot schools, where no enforcement was conducted.

Lessons Learned

Lesson One:

A program coordinator must be included and demonstrate an active commitment and presence to the program to potentiate the effects of the peer program. Results of the study make it clear that it is unrealistic to increase helmet use by middle school students by using positive reinforcement and information of the safety benefits of helmet use alone. The results of our study indicate it is possible to significantly increase correct helmet use with positive reinforcement and information. However, if the goal is to attain and sustain levels of helmet use compliance above 80 percent,

the results of the pilot study and this study taken together strongly suggest that sanctions for students that fail to observe the law regarding the use of helmets when bicycling may be required.

Enforcement is one way to give credibility to helmet use. Although one could argue it is essentially a safety issue, students are likely aware that enforcement reflects risk. They know that young children need to be in child restraints, that older children need to be restrained in a seatbelt. They also know that law enforcement officers enforce these safety laws. **If they can ride by their resource officer repeatedly without helmets with no consequence it could send the unintended message to children that they do not consider this rule to be important as other problems they are addressing**. In jurisdictions with a State statute or municipal code regulation requiring bicycle helmets, it is important that the rule be enforced. Absent a State law, the school can pass a rule that requires students to wear helmets if they ride their bicycles to school. Enforcement need not involve writing citations, it is also possible to impound bicycles until the child presents a helmet and leaves school with the helmet or until the officer can contact a parent.

One of the unintended side effect of the helmet law for bicyclists in Florida is that it unwittingly conveys the message that children and younger teens need to wear their helmets because of their age and that it is no longer necessary to wear helmets once they reach16. At the Stonewall Jackson Middle School, 16-year-old students refused to wear their helmets, and the SRO could do little to convince them to wear them. The younger students reported they felt that helmet use was for kids, not for older teens and for adults. The law conveys the old message, "Don't do as I do, do as I say," because you are too young to behave like an adult.

Lesson Two:

The program may not produce substantial results without a champion who is willing to help the students organize the program and ensure on-going support for their efforts. Those teachers who were most enthusiastic about the helmet program obtained the best results for helmet use. Mona Shores, Kanapaha, Westwood, and Amberlea all had a coordinator who strongly championed the program. The correct helmet use averaged 51 percent between these four sites; similar to the high helmet use rate found in the three pilot schools. Perhaps this shows that a strong coordinator, even in the absence of enforcement, can generate similar increases in helmet use in this age population. The clear message was that this program will not be effective when implemented by a mildly interested adult supervisor in the school not willing to be put in the required effort.

Lesson Three:

Involving students as data collectors and in a leadership role is a realistic objective. We have found that the data collected by student data collectors is as reliable as the data collected by paid adult data collectors. When students play a leadership role and assume responsibility for the program, they promote a sense of ownership by all participating students. We noticed that the best intentioned adult supervisors tended to do some of the students work, such as posting weekly helmet use signs in the school, in order to save time. In other cases, the percent used for the feedback signs were based on the adult supervisors' data, again, to save time and effort. It does require more effort to get students to assume their responsibilities than to do the tasks for them.

Future Directions

These results show that a stand-alone bicycle helmet program is not enticing enough to produce high levels of bicycle helmet use as was hoped. However, including it as part of a more encompassing community based effort that includes competition and incorporating other tracking goals such as times bicycled, distance bicycled, calories burned, and energy saving, might be more appealing to this age group. Future research should examine:

- Whether including exercise and energy conservation goals would be more effective in producing student buy-in to the program.
- Whether the program could be implemented through other settings besides or in addition to schools. Encouraging safe bicycling and helmet use in other community based programs or activities (Boys and Girls Clubs, after school programs, summer camps, or even by a community swim clubs) could reach more youth.
- The role of implementing a clear school regulation on bicycle helmet use by students commuting to school. Other variables that could be studied is the use of an email list serve to keep parents informed about the program and the use of a semi-formal written pledge by each participating student, as well as parents.

