Effectiveness of Teens in the Driver Seat Safety Program in Texas

Srinivas Reddy Geedipally, Ph.D., P.E.¹
Assistant Research Engineer
Texas Transportation Institute
Texas A&M University System
110 N. Davis Drive, Suite 101
Arlington, TX 76013-1877
Tel. (817) 462-0519
Email: srinivas-g@ttimail.tamu.edu

Russell H. Henk, P.E.
Program Director, Teens in the Driver Seat
Senior Research Engineer & Division Head
Texas Transportation Institute
San Antonio, TX 78213
Tel. (210) 979-9411
Fax. (210) 979-9694
Email: r-henk@tamu.edu

Bernie Fette
Senior Research Specialist
Texas Transportation Institute
Texas A&M University System
3135 TAMU
College Station, TX 77843-3135
Tel. (979) 845-2623
Fax. (979) 845-9848
Email: b-fette@tamu.edu

Paper submitted to the 92nd Annual Meeting of the Transportation Research Board
Word Count: 3,341 + 2,000 (3 tables + 5 figures) = 5,341 words
July, 2012

¹ Corresponding author
ABSTRACT

According to the National Institutes of Health, car crashes kill and injure more young people than any other cause, accounting for nearly half of all teen deaths in America each year at a rate of more than 3,500 teens annually. In response to this public health crisis, the Texas Transportation Institute created Teens in the Driver Seat® (TDS), the first peer-to-peer program in the U.S. focused solely on teen driving safety. The program directly involves teens in developing and delivering important safety messages to their peers. Since the program’s deployment began in 2003, Texas is the only state in the nation to experience a decline in fatal crashes involving teen drivers each and every year – now down a total of 45 percent from 2003 to 2010. In comparison, fatal crashes involving adult drivers have only decreased 15 percent over that same period. The purpose of this paper is to present a basic overview of the TDS program and provide a detailed description of the statistical analysis used to assess the program’s performance. A before-and-after study with treatment and comparison group was conducted to evaluate the effectiveness of the program. The treatment group (10 counties with TDS) and comparison group (10 counties without TDS) were selected and compared based on similar characteristics (demographics and crash trends). The results showed a 14.6 percent average reduction (statistically significant at the 99 percent confidence level) in teen crashes in Texas counties where TDS was implemented.

Keywords: Teen Crashes, Teens in the Driver Seat, Before-After Study.
1. INTRODUCTION

According to the National Institutes of Health, car crashes kill and injure more teenagers across the United States each year than any other cause. Approximately 3,500 young people die in this way annually across the nation – the equivalent of a commercial jet full of teens crashing once every other week for an entire year. The financial cost of these deaths exceeds $40 billion annually. In addition, for every teen killed in a crash, 50 more are seriously injured. In response to this growing public health crisis, the Texas Transportation Institute has created “Teens in the Driver Seat®,” the first driving safety program in the U.S. focused solely on this issue that directly involves teens in developing and then delivering important safety messages to their peers.

The TDS Program is based on research findings showing that teens are significantly influenced by each other (i.e., their peers), and that the peer-to-peer communication culture and pressures are important factors that influence youth behavior. One of the important goals of the TDS Program is to leverage that peer-to-peer communication dynamic and network in order to increase awareness of primary teen driving risks, and ultimately improve teen driving behavior and decrease the frequency of automobile crashes involving teen drivers.

Messages and TDS Program materials shed light on the consequences of the combination of driver inexperience coupled with the most common risk factors for young drivers: driving at night, distractions (such as cell phones, “texting” and too many teen passengers), low seat belt use, speeding, and alcohol. This approach represents a sharp departure from long-established safety outreach efforts in two ways. First, every aspect of the program is influenced in some way by the target audience. Second, messages focus less on alcohol and more on what statistics show to be more common (and lesser known) driving risk factors among teens. A wide variety of resources are provided to the teens to deploy such messages throughout their schools and communities.

