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EXECUTIVE SUMMARY
Literature from NHTSA indicate that when seat belts are properly used, the risk of death to passengers seated in the front row in a motor vehicle is reduced by 45 percent. When used properly, child safety seats are 71 percent effective in reducing death to children under five years of age, and 69 percent effective in reducing the need for hospitalization. In Las Vegas in 1998, 70 percent of the 300 children involved in a crash treated at the University Medical Center were unrestrained. Data for restraint usage for passengers under five in Nevada are similarly alarming. But such statistics are based on limited observations and there exists a need for a more comprehensive evaluation.

This report documents the efforts of and findings from the project to evaluate the use of child safety seats and other restraints for infants and toddlers in Nevada. An infant or toddler was defined to be a child who appeared to be under five and under 40 pounds in weight, which correspond to the requirements for mandatory safety seat usage in Nevada (NRS 484.474). The project involved making a total of 3,197 observations at 50 sites located throughout the state. The statewide average for infants or toddlers in a safety seat is 62.6 percent. This is a 68.3 percent increase in safety seat usage from the 37.2 percent rate from the 2002 survey. The following are some of the main observations in the study.

1) There were 63.5 percent of all children observed to be placed in a child safety seat in the Northern Urban group, and 71.8 percent and 52.0 percent of children observed to be placed in a child safety seat in the Southern Urban and Rural study groups respectively. Statewide, 62.6 percent all children were observed to be placed in a child safety seat.

2) All three study groups show that 0.16 percent of all children observed were placed in the lap of an adult and had an adult seat belt placed across the child and the adult (together) down from 1.5 percent from the 2002 survey.

3) The Southern Urban and Northern study groups show similar proportion of all children used an adult seat belt with the Rural study group with a higher percent. These were 25.4 percent in the Northern Urban study group, 22.1 percent in the Southern Urban study group, 32.6 percent for the Rural study group with a statewide average of 26.6 percent.

4) All three study groups show similar proportion of all children held on the lap of an adult. These were 0.0 percent in the Northern Urban, 0.09 percent in the Southern Urban, and 0.19 percent in the Rural with a statewide average for children held on the lap of an adult of 0.09 percent.

5) The usage rate in the Northern Urban study group that were not restrained using any of the aforementioned safety mechanisms was 10.9 percent. The corresponding figures for the Southern Urban and Rural study groups were 5.9 percent and 14.9 percent respectively. The statewide average for children not restrained using any of the aforementioned safety mechanisms was 10.5 percent.

6) The percent of all children restrained in either a safety seat or in an adult belt were similar for the three study groups with 94.0 percent for Southern Urban, 88.9 percent for the Northern Urban, and 84.6 percent for the Rural. The statewide average for children in either a safety seat or in an adult belt is 89.2 percent.
7) Even when statistically significant, the proportion of infants or toddlers secured in rear facing child safety seats was small compared to those secured in forward facing child safety seats for each of the three study groups.

8) For Northern and Rural area, infants were more likely to be secured in a front-facing safety seat in the back seat of the vehicle (respectively 52.0 percent and 57.4 percent of all infants in the area) than in any other restraint measure. However, in Southern area, infants were more likely to be secured in a rear-facing safety seat in the back seat of the vehicle (72.1 percent of all infants in the area) than in any other restraint measure. No infants were located in the cargo areas of any vehicle observed. The statewide average for front-facing safety seat usage in the back seat is 47.0 percent, which is close to the statewide average for rear-facing safety seat, 46.8 percent.

9) There were 42.6 percent of all infants observed secured in a rear facing safety seat in the Northern Urban Study group, and 72.1 percent and 33.0 percent of infants observed in the Southern Urban and Rural study groups respectively. Statewide, 46.8 percent of all infants observed in a rear facing safety seat.

10) There was an increase in the use of child safety seats, both front facing and rear facing, in the Northern Urban study group (63.5 percent up from 39.2 percent), in the Southern Urban (71.8 percent up from 41.2 percent), and the Rural (52.0 percent up from 32.8 percent). Statewide there was an increase in usage (62.6 percent up from 37.2 percent).

11) The surveys were conducted from the middle of July through early August for the 2003 Child Safety Seat Usage Survey. The surveys started approximately one week earlier than the surveys that were conducted during the 2002 Child Safety Seat Usage Survey.

The results presented need to be used with caution regarding the limitations of the estimates based on statistical tests and confidence limits. During the survey an attempt was made to collect a minimum number of observations for each vehicle type for each study group in order to lower the confidence interval to plus or minus ten. The minimum number of observations was collected for four of the five vehicle types (sedans, pickups, vans, and sport utility vehicles). In spite of this effort a small sample size was collected for several of the restraint usages by vehicle type. As a result of this the confidence levels for some of the analyses (restraint usage by vehicle type) are still large. In order to obtain more statistically rigorous results the number of observations needs to be increased at the restraint usage by vehicle type level. However, this is not feasible due to the large number of observations that would need to be made at each location.
INTRODUCTION

Literature from NHTSA document that every 9 seconds someone is injured in a traffic crash and that every 13 minutes someone is killed (1). While personal loss, suffering and pain (from the grief losing a family member or serious injury to a family member) cannot be easily quantified, it is estimated that vehicle crashes in 1994 in America cost over $150 billion annually (1). Individuals and children who are properly restrained (either using seat belts or in a safety seat, as appropriate) are far less likely to sustain traumatic injury in a vehicle crash. In turn, medical costs are reduced as well.