Should a school embrace a bicycle helmet policy for students riding to school, we strongly suggest that the policy include helmet use by all school staff and parents bicycling to school with their child. Further, consideration should also be given to including a be a "Roll Model" campaign in which adults are also encouraged to lead by example by wearing helmets when riding and follow the same rules and responsibilities as they expect of children. For more information on the "Roll Model" campaign see:
www.nhtsa.gov/Driving+Safety/Bicycles/Be+a+Roll+Model

SUMMARY

The demonstration of the youth bicycle helmet program produced a significant increase in helmet use at almost all the participating middle schools. Statistically significant increases in helmet use are not enough unless a large proportion of middle school bicyclist can be influenced to wear a bicycle helmet. These data taken together indicate that it is necessary to have a strong enforcement component to accompany the positive peer program. Data also indicated that obtaining the best results involves having an adult who will make the commitment to shepherd the program.

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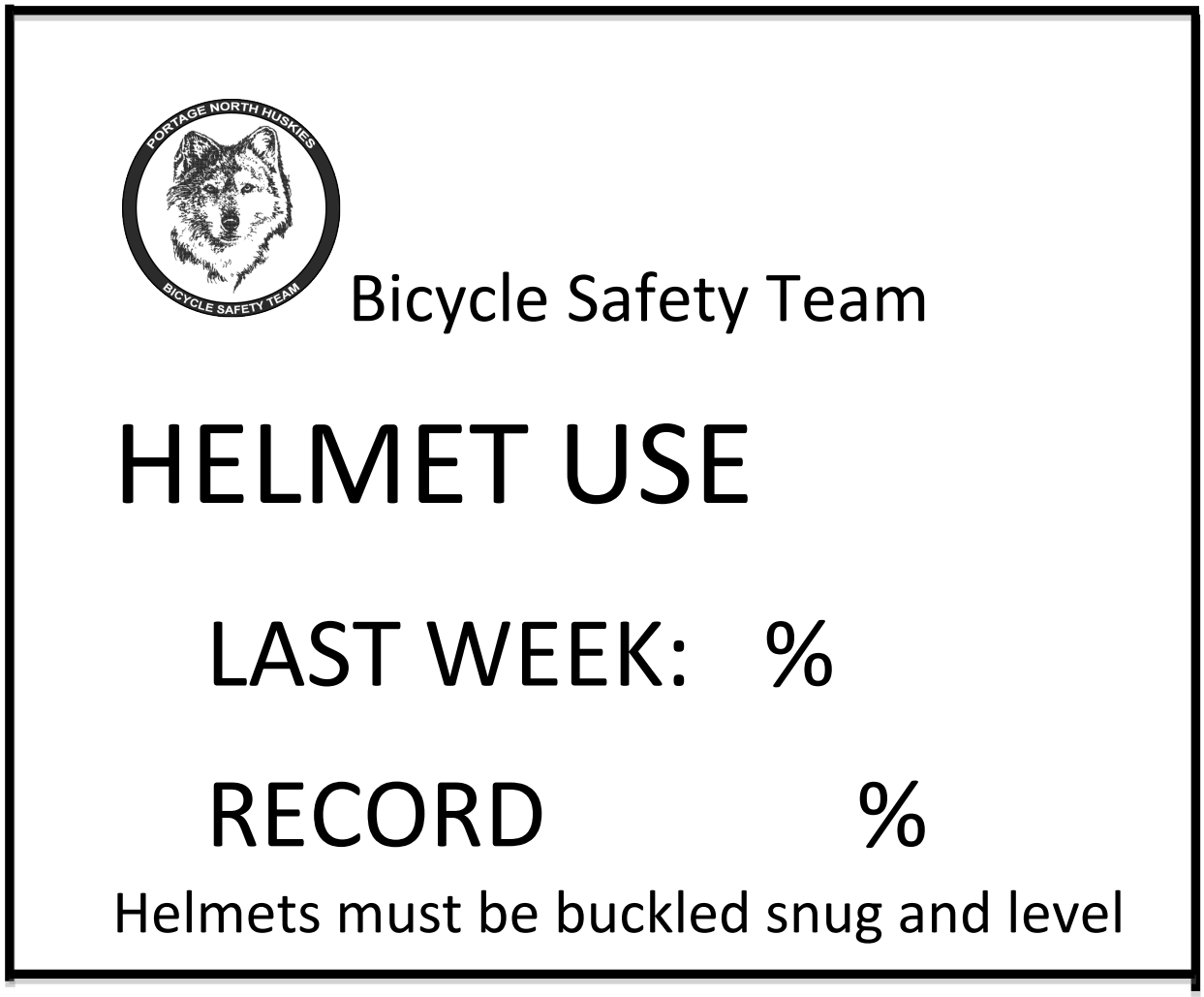
Appendix A. An illustration of a feedback chart used for the project.