The TDS program was first introduced in Texas in 2002 through funding provided by the San Antonio District of the Texas Department of Transportation (TxDOT). The TDS program is now supported through TxDOT’s 402 Safety Program and State Farm of Texas.

2. TEENS IN THE DRIVER SEAT PROGRAM DESCRIPTION

The Teens in the Driver Seat program is available to Texas public and private schools at no cost. The program has been started in more than 550 Texas schools. Typically, the program is managed by ten to fifteen student leaders who are responsible for planning and conducting activities and involving peers to spread driving safety messages. The activities and communication strategies designed by the students vary widely in many cases, but all efforts share one common distinction – the messages are developed and delivered exclusively by students and their peers. A network of several TTI staff members is available to assist the student teams with specific needs, but these staff members operate completely in the background, leaving each school’s program free of “adult fingerprints” and thus more likely to be viewed as credible and resonate with young drivers and passengers. In a broader sense, the program is led in part by the Teens
in the Driver Seat Program Teen Advisory Board, a group of 15 high school students from different communities in the State of Texas who meet quarterly and provide ongoing insight and guidance to ensure program effectiveness.

The program is marketed to potential program schools through its website: www.t-driver.com. Additional promotion has been generated through television and radio public service announcements, along with occasional press conferences led by student team members at TDS program schools. The program is also strongly represented in the statewide networks of the Texas Association of Student Councils and the Family, Career and Community Leaders of America organization in Texas. Through its wide range of activities, the program has directly reached more than 600,000 students in Texas.

Teens in the Driver Seat is the recipient of more than ten national awards, including the Governor’s Highway Safety Association’s Peter K. O’Rourke Special Achievement Award, the National Safety Council’s Teen Driver Safety Leadership Award, the Institute of Transportation Engineers Transportation Achievement Award for Safety (twice), and the American Association of State Highway Transportation Officials President’s Safety Award. The program has also been recognized as a national best practice for safety the past three years in a row.

The program’s effectiveness has been demonstrated in a number of ways, including:
- Up to 200 percent improvement in awareness of teen driving risks
- A 14 percent increase in seat belt use by teen drivers and passengers
- A 30 percent reduction in cell phone use by teen drivers

Texas has experienced an especially significant drop in teen-driver crashes in recent years – more than a 45 percent drop in fatal crashes, in fact (see Figure 1). Two of the most significant developments during that time were the implementation of the state’s graduated driver license law (GDL) in 2002, and the introduction of the Teens in the Driver Seat Program.
Figure 1: Teen Traffic Fatality Trends in Texas.

According to research prepared for the AAA Foundation for Traffic Safety in 2007 (1), GDL laws have brought about an 11 percent reduction in fatal crashes and a 19 percent drop in injury crashes. Similarly, a 2009 analysis by the Insurance Institute for Highway Safety (2) noted that states with GDL laws similar to that in Texas should expect an average 11 percent reduction in fatal crashes involving 16-year-old drivers. Still other research suggests that GDL laws are responsible for a 5.8 percent reduction in crashes involving 15- to 17-year-old drivers (3). Illustrated in Figure 2 are the expected impacts of GDL in Texas compared to the improvements that have actually occurred for teens in Texas. Apart from the introduction of a GDL in Texas, the impact of other factors has not been fully assessed.
3. PROGRAM EFFECTIVENESS

Following are a variety of assessment activities and data associated with assessing the progress of the TDS Program.

3.1. Teen Awareness of Top Driving Risks

One key performance measure for the TDS Program was to raise teen awareness of the top driving risks they face as novice drivers. Table 1 summarizes the teen awareness of top driving risks before and after implementation of the TDS program. The largest pre- and post-program data sample (1,105 pre- and 617 post-samples) was obtained from Garland High School, Garland, Texas.

