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Safety Belt Use in Wayne County Communities: Fall 2002

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October 2002

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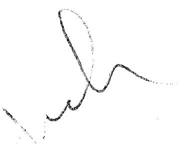

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16. Abstract

Results of a direct observation survey of safety belt use in a six community area of Wayne County, Michigan, conducted in the fall of 2002, are reported here. The six communities included in the survey area were: Brownstown Township, Dearborn, Detroit, Livonia, Romulus, and Taylor. In this study, 2,913 occupants traveling in four vehicle types (passenger cars, sport-utility vehicles, vans/minivans, and pickup trucks) were surveyed during September, 2002. Belt use was estimated for all commercial/noncommercial vehicle types combined and separately for each vehicle type. Belt use by seating position, sex, time of day, and age was also calculated. Overall belt use was 72.9 percent. Belt use was 74.4 percent for passenger cars, 76.0 percent for sport-utility vehicles, 77.3 percent for vans/minivans, and 60.7 percent for pickup trucks. Overall belt use was higher for females than for males, and higher for drivers than for passengers. Belt use was low for 16-to-29-year olds, and increased with age. These findings enable us to examine and measure safety belt use trends in the six communities, and assess the effects of Public Information and Education programs.

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INTRODUCTION

One difficulty with designing a program to increase statewide safety belt use is that across a state like Michigan, safety belt use rates and population demographics are very different depending upon the specific location within the state. Programs can target specific low belt use groups, or attempt to appeal to a specific demographic, but with any given program, certain people will likely not be reached. Another problem with conducting a statewide belt use promotion is evaluating that program. At a minimum, an evaluation should include a baseline survey (or historical comparison data), along with a follow up survey conducted during or after the intervention. Conducting a study such as this on a statewide level can take significant time and may be cost-prohibitive. Conversely, when a program targets a specific community, some of these problems can be minimized. For example, the population of a specific city or township tends to have a population with similar demographics. This similarity lends itself to understanding the population as a whole, thus safety belt promotions can be designed with these specific demographics in mind.

Certain groups in Michigan tend to wear safety belts less often than others – males, 16-to-29 year olds, pickup truck drivers, and motorists in Wayne County (see, e.g. Eby, Molnar, & Olk, 2000; Eby, Vivoda, & Fordyce, 2002). Generally, these groups should always be a focus of safety belt campaigns. However, when focusing a campaign within a specific community, it is important to have a thorough understanding of the groups within that community. A few demographic characteristics that are important to keep in mind include the median household income level, average level of education, and age and race distributions within the area. Studies have shown that income and level of education are positively correlated with safety belt use (National Highway Traffic Safety Administration, NHTSA, 2000a; Wagenaar, Molnar, & Businski, 1987a). Several studies have also reported that safety belt use among African-Americans tends to be lower than belt use by Whites (see, e.g., Eby, et al., 2002; NHTSA, 2000b). Studies conducted in Michigan and elsewhere report that belt use tends to increase with age. Young adults have the lowest belt use, while motorists over the age of 60 tend to have the highest (see e.g., Eby, Molnar, & Olk, 2000; Eby, Vivoda, & Fordyce, 2002; NHTSA, 2000b).

To establish an effective belt use program in a specific community, it is critical to understand how these factors differ in the community of interest. For example, if a Public Information and Education (PI&E) program was being designed to increase belt use in two communities, and one community was predominately comprised of older citizens with a median annual household income of $90,000, while the other community consisted mostly of young families with an average annual household income of $40,000, implementing a single PI&E program for both communities would not be as effective as tailoring specific messages to each community. Understanding the composition of each area would not only lend itself to focusing the message on the appropriate group, but also to understanding how the overall community will respond to the given message. Appropriately targeted belt use campaigns can be very effective tools for increasing belt use in a specific community.