Appendix B. Photo of a BMX style bike helmet with school stickers.

Appendix C. Artist's proof for the front and back of student observer T shirts.

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Appendix D. The Bicycle Scoring (data) Sheet used by student obersers.

Bicycle Scoring Sheet

Location:_____ Observer:_____

Date :_____

Month/day/year

Start Time:_____Stop Time:_____

Obs #	Did Cyclist **Wear** a Helmet ?		Was Helmet worn **Correctly?**			✓ if Removed	Obs #	Did Cyclist **Wear** a Helmet ?		Was Helmet worn **Correctly?**			✓ if Removed
	YES	NO	YES	NOT BUCKLED	NOT LEVEL			YES	NO	YES	NOT BUCKLED	NOT LEVEL	
1							26						
2							27						
3							28						
4							29						
5							30						
6							31						
7							32						
8							33						
9							34						
10							35						
11							36						
12							37						
13							38						
14							39						
15							40						
16							41						
17							42						
18							43						
19							44						
20							45						
21							46						
22							47						
23							48						
24							49						
25							50						

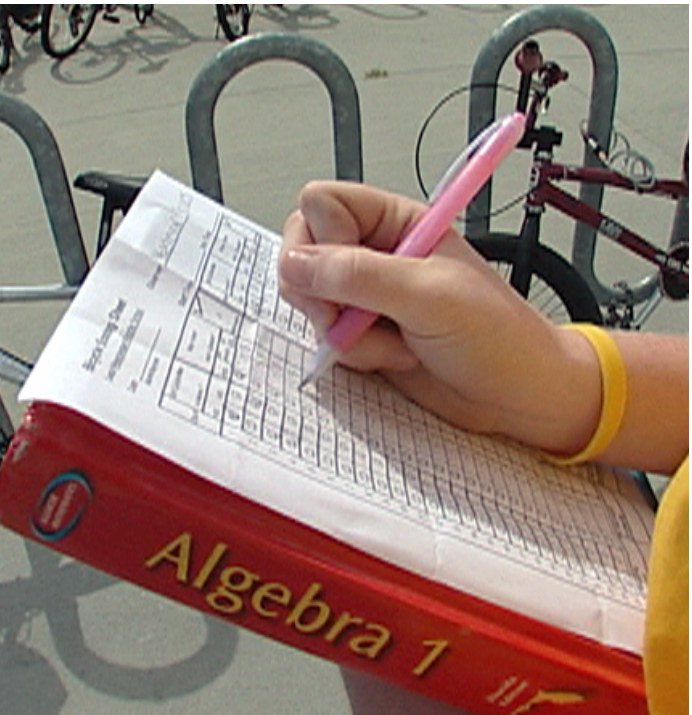
% **Wearing** Helmet	% Helmeted **Correctly**	% Helmet **Unbuckled**	% Helmet Not Level	% **Removed** Helmet Within View

Appendix E. Parent Information Flyer

Bicycle Safety Team

Your child has the opportunity to participate in a nationwide study funded through the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) to promote the use of bicycle helmets in middle school students. With the permission of the school's administration, Dr. Ron Van Houten and Dr. Louis Malenfant of the Center for Education and Research in Safety, renowned specialists in traffic safety, and their data collectors have observed a number of students wearing helmets correctly for the past three weeks.

Recently, your child received a helmet with the school logo for attending a presentation on the importance of helmet use. For achieving the schools target goal, your child will be awarded a wrap up party with the rest of the school's bicyclists to celebrate their success. Thank you for supporting this study and encouraging your child to wear his or her helmet. If you have any questions, you may call the school or call Dr. Malenfant or Dr. Van Houten at 1-800-665-1107



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