Literature from NHTSA indicate that when lap/shoulder belts are properly used, the risk of death to front passengers is reduced by 45 percent (2). In 1998, it is estimated that 51 percent of the 575 fatalities nationwide among children under 5 years of age were totally unrestrained (2). When used properly, child safety seats are 71 percent effective in reducing death to infants under the age of one and 54 percent effective for toddlers (1-4 years old) in passenger cars (2). But, it is estimated that half of all children under the age of five who die in crashes are not buckled up. Further, an indication of the severity of the problem in Nevada is that in 1998 among the 300 children treated at the University Medical Center (in Las Vegas) who were involved in a vehicle crash, 70 percent were unrestrained. Data for the use of appropriate restraint for passengers under 5 years of age in Nevada are similarly alarming. In 1998, 50 percent of the fatalities were not properly restrained. The figures for 1997 and 1996 are 67 percent and zero percent respectively. There were a total of 8, 6 and 2 fatalities in this age group in Nevada 1998, 1997 and 1996 respectively (3). Similar statistics for those involved on non-fatal crashes are 10 percent (20 observations), 50 percent (16 observations), and 23 percent (21 observations) respectively for 1997, 1996, and 1995. But, these statistics are based on a very limited set of observations and there exists a need for a more comprehensive evaluation of the situation.

While programs to increase seat belt use and child safety seat use have been implemented in the State of Nevada, the effectiveness of child safety use programs has not been determined through a statewide child safety seat use survey. The Nevada Department of Transportation (NDOT) conducts annual seat belt use studies for the Nevada Office of Traffic Safety, but does not conduct a child safety seat use survey (4). This progress report documents the efforts of and findings to date from the project to evaluate the use of child safety seats and other restraints for infants and toddlers traveling in motor vehicles in Nevada.

Following the Introduction section of this report is a section that documents the methodology developed and adopted for the project. The methodology section includes discussions on the procedures to be adopted for field observations, the selection of candidate sites for field observations, determination of sample sizes needed and the instrument to be used for the survey/field observations. This is followed by a section that presents an analysis of the data collected. Conclusions and recommendations are presented in the final section of the report.
METHODOLOGY

The UNLV Transportation Research Center (TRC) developed a methodology for a child safety seat use survey, determined survey locations, and conducted a state-wide survey. The “Belt Use Survey Guidelines (5)” and the “Guidelines for Observing Child Safety Seat Use (6)” both developed by the National Highway Traffic Safety Administration, Traffic Safety Programs office were used in the development of the methodology for this child safety seat use survey. Survey sites were established to ensure that the geographic areas of the state as well as ethnic and socio-economic groups were represented to the extent possible. To the extent possible, survey sites were located to be proximate to locations used by NDOT for the seat belt use survey.

Field Observations

The annual seat belt use surveys performed by NDOT are conducted by observers positioned along roadways who try to determine if the driver and passenger in the front seat of the vehicle were wearing seat belts by a visual inspection of the vehicles shoulder strap. If restraint use cannot be determined, the vehicle is excluded from the sample. However, it would be extremely difficult to use the same process to determine the rate of use of Child Safety Seats in vehicles. This is because child safety seats may not be visible from the outside to stationary observers when the vehicle is in motion (and at fairly high speeds on major arterials and freeways). Thus, it was necessary to make observations at parking lots when vehicles are stationary or moving slowly - having just arrived or preparing to leave.

An observation is recorded for each infant or toddler observed in a vehicle. If the type of restraint used for a toddler or infant could not be determined, that child was excluded from the data set. An infant or toddler was defined to be a child who could not walk by himself or herself or who appeared to be under five years of age or under 40 pounds in weight. These correspond to the age and weight requirements for mandatory safety seat usage in the State of Nevada (NRS 484.474). Typically, these were children who were either picked up by an older individual or needed help/guidance from an older person to exit a vehicle and walk to a store or a building.

Site Selection Criteria

The TRC selected the general locations of the sites for the child safety seat usage survey using information obtained from previous child safety seat usage studies conducted by NDOT (7) and the TRC (8)(9), from seat belt usages studies conducted by NDOT (4), and from federal guidelines (5)(6). Based on these prior studies, 50 observation sites were needed for this study. The TRC decided to use three study groups, instead of 50 individual study locations, to conduct this study to reduce the number of observations needed in the field. This decision was based on consultations with staff from the Nevada Office of Traffic Safety (OTS), who sponsored the project. The three study groups were identified as Northern Urban, Southern Urban, and Rural. The cities included in the Northern Urban study group were Carson City, Reno, and Sparks. The Southern Urban study group included the cities of Henderson, Las Vegas, and North Las Vegas and the unincorporated urbanized section of Clark County. The Rural study group included all areas of the State of Nevada not included in the two Urban study groups. The next step in the process was to
determine the minimum number of observations needed in each study group.

Sample Size Determination

The number of observations depends on the desired level accuracy of the resulting estimates of the safety seat usage. The number of needed observations was determined using a 95 percent confidence level and a five percent tolerable error, which were the numbers agreed upon following discussions with staff from OTS. These numbers indicate that there is a 95 percent probability (confidence level) that the observed usage rate will be within the actual usage rate plus or minus the tolerable error. In order to properly estimate the needed number of observations, either a usage rate from an earlier study or an estimate of the usage rate is needed. For the first year of the study an unbiased usage rate was not available for each of the study groups, therefore TRC elected to use a 50 percent usage rate for this calculation. This usage rate is considered a starting point for the calculations since it will generate the highest number of needed observations. Using the 50 percent usage rate as a starting point also yields a conservative estimate of the sample size required.

A binomial distribution was assumed for the data. Thus, the corresponding equation used to determine the number of observations is shown in Equation 1.

\[ n = \frac{z^2 P(1 - P)}{e^2} \]  

Equation (1)

where,
- \( n \) is the number of needed observations,
- \( z \) is the standard normal deviate appropriate for the desired confidence level,
- \( P \) is initial or anticipated estimated usage rate, and
- \( e \) is the tolerable error.

For comparison the TRC also calculated the minimum number of needed observations for combinations of 90 and 95 percent confidence levels and five and ten percent tolerable errors. The number of needed observations for each study group was calculated to be 384.2 rounded up to 385 for a 95 percent confidence level and a five percent tolerable error. The number of needed observations drops dramatically from 385 to 96 when the tolerable error is increased from five to ten percent for a 95 percent confidence level. The number of needed observations for five and ten percent tolerable errors with a 90 percent confidence level are 271 and 68 respectively. As a factor of safety, the TRC decided to increase the number of observations to at least 450 for each study group. This number was finalized at 462 for ease of calculations.