The most effective types of programs for increasing belt use include highly visible safety belt law enforcement combined with extensive media support (Solomon, Nissen, & Preusser, 1999). Implementing this type of safety belt campaign on a statewide level can be problematic. A statewide enforcement campaign may be limited to the regions of the state where most of the police resources have been allocated – typically the most densely populated areas. As such, it may be difficult to affect an increase in safety belt use in all areas of the state, such as small communities or rural areas. However, a campaign conducted in a relatively small geographic area, like a city or township, is less likely to encounter these types of problems. Tailoring the program for a specific community allows police enforcement to be allocated more effectively. Local police will likely be more familiar with specific problem areas and can therefore saturate these areas, along with the entire city or township, with enforcement.

A very good illustration of effective implementation of a belt use program in a medium-sized community is noted in Elmira, New York. In October, 1999, a Selective Traffic Enforcement Program (sTEP) was implemented to increase belt use in the area (NHTSA, 2000c). Over a period of three weeks, belt use in Elmira increased 27 percentage points from 63 percent to 90 percent. This particular program began with a period of "soft" publicity addressing the value of wearing a safety belt; followed by a period of "hard" publicity during which the public was told that intensified enforcement was coming. The final phase involved a period of intensive enforcement with continued publicity (NHTSA, 2000c). This program was successful for several key reasons. To garner support for the effort from different sources within the community, a "community coalition" was built and led by local police agencies. Highly publicized, zero-tolerance enforcement of the belt law was implemented along with intensive publicity focusing on the enforcement. Data were collected before, during, and after the program to measure its effects. Finally, feedback was given to the community regarding the results and progress toward the belt use goal. Another critical aspect to the success of this program was that it was contained within a well defined geographic area. The media and enforcement were able to focus specifically on the area and target the safety belt messages appropriately.

For many years, Michigan has implemented various programs in a concerted effort to increase belt use in Wayne County. In March, 2000, Michigan received additional funding from NHTSA to enhance these efforts. The Wayne County Safety Belt Project is a broad based, multi-year campaign designed to educate and train the public, law enforcement officers, and judges about the importance of safety belt and child passenger restraint use. Police enforcement and community awareness programs were also implemented as part of this project (OHSP, 2000a). This type of community-based program may have the greatest potential for reaching segments of the population that disregard safety belt use. The project focuses on six communities: Brownstown Township, Dearborn, Detroit, Livonia, Romulus, and Taylor. During the first year of the project, community support for the effort was established by developing and distributing materials that emphasize the importance of safety belt use and child passenger safety (OHSP, 2000a). The communities participated in the distribution of yard signs that read, "It's there (picture of a safety belt) to wear." The signs were intended to raise community awareness of safety belt use. Neighborhood coalitions promoted the signs and assisted with community outreach activities (OHSP, 2000a). In addition, a public education group marketed safety belt use to local churches and medical groups to ensure that minority populations in Wayne County were aware of the benefits of safety belt and car safety seat use (OHSP, 2000b).

Every September, the University of Michigan Transportation Research Institute (UMTRI) conducts a statewide direct observation survey of safety belt use in Michigan which includes the Wayne County area. However, these observations reflect a belt use rate for Wayne County collectively, and do not differentiate one area from another. The participation of specific communities in the Wayne County Safety Belt Project highlights the importance of measuring safety belt use in this specific area. Given the vast difference in demographics, socio-economic status, and level of urbanization in the participating communities, using the overall Wayne County belt use rate as an average might overlook a change that occurred within this area, yet was not observable in the overall county rate.

The current survey provides data for both assisting in the development of appropriate safety belt promotion programs in specific Wayne County communities, and evaluating the effectiveness of the existing program. The design of this survey focuses exclusively upon belt use on local roads in the six Wayne County communities. Thus, the survey provides data to closely track changes in belt use within the populations most likely to be influenced by programs developed by the Michigan Office of Highway Safety Planning.

METHODS

Sample Design

The sample design for the current survey was closely based upon the one used by Streff, Eby, Molnar, Joksch, and Wallace (1993). While the entire sampling procedure is presented in the previous report, it is repeated here for completeness, with modifications noted.