Overall there were significant increases in the majority of the top risks faced by teen drivers. In addition to the noteworthy increases in most individual risk awareness levels, the percentage of teens able to cite at least four risks increased by 156%, and the number of teens able to cite five risks correctly increased by 500% -- all signs that there were, in general, solid increases in teen driving risk awareness after TDS Program implementation. That noted, it appears greater emphasis may be warranted for the risks of speeding and drinking & driving.

Stated alternatively, the performance measure target for this topic area was to accomplish at least a 50% awareness level of the top risk factors faced by teen drivers. As shown in...
Table 1, this target has been met for “cell phone use/texting” and “drinking & driving.” Risk awareness for “speeding” and “teen passengers” was just shy of the 50% benchmark, with significant improvement still needed in the areas of “driving at night” and “seat belt use” in order to reach the 50% level.

Table 1: Summary of Garland High School Risk Awareness Data

<table>
<thead>
<tr>
<th>Teen Driving Risk</th>
<th>Pre-TDS % Aware (n = 1,105)</th>
<th>Post-TDS % Aware (n = 617)</th>
<th>Net Change</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving at night</td>
<td>1</td>
<td>14</td>
<td>+13</td>
<td>+1,300%</td>
</tr>
<tr>
<td>Teen passengers</td>
<td>31</td>
<td>43</td>
<td>+12</td>
<td>+39%</td>
</tr>
<tr>
<td>Cell phone/“texting”</td>
<td>60</td>
<td>83</td>
<td>+23</td>
<td>+38%</td>
</tr>
<tr>
<td>Seat belt use</td>
<td>13</td>
<td>16</td>
<td>+3</td>
<td>+23%</td>
</tr>
<tr>
<td>Speeding</td>
<td>48</td>
<td>47</td>
<td>-1</td>
<td>-2%</td>
</tr>
<tr>
<td>Drinking &amp; driving</td>
<td>84</td>
<td>77</td>
<td>-7</td>
<td>-8%</td>
</tr>
</tbody>
</table>

3.2. Teen Seat Belt use

TTI conducted observational surveys in Garland, Texas in 2007 and selected nearby Mesquite, Texas as a comparison city that did not participate in the program. Teens in the Driver Seat was launched in Garland, Texas in 2007 and was a very active program during its first year, engaging each high school in the city and making the surrounding community more aware of teen traffic safety issues through a highly publicized press event to kick off the program. Four high schools in each city were surveyed at two intervals. Table 2 summarizes the safety belt use for these two school districts at the end of 2007 (before period) and 2008 (after period). Garland remained an active participant in the Teens in the Driver Seat program, while Mesquite was not. The survey results (seen in Table 2) show that Garland teen safety belt use continued to improve as it had the preceding year, while Mesquite teen belt use declined slightly. Back seat passenger safety belt use in both cities continues to be very low, despite the legal mandate in Texas that passengers under 17 use safety belts regardless of their seating position.

Table 2: Teen Belt Use, Garland compared to Mesquite School Districts

<table>
<thead>
<tr>
<th>Category</th>
<th>Garland, with TDS Program</th>
<th>Mesquite, no TDS Program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before (n = 1308)</td>
<td>After (n = 1566)</td>
</tr>
<tr>
<td>Driver</td>
<td>90.8</td>
<td>93.5</td>
</tr>
<tr>
<td>Front Passengers</td>
<td>77.3</td>
<td>89.1</td>
</tr>
<tr>
<td>Back Passengers</td>
<td>48.8</td>
<td>40.6</td>
</tr>
<tr>
<td>Overall</td>
<td>85.7</td>
<td>90.2</td>
</tr>
</tbody>
</table>

The target performance measure for seat belt use at TDS Program schools was to demonstrate an increase of 10 percent. The results of the seat belt increase at a rural school conducting a limited deployment of TDS was +8.5%, while the overall seat belt use at an urban school deploying the TDS Program in earnest was +19.8% better than
seat belt use at a neighboring school who did not take part in the program. Noteworthy year-over-year improvements were also accomplished at this latter school (i.e., Garland HS).