Identification of Sites for Field Observations

To generate the preliminary list of the general locations of the sites for the observations in each study group, the TRC started the selection process using the techniques used for the NDOT seat belt study. This study based its site selection on Average Daily Traffic and functional classification of the roadway, with each functional classification having a minimum of two observation sites. The sites were located at places where vehicles were moving slowly or could be stopped such as at intersections and highway off-ramps. The general locations of these sites included 14 in the Northern Urban study group, 19 in the Southern Urban study group, and 17 in the Rural study group.
The number of observations needed at each site was calculated using the number of needed observations (462) and the number of sites in each study group. This is shown in Equation 2.

\[ n_{ij} = \frac{N_j}{s_j} \quad \text{Equation (2)} \]

where,

- \( n_{ij} \) is the number of observations needed for Group j at site i (j=1,2,3),
- \( N_j \) is the total number of observations needed for Group j, and
- \( s_j \) is the number of sites selected for Group j.

The number of observations per site needed using Equation 2 was determined to be 33 for each Northern Urban site, 24 for each Southern Urban site, and 27 for each Rural site. However, it was felt that it would be likely that 27 observations could be made in a short period of time at each of the 17 rural sites. In consultation with staff from OTS, changes were made in the general locations of the sites to increase the number of Rural sites to 22 and decrease the number Southern Urban sites to 14. The locations of the added Rural study group sites were done based on population of the cities in the state.

The minimum number of observations at each site for the two Urban study groups was 33 and the minimum number for the Rural study group sites was 21. The minimum total number of observations for each study group was 462. This was done to ensure a consistent study group sample size. The specific observation sites were determined by selecting businesses and recreational facilities that attract people with children. This selection was done either by contacting staff in each entity’s governing body to ascertain the locations where children might be taken or by driving through the area and selecting a location that had a high turn-around rate for the vehicles in its parking lot. Examples of observation sites included supermarkets, department stores, post offices, and fast food restaurants. Day care facilities were not used for this study as an observation site to eliminate any chance of compromising the data because it was felt that individuals who bring children to such facilities were more likely to use appropriate restraining devices for the children.

**Determination of Vehicle Types to be Observed**

One of the drawbacks of previous efforts was the limited number of observations collected for each vehicle type (9). This limited the analysis that could be performed due to a wide range in confidence interval (or error range). In an attempt to increase the confidence of the results it was decided to collect data on a minimum number of each vehicle type at each observation location. This number was determined using Equation 1 to calculate the number of observations needed to decrease the tolerable error to at least ten for each restraint type by vehicle type based on results of previous efforts. The highest minimum number of needed observations for each vehicle type was then selected as the number of observations needed for the vehicle type in that study group. This process was repeated for each of the three study groups. This number was then divided by the number of locations in the study group to determine the average number of needed observations at each location. The minimum number of observations at each location for each vehicle type ranged from 4.06 to 4.37 for the Rural study group (rounded to 5), from 6.11 to 6.86 for the Southern Urban study group (rounded to 7), and from 6.17 to 6.86 for the Northern Urban study group (rounded to 7).
It was decided that during field surveys the observations must continue at each site until one of three conditions was met. The first condition was to get the minimum number of observations for each vehicle type (five for Rural and seven for Urban). The second condition was the minimum number of observations to be collected (30 for Rural and 60 for Urban). The third condition was the time spent at the site (two hours for Rural and three hours for Urban) in conjunction with a minimum number of observations (21 for Rural and 33 for Urban). By using these conditions the number of observations and amount of time spent in the field were balanced. It must be noted that the observations were recorded by the number of infants or toddlers in the vehicle and not by the number of vehicles. This is a distinction that must be made since the same vehicle could have multiple observations.

Survey Instrument (Form)

After discussions with representatives of the OTS and the Clark County Safe Communities Partnership and review of previous studies, a draft survey form was developed. Since surveys were only done on vehicles with infants and / or toddlers as passengers, that was the first item on the form. As stated previously, for the purposes of this survey, children will be considered infants or toddlers if they appear to be under five years old or under forty pounds. The survey form used during the safety seat usage survey is shown in Figure 1. Other items that are on the form include:

1) Infant or Toddler
2) Location of infant or toddler in vehicle (front seat, back seat, or cargo area)
3) Type of restraint used for infant or toddler (front facing safety seat, rear facing safety seat, held on lap, in lap held by belt, in adult belt, no restraint, or unable to determine)
4) Type of vehicle (sedan, pick-up truck, van, station wagon, or sports utility vehicle)
5) License plate information for each vehicle (Nevada, California, Other United States, or Foreign)
6) Presence of children in bed of pick-up trucks
7) Restraint used by other passengers in the vehicle.

One change to the form from the previous one is the addition of the infant or toddler box. This was included to increase the potential usefulness of the gathered data.

Data Collection and Assimilation

One copy of the survey instrument was used to record observations for each vehicle. Observers worked in pairs for personal safety. A few trial exercises were conducted in April and May 2000. These exercises were conducted proximate to the UNLV campus. The objective of these exercises were two fold: 1. to determine the usability of the survey form; and 2. to familiarize the observers with the layout of the form and the data recording process (i.e., training the observers). Following the successful completion of the trial exercises, observations were made at the 50 locations identified during the period of July 20, 2002 to August 15, 2002.

There were a total of 1,099 observations made at the 14 locations in the Northern Urban study group. The locations used for the Northern Urban study group were numbered 1 to 14 and are
listed in Table 1 and shown in Figure 2. There were a total of 814 observations made at the 14 locations in the Southern Urban study group. The locations used for the Southern Urban study group were numbered 15 to 28 and are listed in Table 2 and shown in Figure 3. There were a total of 1,171 observations made at the 22 locations in the Rural study group. The locations used for the Rural study group were numbered 29 to 51, excluding number 40 and are listed in Table 3 and shown in Figure 4. Site 40 (Northern Rural) was eliminated from the list of locations and replaced by site 51 (Southern Rural) to increase the number of rural sites in the southern portion of the state. In total, 2,994 observations were recorded at all the 50 locations combined.