The purpose of the study was to assess the safety belt use rate in a six-community area in Wayne county[1]. This area consisted of the following communities: Brownstown Township, Dearborn, Detroit, Livonia, Romulus, and Taylor. Because communities were sampled collectively, individual safety belt use rates calculated for each community may not be representative of that community's belt use rate. Separate community safety belt use rates are presented only as a way of tracking the effectiveness of belt use programs in each of the six communities.

Observation sites for the study were selected using a procedure that ensured an equal probability of selection for every roadway intersection within the borders of the six communities. Detailed equal-scaled road maps of the Detroit Metropolitan Area were obtained. The six communities were included in 30 of these maps. Each map was numbered and overlaid with a grid pattern. The grid dimensions were 86 lines horizontally and 69 lines vertically. The lines of the grid were separated by approximately 1/8 inch. The maps were approximately *1 7/8 inch:mile* scale, thus creating grid squares that were .07 miles per side. Each grid square was uniquely identified by two numbers, a horizontal (x) coordinate and a vertical (y) coordinate.

[1]The study was originally designed with 5 cities. One of the cities is no longer part of the survey, while two additional communities have been added. The same procedures were followed for site selection in the additional two communities.

The 41 sites in the survey were chosen sequentially, by first randomly selecting a map number containing one of the cities in the sample[2]. A number between 1 and 30 was randomly chosen and the corresponding map was delineated as the area from which a site would be selected. Once the map was selected, a random *x* and a random *y* coordinate were chosen and the corresponding grid square identified. If the chosen grid square contained an intersection that was within the boundary of one of the six communities, that intersection was marked as the observation site. An alternate map number was randomly generated if the grid square did not contain an intersection, or if the intersection did not fall within the boundary of one of the six communities. This process was repeated until an eligible intersection was identified. Site numbers were assigned in numerical order, following this same process, until 41 sites were selected. Refer to Appendix B for a listing of the sites.

Once all of the sites were selected, the street and direction of traffic flow to be observed was determined. The street to be observed was randomly assigned via a coin flip. The direction of traffic flow was also assigned using this method. All sites were visited by the field supervisor to determine if observations were possible. Each site was required to have a traffic control device, and traffic flow in the lane that had been designated for observations. If the street designated as the observation street did not have a traffic control device, the other street in the intersection was assigned as the street to be observed. In a similar manner, if it was not possible to observe the traffic flow in the direction chosen during site selection, the opposite direction was assigned for observation. For example, if northbound Second Street was to be observed, and Second Street was a one-way street with traffic flowing south, the southbound traffic was assigned as the direction to be observed.

For each primary intersection site, an alternate site was also selected. Alternate sites were determined by counting the number of eligible intersections within a one mile radius around the primary site. These intersections were assigned a number. A random number was then generated, between one and the total number of eligible intersections,

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[2]It should be noted that this step does not constitute an additional stage of sampling. It is simply a convenient method for randomly selecting a grid square from several pages of sequential grids.

and the corresponding intersection was assigned as the alternate site. The observer location at the alternate intersection was determined in the same way as at the primary site.

The day of week and time of day for site observation were randomly assigned to sites in such a way that all days of the week and all daylight hours (7:00 a.m. - 7:00 p.m.) had essentially equal probability of selection. The sites were observed using a clustering procedure. That is, sites that were located spatially adjacent to each other were considered to be a cluster. Within each cluster, the shortest route between all of the sites was decided (essentially a loop), and each site was numbered. An observer watched traffic at all sites in the cluster during a single day. The day the cluster was to be observed was randomly determined. After taking into consideration the time required to finish all sites before dark, a random starting time for the day was selected. In addition, a random number between one and the number of sites in the cluster was selected. This number determined the site within the cluster where the first observation would take place. The observer then visited sites following the loop in a clockwise direction. Because of various scheduling limitations (e.g., observer availability, number of hours worked per week), certain days were selected that could not be observed. When this occurred, a new day was randomly selected until a usable one was found. It should be noted that the random process of selecting the day and time assignments for the sites was not correlated with belt use at a site. This method is random with respect to this issue.