3.3. Teen Use of Wireless Devices While Driving

Self-reported driving behavior of teens that is routinely gathered as part of the TDS Program is illustrated in Figures 3 and 4. These figures give a summary of teens who responded “yes” to the survey question of “Have you used your cell phone or “texted”, while driving within the past month?” Data presented therein show that, during the 2008-2009 school year, 49 percent of teens used their cell phone at least once per month while driving. The frequency varied slightly between urban and rural teens, with rural teens being more likely to do so. This same dynamic was seen when it came to teens that “text” while driving, although teens were less likely to “text” and drive in comparison to talking on a phone while driving.

![Figure 3: Percentage of Teens Who Talk on Cell Phone While Driving at Least Once per Month](image-url)
3.4. Teen Drivers Carrying Teen Passengers

One of the goals of the TDS program is to decrease the number of teen drivers who travel with teen passengers without an adult present (consistent with good graduated driver licensing (GDL) practices). Data gathered as part of the teen seat belt use field observations indicate that approximately 10 percent of teen drivers were traveling with teen passengers. Shown in Figure 5 is a summary of teen drivers who, based upon their self-reported driving behavior, carry teen passengers (without an adult present) at a frequency of at least once per month. As noted therein, this situation has improved significantly during after the deployment of TDS program. As with cell phone use and “texting”, this activity is more prevalent amongst rural teens. The source of these data is the same surveys (over 18,000 total) within the TDS Program database. The goal was to have less than 70 percent of teen drivers traveling with teen passengers. That goal was achieved, as well as an overall (significant) decrease from the 2007-2008 school/contract year.
3.5. Safety Benefits

To provide an insight into the safety benefits of the TDS program, a review of the teen crashes in counties where the program was implemented was conducted. Data on crashes involving teens that occurred on the Texas state highway system from 2003 through 2009 were obtained from the Texas Department of Transportation (TxDOT) Crash Records Information System (CRIS). The dataset contained information on crash severity, crash type, roadway information, environmental condition, driver gender and age, vehicle age, and driving under alcohol influence among others. Since it is widely-recognized that property damage only (PDO) crash counts vary widely on a regional basis due to significant variation in reporting threshold, only those crashes that are associated with injury or fatality were considered in this study.

A detailed before-after study was used to evaluate the safety effectiveness of TDS program in Texas. To overcome some of the limitations with a simple or naïve before-after study, the comparison group method was used in this analysis. This method uses a group of comparison sites selected as being similar to the treated sites in terms of geographic characteristics and crash trends. Two assumptions underlying this approach are: (a) the factors that affected safety have changed in the same way for both the treatment and the comparison groups, and (b) the changes in the various factors influence the safety of the treatment and the comparison groups in the same manner (4). The results from this approach are considered more accurate and reliable than the simple before-after study because it can help account for external causal factors and maturation problems. The results are, however, greatly dependent on the availability of comparison sites, as well as the similarity between the comparison and the treated sites. While this approach can improve upon the weakness of a simple before-and-after study method (by carefully selecting the comparison groups), it is still subject to the regression-to-the-mean bias.
because it predicts the expected number of target crashes of a site based on the before-period crash data.

The procedures for using the before-after study with the comparison group method are described in more detail as follows:

**Step 1. Select the treatment group**

The TDS program was originally developed and pilot-tested in 2001-2002. In each subsequent year, there was a significant increase in the number of participating schools. As of the 2010-11 year, the TDS program had been implemented in schools in 101 counties in Texas.

Because the crash data were available only until 2009 at the time of this analysis, counties where the TDS program started after the year 2009-10 school year were not considered in the analysis. In addition, counties where there was a discontinuity in the TDS program prior to 2009 were also not considered.