Raw data from each of the observations sheets (survey instruments) were coded using a spreadsheet program on personal computers to facilitate analysis. The coded data for the three study groups is displayed in Appendices A, B, and C.

DATA ANALYSIS

Two principal approaches were adopted for analyzing the data. The first approach was to develop simple measures or indicators. For this purpose, the simple arithmetic means were computed for the observations. This approach is simple in nature, but does not provide any insights into the accuracy or certainty of the estimates. Thus, a second approach was to develop confidence limits for estimates of the mean values computed in the first approach. The second approach is based on statistical theory and provides better estimates of the uncertainty of the estimates. A variety of analyses were performed using both the approaches. The results of such analyses are presented in this section of the report.

Determination of Confidence Intervals

The confidence intervals for estimates of the means estimated for the population based on the sample data represent the range of values that the mean could lie within for the stated confidence level. In other words, the upper limit and the lower limit of the confidence interval represent the highest and lowest values of the mean that could be expected in the population at the given level of certainty. For example, let the objective be to determine what proportion of the infants and toddlers were restrained in a vehicle with the “use of a forward facing child safety seat” and the desired certainty or “confidence level” were to be 95 percent. In this example, let the upper limit of the estimate of the mean value be 56.34 percent, the mean be 49.21, and the lower limit of the confidence interval be 42.08 percent. This implies that it can be stated with 95 percent confidence that the mean value for the “use of a forward facing child safety seat” to restrain an infant or toddler is 49.21 percent and that it is no less than 42.08 percent and no more than 56.34 percent.

The confidence interval was determined based on the assumption that the data belonged to a discrete distribution that could be approximated using the normal assumption to the binomial distribution (which are reasonable assumptions to begin with). The upper and lower confidence limits, U and L respectively, for such a distribution were estimated using the following formulae.
Where

\[ C \text{ is Chi-squared for confidence level } p \text{ and } (k-1) \text{ degrees of freedom} \]

\[ n_i \text{ is the number of observations for category “i” (e.g., type of restraint)} \]

\[ n = \sum_{i=1}^{k} n_i \quad \text{Equation (3)} \]

\[ A = C + 2n \quad \text{Equation (4)} \]

\[ B = \sqrt{C + 4n((n - n_i) / n)} \quad \text{Equation (5)} \]

\[ U = \frac{A + B}{2(n + C)} \quad \text{Equation (6)} \]

\[ L = \frac{A - B}{2(n + C)} \quad \text{Equation (7)} \]

**Limitations of Confidence Intervals**

The statistical tests are based on the assumptions that the data belong to the normal approximation to the binomial distribution function. However, if the sample sizes become relatively small, this assumption may not hold. Thus, in such instances the confidence limits are not meaningful. Specifically, if

\[ n \text{ is the number of observations} \]

\[ p_\text{hat} \text{ is the estimated mean} \]

the confidence limits are only valid if the two following conditions are satisfied (10).

\[ n \times (p_\text{hat}) \geq 5 \quad \text{and} \quad \text{Equation (8)} \]

\[ n \times (1 - (p_\text{hat})) \geq 5 \quad \text{Equation (9)} \]

In all other cases, the confidence limits are not meaningful. Further, in such cases even the estimates of the means should be used with caution and discretion.
Analysis

Some examples of the types of analysis performed are presented next followed by a summary of the results of the analyses.

Infant or Toddler in Vehicle

The initial part of the survey process was to determine whether an infant or toddler was in an observed vehicle. As shown in Table 4, of the 3,197 observations made during this survey, 2,639 (82.5 percent) were toddlers and 558 (17.5 percent) were infants. Out of the 1,058 observations made in the Northern Urban study group there were 856 (80.9 percent) toddlers and 202 (19.1 percent) infants. Of the 1,093 observations made in the Southern Urban study group there were 946 (86.6 percent) toddlers and 147 (13.4 percent) infants. Of the 1,046 observations made in the Rural study group there were 837 (80.0 percent) toddlers and 209 (20.0 percent) infants. Thus a majority of the children observed were toddlers. Additional analyses on the location and restraint observed being used on these children are presented in the following sections, however there are not detailed separate results for the infants and toddlers.

Location of Infant or Toddler in the Vehicle

A summary of the observations for the location of the infant or toddler categorized by the three study groups and for the state of Nevada as a whole is presented in Table 5 and Figure 5. It is to be noted that a vast majority (86.2 percent) of all of the infants and toddlers were located in the rear seat area of vehicles and extremely few (4 observations, 0.1 percent) were located in the cargo area of vans and station wagons or in the beds of pick-up vehicles. There were no infants observed to be in the cargo area. There were 94.4 percent of the infants and 84.5 percent of the toddlers observed in the rear seat area of the vehicles.

Type of Restraint Used

A summary of the observations for the type of restraint used for an infant or toddler categorized by the three study groups and for the state of Nevada as a whole is presented in Table 6 and Figure 6. Safety seats were observed to be used on 62.6 percent of all children. This number is up 68.3 percent from the usage rate observed during the 2002 Child Safety Seat Usage Survey of 37.2 percent. The safety seat usage rates were 63.5 percent in the Northern Urban study group, 71.8 percent in the Southern Urban study group, and 52.0 percent in the Rural study group. It can be seen that for the state as a whole, 89.2 percent of infants and toddlers were in either a safety seat or an adult belt. This figure was 84.6 percent in the Rural areas, 88.9 percent in the Northern Urban areas, and 94.0 percent in the Southern Urban areas.