Table 1 shows descriptive statistics for the 41 observation sites. As shown in this table, the observations were fairly well distributed over time of day, with the exception of very early mornings and evenings. Another exception was that no observations occurred on Friday. Note that an observation session was included in the time slot that represented the majority of the observation period. If the observation period was evenly distributed between two time slots, it was included in the later time slot. This table also shows that nearly every site observed was the primary site, and the majority of observations occurred on sunny days followed by cloudy days, with only a few observations conducted during rain.

Table 1. Descriptive Statistics for the 41 Observation Sites							
Day of Week		**Observation Period**		**Site Choice**		**Weather**	
Monday	21.9%	7-9 a.m.	9.8%	Primary	97.6%	Sunny	61.0%
Tuesday	17.1%	9-11 a.m.	24.4%	Alternate	2.4%	Cloudy	31.7%
Wednesday	12.2%	11-1 p.m.	19.5%			Rain	7.3%
Thursday	17.1%	1-3 p.m.	24.4%			Snow	0.0%
Friday	0.0%	3-5 p.m.	19.5%				
Saturday	9.8%	5-7 p.m.	2.4%				
Sunday	21.9%						
TOTALS	100%		100%		100%		100%

Data Collection

Data collection for the study involved direct observation of vehicle type, whether or not the vehicle was used for commercial purposes, shoulder belt use, estimated age, and sex for both the driver and front-right passenger. Trained field staff observed shoulder belt use of drivers and front-right passengers traveling in passenger cars, sport-utility vehicles, vans/minivans, and pickup trucks during daylight hours from September 14 through September 19, 2002. Observations were conducted when a vehicle came to a stop at a traffic light or a stop sign.

Data Collection Forms

Two forms were used for data collection: a site description form and an observation form. The site description form (see Appendix A) provided descriptive information about the site including the site number, location, site type, site choice (primary or alternate), observer number, date, day of week, time of day, weather, and a count of eligible vehicles traveling on the proper traffic leg. A place on the form was also designated for observers to sketch the intersection and identify observation locations and traffic flow patterns. Finally, a comments section was available for observers to identify landmarks that might be helpful in characterizing the site (e.g., school, shopping mall) and to discuss problems or issues relevant to the site or study.

The second form, the observation form, was used to record safety belt use, passenger information, and vehicle information (see Appendix A). Each observation form was divided into four boxes with each box having room for the survey of a single vehicle. For every vehicle surveyed, shoulder belt use, sex, and estimated age of the driver as well as vehicle type were recorded on the upper half of the box, while the same information for the front-outboard passenger could be recorded in the lower half of the box, if there was a front-right passenger present. Furthermore, whether or not the vehicle was used for commercial purposes was also recorded. Children riding in child safety seats (CSSs) were recorded but not included in any part of the analysis. Occupants observed with their shoulder belt worn under the arm or behind the back were noted but considered as belted in the analysis. At each site, the observer carried several data collection forms and completed as many as were necessary during the observation period.

Procedures at Each Site

Every site in the sample was visited by one observer for a period of one hour, with the exception of sites in the city of Detroit, and sites in other communities observed on the same day as the Detroit sites. To address potential security concerns, Detroit sites were visited by two-person teams of observers for a period of 30 minutes. Because each team member at Detroit sites recorded data for different lanes of traffic, the total amount of data collection time at Detroit sites was equivalent to that at other sites.

Upon arrival at a site, observers determined whether observations were possible. If observations were not possible (e.g., due to construction in the designated observation lane), observers proceeded to the alternate site. Otherwise, observers completed the site description form and then moved to their observation position near the traffic control device.

Observers were instructed to observe only the lane immediately adjacent to the curb regardless of the number of lanes present. At sites visited by two-person teams, team members observed different lanes of the same traffic leg (standing with one observer on the curb and one observer on the median if there was more than one traffic lane and a median), or on diagonally opposite corners of the intersection.