**Step 2. Define the comparison group**

The comparison groups were selected in such a way that the factors external to the TDS Program that affected safety have changed in the same way as that of the treated group and the change in the various factors influence the safety of the treatment and the control groups in the same manner. The following restrictions were imposed in selecting a comparison group:

1. The comparison county should be located in the same geographical area as that of the treated county (i.e. east, west, north or south Texas).
2. The trend in the teen crashes before the implementation of the TDS program should be the same in both treatment and comparison county such that the expectation of odds ratio, \( \omega \) is equal to 1, as defined in Hauer (4).

**Step 3. Predict the expected number of crashes and variances for after period**

The expected number of after-period crashes and their variances for site \( i \) had the treatment not been implemented at the treated site is given as (4):

\[
\hat{\pi} = \hat{r}_i K \quad \text{and} \quad \text{VAR}(\hat{\pi}) = \hat{\pi}^2 \left[ \frac{1}{K} + \text{VAR}(\hat{r}_i) / r_i^2 \right]
\]

with, \( \hat{r}_i = (N / M) / (1 + 1 / M) \) and \( \text{VAR}(\hat{r}_i) / r_i^2 \equiv 1 / M + 1 / N \)

where,

- \( K \) = total crash counts during the before period in the treated county
- \( M \) = total crash counts during the before period in the comparison county
- \( N \) = total crash counts during the after period in the comparison county

**Step 4. Compute the sum of the predicted crashes over all treated sites and its variance**

\[
\hat{\pi} = \sum_{i=1}^{N} \hat{\pi}_i \quad \text{and} \quad \text{VAR}(\hat{\pi}) = \sum_{i=1}^{N} \text{VAR}(\hat{\pi}_i)
\]

Where, \( N \) is the total number of sites in the treatment group, and \( \hat{\pi} \) is the expected after-period crashes at all treated sites had there been no treatment.
Step 5. Compute the sum of the actual crashes over all treated sites

\[ \hat{\lambda} = \sum_{i=1}^{N} L_i \]

where \( L_i \) is the total crash counts during the after period at site \( i \).

Step 6. Compute the unbiased estimate of safety-effectiveness of the treatment and its variance

\[ \hat{\theta} = \frac{\hat{\lambda}}{\pi} \left( 1 + \frac{\text{Var}(\hat{\pi})}{\hat{\pi}^2} \right) \]

The percent change in the number of target crashes due to the treatment is calculated by \( 100(1 - \hat{\theta}) \)%. If \( \hat{\theta} \) is less than 1, then the treatment has a positive safety effect.

The estimated variance and standard error of the estimated safety-effectiveness are given by

\[ \text{Var}(\hat{\theta}) = \hat{\theta}^2 \left( \frac{1/L + \text{Var}(\hat{\pi})/\hat{\pi}^2}{(1+\text{Var}(\hat{\pi})/\hat{\pi}^2)^2} \right) \]

\[ \text{s.e.}(\hat{\theta}) = \sqrt{\text{Var}(\hat{\theta})} \]

The approximate 95% confidence interval for \( \theta \) is given by adding and subtracting 1.96 \( \text{s.e.}(\hat{\theta}) \) from \( \hat{\theta} \). If the confidence interval contains the value 1, then no significant effect has been observed.

Table 3 summarizes the estimated teen crash reductions after the implementation of the TDS program. The percent reduction in the number of crashes, \( 100(1 - \hat{\theta}) \), shows that there is an 14.6 percent reduction in teen crashes. The standard error of the decrease is 4.2 percent, which means that, at 5 percent significance level, one can expect a crash reduction anywhere from 6.4 percent to 23 percent. Also, since the 95 percent confidence interval for \( \hat{\theta} \) does not include 1, the observed reduction is statistically significant. The decrease in teen crashes is statistically significant at the 99 percent confidence level.
Table 3. Before-After Analysis of the TDS Program