Type of Vehicle

A summary of the type of vehicle observed during this survey is shown in Table 7 and Figure 7. The vehicles were identified as either sedans, pickups, station wagons, vans, or sport utility vehicles. Even after a concerted effort was made to meet minimum numbers of vehicle types at each observation site, the number of station wagon observations was low for the Rural
study group. Throughout the state there were 314 infants or toddlers observed in station wagons for 9.8 percent of the total observations. This breakdowns to 104 in the Northern Urban, 132 in the Southern Urban, and 78 in the Rural study groups. This low number of observations among station wagons will influence the level of confidence in the analysis for station wagons. Sedans (1084 observations for 33.9 percent) account for the largest component of the vehicle mix identified, followed by SUVs (770 observations for 24.1 percent), vans (654 observations for 20.5 percent), and pick-up trucks (375 observations for 11.7 percent).

Analyzes of Combined Variables

Statistical analyses of the use of various types of restraints for the study groups and various variables will be based on the methodology presented previously in this paper. These will be summarized in graphical formats. These summaries are shown in Figures 8 through 22. Figure 8 shows the details of restraint usage in sedans for the Northern Urban study group with the confidence limits and the mean included in the graphic. Similarly, Figures 13 and 18 shows the details of restraint usage in sedans for the Southern Urban and Rural study groups with confidence limits and the mean included in the graphic. Figures 9 through 12 show the details of restraint usage for the Northern Urban study group for pick-ups, station wagons, vans, and SUV’s respectively. Similar figures are shown for the Southern Urban study group (Figures 14 to 17) and the Rural study group (Figures 19 to 22). In each figure the number of observations is noted “N = xxx” (where xxx is the number of observations for that vehicle type in that study group). The number of observations collected in the field was greater than the number of observations calculated for the sedans, pick-ups, vans, and SUV’s. However, the confidence levels for some of the restraint types are still large due to the small sample observed for the restraint type by vehicle. The figures clearly indicate that the use of each type of restraining device is similar for infants and toddlers traveling in sedans in the three study groups.

Some interesting observations made from these analyses are included in the following section. The “held in lap” restraint choice accounted for only 0.09 percent of the total observations statewide. It is interesting to note that there were no such observations recorded at 47 of the 50 sites, down from 27 such sites during the 2002 survey. The “held in lap by belt” restraint choice accounted for only 0.16 percent of all observations. It is interesting to note that there were only four sites with such observations recorded, up from two such sites during the 2002 survey.

While an attempt was made to have a “large” number of observations for each vehicle type, the confidence level for some of the restraint by vehicle type is still low. This is due to the low number of restraint observations for each vehicle type.

Since an inadequate number of observed vehicles had out-of-state registration (as evidenced by the license plate on the vehicle) no meaningful analysis could be performed based on registration. Of the 3,197 observations there were 155 out of state vehicle which included 63 California registered, 92 other US registered, and no foreign registrations.
COMPARISON TO PREVIOUS SURVEYS

A comparison to the results of the previous child safety seat usage surveys conducted by the TRC shows that statewide there is an increase in the use of child safety seats and a decrease in the use of adults seat belts and no restraint. Figure 23 shows the restraint usage for the Northern Urban study group over the last three years. As can be seen in the figure the use of child safety seats has increased and the usage of the other four restraint types has decreased from the 2000 survey results. Similar information is shown in Figure 24 for the Southern Urban study group, Figure 25 for the Rural study group, and Figure 26 for the State of Nevada. Figure 27 shows the combined usage of both the front facing and rear facing child safety seats. There was an increase in usage in the Northern and Rural study groups and statewide.

RESULTS OF ANALYSIS

The following comments are based on analyses conducted using the methodology previously identified in this paper.

1) There were 63.5 percent of all children observed to be placed in a child safety seat in the Northern Urban group, and 71.8 percent and 52.0 percent of children observed to be placed in a child safety seat in the Southern Urban and Rural study groups respectively. Statewide, 62.6 percent all children were observed to be placed in a child safety seat.

2) All three study groups show that 0.16 percent of all children observed were placed in the lap of an adult and had an adult seat belt placed across the child and the adult (together) down from 1.5 percent from the 2002 survey.

3) The Southern Urban and Northern study groups show similar proportion of all children used an adult seat belt with the Rural study group with a higher percent. These were 25.4 percent in the Northern Urban study group, 22.1 percent in the Southern Urban study group, 32.6 percent for the Rural study group with a statewide average of 26.6 percent.

4) All three study groups show similar proportion of all children held on the lap of an adult. These were 0.0 percent in the Northern Urban, 0.09 percent in the Southern Urban, and 0.19 percent in the Rural with a statewide average for children held on the lap of an adult of 0.09 percent.

5) The usage rate in the Northern Urban study group that were not restrained using any of the aforementioned safety mechanisms was 10.9 percent. The corresponding figures for the Southern Urban and Rural study groups were 5.9 percent and 14.9 percent respectively. The statewide average for children not restrained using any of the aforementioned safety mechanisms was 10.5 percent.

6) The percent of all children restrained in either a safety seat or in an adult belt were similar for the three study groups with 94.0 percent for Southern Urban, 88.9 percent for the Northern Urban, and 84.6 percent for the Rural. The statewide average for children in either a safety seat or in an adult belt is 89.2 percent.
7) Even when statistically significant, the proportion of infants or toddlers secured in rear facing child safety seats was small compared to those secured in forward facing child safety seats for each of the three study groups.

8) For Northern and Rural area, infants were more likely to be secured in a front-facing safety seat in the back seat of the vehicle (respectively 52.0 percent and 57.4 percent of all infants in the area) than in any other restraint measure. However, in Southern area, infants were more likely to be secured in a rear-facing safety seat in the back seat of the vehicle (72.1 percent of all infants in the area) than in any other restraint measure. No infants were located in the cargo areas of any vehicle observed. The statewide average for front-facing safety seat usage in the back seat is 47.0 percent, which is close to the statewide average for rear-facing safety seat, 46.8 percent.

9) There were 42.6 percent of all infants observed secured in a rear facing safety seat in the Northern Urban Study group, and 72.1 percent and 33.0 percent of infants observed in the Southern Urban and Rural study groups respectively. Statewide, 46.8 percent of all infants observed in a rear facing safety seat.