At each site, observers conducted a 5-minute count of all eligible vehicles on the designated traffic leg before beginning safety belt observations. Observations began immediately after completion of the count, and continued for 50 minutes at sites with one observer and 25 minutes at sites with two observers. During the observation period, observers recorded data for as many eligible vehicles as possible. If traffic flow was heavy, observers were instructed to record data for the first eligible vehicle they saw, then look up and record data for the next eligible vehicle they saw, continuing this process for the remainder of the observation period. At the end of the observation period, a second 5-minute vehicle count was conducted at one-observer sites.

Observer Training

Prior to data collection, field observers participated in 5 days of intensive training including both classroom review of data collection procedures and practice field observations. Each observer received a training manual containing detailed information on field procedures for observations, data collection forms, and administrative policies and procedures. The manual included a site schedule identifying the location, date, time, and traffic leg to be observed for each site (see Appendix B for a listing of the sites).

After intensive review of the manual, observers conducted practice observations at several sites chosen to represent the types of sites and situations that would actually be encountered in the field. None of these practice sites were the same as sites observed during the study. Training at each practice site focused on completing the site description form, determining where to stand and which lane to observe, conducting the vehicle count, recording safety belt use, estimating age and sex, and differentiating between commercial and noncommercial vehicles. Observers worked in teams of two, observing the same vehicles, but recording data independently on separate data collection forms. The forms were then compared for consistency. Teams were rotated throughout the training to ensure that each observer was paired with every other observer at least eight times. Each observer pair practiced recording safety belt use, sex, age, and vehicle information until there was an inter-observer reliability of at least 85 percent for all measures on drivers and front-right passengers for each pair of observers.

Each observer was provided an atlas of Michigan county maps and all necessary field supplies. Observers were given time to mark their assigned sites on the appropriate maps and plan travel routes to the sites. After marking the sites on their maps, the marked locations were compared to a master map of locations to ensure that the correct sites had been identified. Field procedures were reviewed for the final time and observers were informed that unannounced site visits would be made by the field supervisor during data collection to ensure adherence to study protocols.

Observer Supervision and Monitoring

During data collection, each observer was spot checked in the field on at least two occasions by the field supervisor. Contact between the field supervisor and field staff was also maintained on a regular basis through staff visits to the UMTRI office to drop off completed forms, and through telephone calls from staff to report progress and discuss problems encountered in the field. Field staff were instructed to call the field supervisor at home if problems arose during evening hours or on weekends.

Incoming data forms were examined by the field supervisor and problems (e.g., missing data, discrepancies between the site description form and site listing or schedule) were noted and discussed with field staff. Attention was also given to comments on site description forms about site-specific characteristics that might affect future surveys (e.g., traffic flow patterns, traffic control devices, site access).

Data Processing and Estimation Procedures

Data from the site description and observation forms were entered into an electronic format. The accuracy of the data entry was verified in two ways. First, all data were entered twice and the data sets were compared for consistency. Second, the data from randomly selected sites were reviewed for accuracy by a second party and all site data were checked for inconsistent codes (e.g., the observation end time occurring before the start time). Errors were corrected after consultation with the original data forms.

For each site, computer analysis programs determined the number of observed vehicles, belted and unbelted drivers, and belted and unbelted passengers. Separate counts were made for each independent variable in the survey (i.e., site type, time of day, day of week, weather, sex, age, seating position, and vehicle type). This information was combined with the site information to create a file used for generating study results.

The goal of this safety belt survey was to estimate belt use for the six community area in Wayne County, Michigan based on vehicle miles of travel (VMT). The self-weighting-by-VMT scheme employed is limited by the number of vehicles for which an observer can accurately record information. To correct for this limitation, the vehicle count information was used to weight the observed traffic volumes so they would more accurately reflect VMT.