<table>
<thead>
<tr>
<th>County</th>
<th>Treatment Before</th>
<th>Treatment After</th>
<th>Comparison Before</th>
<th>Comparison After</th>
<th>Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>K</td>
<td>L</td>
<td>M</td>
<td>N</td>
<td>λ</td>
</tr>
<tr>
<td>Bandera</td>
<td>122</td>
<td>96</td>
<td>295</td>
<td>233</td>
<td>96</td>
</tr>
<tr>
<td>Burleson</td>
<td>163</td>
<td>66</td>
<td>356</td>
<td>149</td>
<td>66</td>
</tr>
<tr>
<td>Cass</td>
<td>190</td>
<td>78</td>
<td>1081</td>
<td>588</td>
<td>78</td>
</tr>
<tr>
<td>Fayette</td>
<td>170</td>
<td>91</td>
<td>443</td>
<td>220</td>
<td>91</td>
</tr>
<tr>
<td>Atascosa</td>
<td>179</td>
<td>80</td>
<td>287</td>
<td>181</td>
<td>80</td>
</tr>
<tr>
<td>Hopkins</td>
<td>311</td>
<td>157</td>
<td>889</td>
<td>514</td>
<td>157</td>
</tr>
<tr>
<td>Jasper</td>
<td>216</td>
<td>122</td>
<td>432</td>
<td>212</td>
<td>122</td>
</tr>
<tr>
<td>Wilson</td>
<td>212</td>
<td>87</td>
<td>783</td>
<td>373</td>
<td>87</td>
</tr>
<tr>
<td>Washington</td>
<td>284</td>
<td>180</td>
<td>338</td>
<td>315</td>
<td>180</td>
</tr>
</tbody>
</table>

Measure Description Value

\( \hat{\lambda} \) Number of crashes observed during the after period 957
\( \hat{\pi} \) Expected number of crashes during after period had TDS program not been implemented 1119.3
\( \text{Var}(\hat{\pi}) \) Variance of \( \hat{\pi} \) 1688.6
\( \hat{\theta} \) Unbiased estimate of index of effectiveness 0.854
\( \sigma(\hat{\theta}) \) Standard error of \( \hat{\theta} \) 0.042
\( 100(1-\hat{\theta}) \) Percent reduction in the number of crashes 14.6%
\( (\theta_{\text{lower}}, \theta_{\text{upper}}) \) 95% confidence interval for \( \theta \) (0.77, 0.94)
Significance Statistical significance level 99.9%

4. CONCLUSIONS

The purpose of this paper is to assess the effectiveness of the Teens in the Driver Seat program and its impact on reducing the frequency of teen driver crashes. A variety of activities such as teen awareness of top driving risks, seat belt use, cell phone use, and carrying teen passengers were assessed. The data associated with assessing the progress of the TDS Program showed that there is a significant positive change in the driving behavior of the teen drivers after the implementation of the TDS program.

The paper also primarily focuses on a review of teen crashes in counties where the program was implemented, making comparisons to counties with similar characteristics where the program was not in place. Further, to evaluate the safety benefits, this paper utilized a before-after study with a comparison group so as to account for factors that change over time. A detailed analysis achieving a high confidence level shows that the Teens in the Driver Seat program has been effective in reducing teen driver crashes by nearly 15 percent, demonstrating that the program has had a statistically significant impact on the overall decline in teen-driver crashes in Texas. The 45 percent teen traffic fatality reduction in Texas is far greater than the reduction to be expected from
introduction of a GDL law. This analysis demonstrates that the TDS Program is another
significant contributor to the declining teen-driver crash frequency in Texas.

REFERENCES

1. Baker, Susan P., Chen, LiHui, and Li, Gouhua. *Nationwide review of graduated
driver licensing*, Johns Hopkins Bloomberg School of Public Health, Center for

2. McCart, Anne T.; Teoh, Eric R.; Fields, Michelle; Braitman, Keli A.; and
Hellinga, Laurie A., *Graduated Licensing Laws and Fatal Crashes of Teenage

3. Dee, Thomas; Grabowski, David; and Morrisey, Michael. Graduated driver
licensing and teen traffic fatalities. *Journal of Health Economics*, 24, 571-589,
2005.