10) There was an increase in the use of child safety seats, both front facing and rear facing, in the Northern Urban study group (63.5 percent up from 39.2 percent), in the Southern Urban (71.8 percent up from 41.2 percent), and the Rural (52.0 percent up from 32.8 percent). Statewide there was an increase in usage (62.6 percent up from 37.2 percent).

11) The surveys were conducted from the middle of July through early August for the 2003 Child Safety Seat Usage Survey. The surveys started approximately one week earlier than the surveys that were conducted during the 2002 Child Safety Seat Usage Survey.

CONCLUSIONS AND RECOMMENDATIONS

This paper has summarized the efforts undertaken to date to evaluate the use of restraining devices to restrain infants and toddlers traveling in vehicles in Nevada. A methodology developed for this purpose has been presented along with findings from the efforts. A total of 3,197 observations were made at a total of 50 observation sites located throughout Nevada. The surveys were conducted from the middle of July through early August for the 2003 survey, starting approximately one week earlier than the surveys that were conducted during the 2002 survey. Statistical analyses were used to determine the utilization of restraining devices for infants and toddlers in vehicles, and the confidence levels for the same. Overall the percent of all children restrained in a safety seat were 63.5 percent for Northern Urban, 71.8 percent for Southern Urban, and 52.0 percent for the Rural study group and the statewide average for children in a safety seat was 62.6 percent. This represents an increase in child safety seat usage of 68.3 percent from the usage rate observed during the 2002 Safety Seat Survey.

The methodology developed and results presented in this study provide a starting point to develop a continual program to evaluate the usage of appropriate restraining mechanisms not only for infants and toddlers, but also for other children and adults. The results presented need to be used with caution especially regarding the limitations of the estimates based on the statistical tests and confidence limits.
In order to obtain more statistically rigorous results the number of observations needs to be increased. Special attention needs to be paid to the field data collection efforts so as to ensure an adequate number of samples are obtained at the desired level (e.g. by type of vehicle and by restraint usage). When evaluating data by study group, sufficient observations were made to draw statistically valid conclusions for sedans, pick-ups, vans and sport utility vehicles. Even for these type of vehicles, there are inadequate numbers of observations for some types of restraints. Likewise, the number of observations for station wagons were relatively small for the study groups making it difficult to draw sound inferences regarding the data for this type of vehicle. However, if the data were to be aggregated for all the study groups, this problem can be overcome.

The results of the study bear the potential to be linked to other efforts underway in Nevada such as the CODES project to try to evaluate the costs associated with crashes involving different types of vehicles and characteristics of occupants of the vehicles including those related to the use or deployment of restraining devices. The methodology used and the findings of these efforts could be used to develop educational and enforcement campaigns to increase the use of appropriate restraining devices for infants and toddlers, not only in Nevada, but also in other states and regions.

REFERENCES


### TABLE 1 Survey Locations of Northern Urban Study Group

<table>
<thead>
<tr>
<th>SITE NUMBER</th>
<th>ENTITY</th>
<th>LOCATION</th>
<th>Date Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Carson City</td>
<td>Scolari’s on US 50 at Lompa</td>
<td>07/11/03</td>
</tr>
<tr>
<td>2</td>
<td>Carson City</td>
<td>Albertsons on US 50 at Airport Road</td>
<td>07/11/03</td>
</tr>
<tr>
<td>3</td>
<td>Carson City</td>
<td>K-Mart on Highway 395 at College</td>
<td>07/12/03</td>
</tr>
<tr>
<td>4</td>
<td>Carson City</td>
<td>Safeway on Highway 395 at Carson Street</td>
<td>07/11/03</td>
</tr>
<tr>
<td>5</td>
<td>Carson City</td>
<td>Walmart on Highway 395 (South)</td>
<td>07/11/03</td>
</tr>
<tr>
<td>6</td>
<td>Reno</td>
<td>Raley’s on Seventh Street at Keystone Avenue</td>
<td>07/12/03</td>
</tr>
<tr>
<td>7</td>
<td>Reno</td>
<td>ShopKo on McCarran at Mae Anne Avenue</td>
<td>07/12/03</td>
</tr>
<tr>
<td>8</td>
<td>Reno</td>
<td>Raley’s on McCarran at Caughlin Ranch</td>
<td>07/12/03</td>
</tr>
<tr>
<td>9</td>
<td>Reno</td>
<td>Parklane Mall on Plumb Lane at Locust Street</td>
<td>07/13/03</td>
</tr>
<tr>
<td>10</td>
<td>Reno</td>
<td>Walmart on McCarran at Northtowne</td>
<td>07/13/03</td>
</tr>
<tr>
<td>11</td>
<td>Sparks</td>
<td>Smiths on Sparks Avenue at Baring Avenue</td>
<td>07/13/03</td>
</tr>
<tr>
<td>12</td>
<td>Sparks</td>
<td>Scolari’s on Vista Drive at Disk Drive</td>
<td>07/13/03</td>
</tr>
<tr>
<td>13</td>
<td>Sparks</td>
<td>Target on McCarran at Prater Way</td>
<td>07/13/03</td>
</tr>
<tr>
<td>14</td>
<td>Sparks</td>
<td>Scolari’s on McCarran at Mira Loma</td>
<td>07/13/03</td>
</tr>
</tbody>
</table>
### TABLE 2 Survey Locations for the Southern Urban Study Group

<table>
<thead>
<tr>
<th>SITE NUMBER</th>
<th>ENTITY</th>
<th>LOCATION</th>
<th>Date Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Henderson</td>
<td>Von’s on Windmill at Pecos</td>
<td>07/22/03</td>
</tr>
<tr>
<td>16</td>
<td>Henderson</td>
<td>Raley’s on Boulder Highway at Lake Mead</td>
<td>07/23/03</td>
</tr>
<tr>
<td>17</td>
<td>Las Vegas</td>
<td>King Ranch Market on Decatur at Washington</td>
<td>07/24/03</td>
</tr>
<tr>
<td>18</td>
<td>Las Vegas</td>
<td>Smiths on Rancho at Craig</td>
<td>07/24/03</td>
</tr>
<tr>
<td>19</td>
<td>Las Vegas</td>
<td>McDonalds on Bonanza at Eastern</td>
<td>07/24/03</td>
</tr>
<tr>
<td>20</td>
<td>North Las Vegas</td>
<td>McDonalds on Lake Mead at Las Vegas Blvd</td>
<td>07/24/03</td>
</tr>
<tr>
<td>21</td>
<td>North Las Vegas</td>
<td>Walmart on M.L. King at Craig</td>
<td>07/24/03</td>
</tr>
<tr>
<td>22</td>
<td>Clark County</td>
<td>Walmart on Nellis at Stewart</td>
<td>07/24/03</td>
</tr>
<tr>
<td>23</td>
<td>Clark County</td>
<td>Rainbow at Flamingo</td>
<td>08/01/03</td>
</tr>
<tr>
<td>24</td>
<td>Clark County</td>
<td>Albertsons on Boulder Highway at Tropicana</td>
<td>07/23/03</td>
</tr>
<tr>
<td>25</td>
<td>Clark County</td>
<td>Walmart on Tropicana at Pecos</td>
<td>07/22/03</td>
</tr>
<tr>
<td>26</td>
<td>Clark County</td>
<td>Albertsons on Flamingo at Maryland Parkway</td>
<td>07/21/03</td>
</tr>
<tr>
<td>27</td>
<td>Summerlin</td>
<td>Raley’s on Lake Mead at Rampart</td>
<td>08/01/03</td>
</tr>
<tr>
<td>28</td>
<td>Summerlin</td>
<td>Von’s on Town Center Drive</td>
<td>08/01/03</td>
</tr>
</tbody>
</table>
### TABLE 3 Survey Locations for the Rural Study Group

<table>
<thead>
<tr>
<th>SITE NUMBER</th>
<th>ENTITY</th>
<th>LOCATION</th>
<th>Date Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>Battle Mountain</td>
<td>Food Mart on Front Street at Sonoma Street</td>
<td>07/09/03</td>
</tr>
<tr>
<td>30</td>
<td>Pahrump</td>
<td>Smiths on Highway 160</td>
<td>07/14/03</td>
</tr>
<tr>
<td>31</td>
<td>Boulder City</td>
<td>Von’s on US 93 at Buchanan</td>
<td>07/29/03</td>
</tr>
<tr>
<td>32</td>
<td>Carlin</td>
<td>Post Office near the 4-way stop</td>
<td>07/09/03</td>
</tr>
<tr>
<td>33</td>
<td>Elko</td>
<td>Albertsons on Idaho at East Jennings</td>
<td>07/09/03</td>
</tr>
<tr>
<td>34</td>
<td>Elko</td>
<td>Walmart on Mountain City Highway at Spruce</td>
<td>07/09/03</td>
</tr>
<tr>
<td>35</td>
<td>Ely</td>
<td>Gorman’s Market on US 93</td>
<td>07/08/03</td>
</tr>
<tr>
<td>36</td>
<td>Fallon</td>
<td>Raley’s on Highway 50</td>
<td>07/10/03</td>
</tr>
<tr>
<td>37</td>
<td>Fallon</td>
<td>Walmart on Highway 50</td>
<td>07/10/03</td>
</tr>
<tr>
<td>38</td>
<td>Fernley</td>
<td>Scolari’s on Highway 50</td>
<td>07/10/03</td>
</tr>
<tr>
<td>39</td>
<td>Gardnerville</td>
<td>Raley’s on Highway 395</td>
<td>07/11/03</td>
</tr>
<tr>
<td>41</td>
<td>Lovelock</td>
<td>Safeway on Central at Western</td>
<td>07/10/03</td>
</tr>
<tr>
<td>42</td>
<td>Mesquite</td>
<td>Post Office on Mesquite at Thistle</td>
<td>07/18/03</td>
</tr>
<tr>
<td>43</td>
<td>Logandale</td>
<td>Post Office on SR 169</td>
<td>07/18/03</td>
</tr>
<tr>
<td>44</td>
<td>Caliente</td>
<td>Main Street</td>
<td>07/08/03</td>
</tr>
<tr>
<td>45</td>
<td>Tonopah</td>
<td>Scolari’s on US 95</td>
<td>07/10/03</td>
</tr>
<tr>
<td>46</td>
<td>Wells</td>
<td>Stuart’s Food Town on Humboldt at Easy Street</td>
<td>07/08/03</td>
</tr>
<tr>
<td>47</td>
<td>McGill</td>
<td>Bradley’s Market on US 93</td>
<td>07/08/03</td>
</tr>
<tr>
<td>48</td>
<td>Winnemucca</td>
<td>Walmart on Winnemucca at Potato Road</td>
<td>07/10/03</td>
</tr>
<tr>
<td>49</td>
<td>Winnemucca</td>
<td>Raley’s on Business Loop</td>
<td>07/09/03</td>
</tr>
<tr>
<td>50</td>
<td>Yerington</td>
<td>Scolari’s on Alternate US 95</td>
<td>07/11/03</td>
</tr>
<tr>
<td>51</td>
<td>Laughlin</td>
<td>Aldape’s Market</td>
<td>07/29/03</td>
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</table>
## TABLE 4 Observed Infants and Toddlers in Study Groups

<table>
<thead>
<tr>
<th>Study Group</th>
<th>Total Observations</th>
<th>Infants Observations</th>
<th>Toddlers Observations</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Urban</td>
<td>1058</td>
<td>202</td>
<td>856</td>
<td>19.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>80.9</td>
</tr>
<tr>
<td>Southern Urban</td>
<td>1093</td>
<td>147</td>
<td>946</td>
<td>13.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>86.6</td>
</tr>
<tr>
<td>Rural</td>
<td>1046</td>
<td>209</td>
<td>837</td>
<td>20.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>80.0</td>
</tr>
<tr>
<td>Total</td>
<td>3197</td>
<td>558</td>
<td>2639</td>
<td>17.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>82.5</td>
</tr>
</tbody>
</table>

## TABLE 5 Observed Location of Infants and Toddlers in Study Groups

<table>
<thead>
<tr>
<th>Study Group</th>
<th>Infants</th>
<th>Toddlers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Front</td>
<td>Back</td>
</tr>
<tr>
<td>Northern</td>
<td>8 (4.0%)</td>
<td>194 (96.0%)</td>
</tr>
<tr>
<td>Southern</td>
<td>3 (2.0%)</td>
<td>144 (98.0%)</td>
</tr>
<tr>
<td>Rural</td>
<td>20 (9.6%)</td>
<td>189 (90.4%)</td>
</tr>
<tr>
<td>Total</td>
<td>31 (5.6%)</td>
<td>527 (94.4%)</td>
</tr>
</tbody>
</table>

## TABLE 6 Observed Restraint Usage in Study Groups

<table>
<thead>
<tr>
<th>Restraint</th>
<th>Northern</th>
<th>Southern</th>
<th>Rural</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Percent</td>
<td>Count</td>
<td>Percent</td>
</tr>
<tr>
<td>Front Facing Safety Seat</td>
<td>578</td>
<td>54.6</td>
<td>662</td>
<td>60.6</td>
</tr>
<tr>
<td>Rear Facing Safety Seat</td>
<td>94</td>
<td>8.9</td>
<td>123</td>
<td>11.3</td>
</tr>
<tr>
<td>Held on Lap</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>In Lap Held by Belt</td>
<td>2</td>
<td>0.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>In Adult Belt</td>
<td>269</td>
<td>25.4</td>
<td>242</td>
<td>22.1</td>
</tr>
<tr>
<td>Type</td>
<td>Northern</td>
<td>Southern</td>
<td>Rural</td>
<td>Total</td>
</tr>
<tr>
<td>--------------</td>
<td>----------</td>
<td>----------</td>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>Sedan</td>
<td>373 (35.3 %)</td>
<td>409 (37.4 %)</td>
<td>302 (28.9 %)</td>
<td>1084 (33.9 %)</td>
</tr>
<tr>
<td>Pick-up</td>
<td>121 (11.4 %)</td>
<td>83 (7.6 %)</td>
<td>171 (16.3 %)</td>
<td>375 (11.7 %)</td>
</tr>
<tr>
<td>Station Wagon</td>
<td>104 (9.8 %)</td>
<td>132 (12.1 %)</td>
<td>78 (7.5 %)</td>
<td>314 (9.8 %)</td>
</tr>
<tr>
<td>Van</td>
<td>182 (17.2 %)</td>
<td>266 (24.3 %)</td>
<td>206 (19.7 %)</td>
<td>654 (20.5 %)</td>
</tr>
<tr>
<td>SUV</td>
<td>278 (26.3 %)</td>
<td>203 (18.6 %)</td>
<td>289 (27.6 %)</td>
<td>770 (24.1 %)</td>
</tr>
</tbody>
</table>
Child Safety Seat Survey

Date: ___________  Site Number: _______  Observer: _____________
Observer Location: __________________________

1. Infant or Toddler in vehicle ______

2. | Child 1 | Child 2 | Child 3 | Child 4 | Child 5 |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant (I) or Toddler (T)</td>
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</tr>
<tr>
<td>Location in Vehicle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Front Seat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Back Seat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Cargo Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Restraint</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Front Facing Safety Seat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Rear Facing Safety Seat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Held on Lap</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 In Lap Held by Belt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 In Adult Belt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 No Restraint</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Unable to Determine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Type of Vehicle  __ 1 sedan  __ 2 pick-up  __ 3 station wagon
   __ 4 van  __ 5 sports utility vehicle

4. License Plate  __ 1 Nevada  __ 2 California  __ 3 Other US  __ 4 Foreign

5. Child(ren) in Bed of Pick-up  __ yes  __ no  If so how many? ______

**Figure 1  Survey Form**
Figure 2  Survey locations for the Northern Urban Study Group
Figure 3  Survey locations for the Southern Urban study group
Figure 4     Survey locations for the Rural study group
Figure 5  Location of child in the vehicle
Figure 6  Type of restraint usage in the study groups
Figure 7  Distribution of vehicle type in the study groups
Figure 8  Use of Restraint in the Northern Urban study group - Sedans (N=373)
Figure 9  Use of restraint in the Northern Urban study group- Pick-ups (N=121)
Figure 10  Use of restraint in the Northern Urban study group - Station Wagons (N=104)
Figure

Use of restraint in the Northern Urban study group - Vans (N=182)
Figure 12  Use of restraint in the Northern Urban study group - Sports Utility Vehicles (N=278)
Figure 13
Use of restraint in the Southern Urban study group - Sedans (N=409)
Figure

Use of restraint in the Southern Urban study group - Pick-ups (N=83)
Figure 15
Use of restraint in the Southern Urban study group - Station Wagons
(N=132)
Figure 16  Use of restraint in the Southern Urban study group - Vans (N=266)
Figure 17 Use of restraint in the Southern Urban study group - Sports Utility Vehicles (N=203)
Figure 18
Use of restraint in the Rural study group - Sedans (N=302)
Figure

Use of restraint in the Rural study group - Pick-ups (N=171)
Figure 20  Use of restraint in the Rural study group - Station Wagons (N=78)
Figure 21
Use of restraint in the Rural study group - Vans (N=206)
Figure 22  Use of restraint in the Rural study group - Sports Utility Vehicles (N=289)
Figure 23
Figure 24  Comparison of restraint usage in the Southern Urban study group (1999-2003)
Figure 25
Figure 26  Comparison of restraint usage in the State of Nevada (1999-2003)
Figure 27  Comparison of child safety seat usage in the State of Nevada (1999-2003)