This weighting was done by adding each of the two 5-minute counts and then multiplying this number by five so that it would represent a 50-minute duration[3]. The resulting number was the estimated number of vehicles passing the site if all eligible vehicles had been included in the survey during the observation period at that site. The estimated count for each site is divided by the actual number of vehicles observed there to obtain a volume weighting factor for that site. These weights are then applied to the number of actual vehicles of each type observed at each site to yield the weighted N for the total number of drivers and passengers, and total number of belted drivers and passengers for each vehicle type. Unless otherwise indicated, all analyses reported are based upon the weighted values.

The overall estimate of belt use per VMT in the six community area of Wayne County, Michigan was determined by calculating the belt use rate for observed vehicle occupants in all vehicle types using the following formula:

$$r = \frac{\textit{Total Number of Belted Occupants, weighted}}{\textit{Total Number of Occupants, weighted}}$$

[3] As mentioned previously, the Detroit sites were visited by pairs of observers for half as long. For these sites, the single 5-minute count was multiplied by five to represent the 25-minute observation period.

The totals are the sums across all 41 sites after weighting, and occupants refers only to front-outboard occupants.

The estimates of variance and the calculation of the confidence bands for the belt use estimates are complex. See Appendix C for a detailed description of the formulas and procedures. The same use rate and variance equations were utilized for the calculation of use rates for each vehicle type separately.

RESULTS

Overall Safety Belt Use

As shown in Figure 1, 72.9 ± 1.9 percent of all front-outboard occupants traveling in commercial/noncommercial passenger cars, sport utility vehicles, vans/minivans, or pickup trucks on local roads in the six community area of Wayne County, Michigan during September 2002 were restrained with shoulder belts. The "±" value following the use rate indicates a 95 percent confidence band around the percentage. This value should be interpreted to mean that we are 95 percent sure that the actual safety belt use rate falls somewhere between 71.0 percent and 74.8 percent.

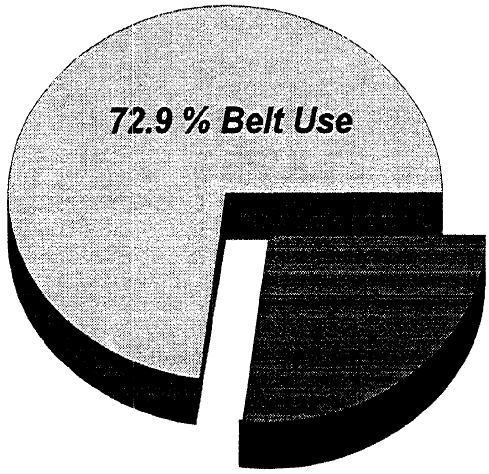

Figure 1. Front-Outboard Shoulder Belt Use in a Six Community Area of Wayne County, Michigan.

Table 2 shows shoulder belt use rates and unweighted number of occupants by vehicle type in the six community area of Wayne County, Michigan. A statistical analysis reveals that belt use does not significantly differ between occupants of passenger cars, vans/minivans, and sport-utility vehicles. However, belt use for occupants of pickup trucks is significantly lower than use for occupants of the other three vehicle types. Note that the unweighted number of occupants is fairly low for all vehicle types except for passenger cars. Thus, it is not possible to calculate meaningful safety belt use rates by those vehicle types for any subcategories. The remaining results are presented with all vehicle types combined.

Table 2. Percent Shoulder Belt Use and Unweighted Number of Occupants by Vehicle Type in the Six Community Area of Wayne County, Michigan		
Vehicle Type	**Percent Use**	**Unweighted N**
Passenger	74.4 ± 2.5 %	1,622
Van/Minivan	77.3 ± 6.5 %	422
Sport Utility	76.0 ± 5.8 %	447
Pickup Truck	60.7 ± 4.3 %	422
All Vehicles Combined	**72.9 ± 1.9 %**	2,913

Estimated Safety Belt Use by Seating Position

Estimated safety belt use rates by seating position are shown in Figure 2. As is typically found in Michigan (Eby, Molnar, & Olk, 2000; Eby, Vivoda, & Fordyce, 2002), driver belt use was higher than passenger belt use.

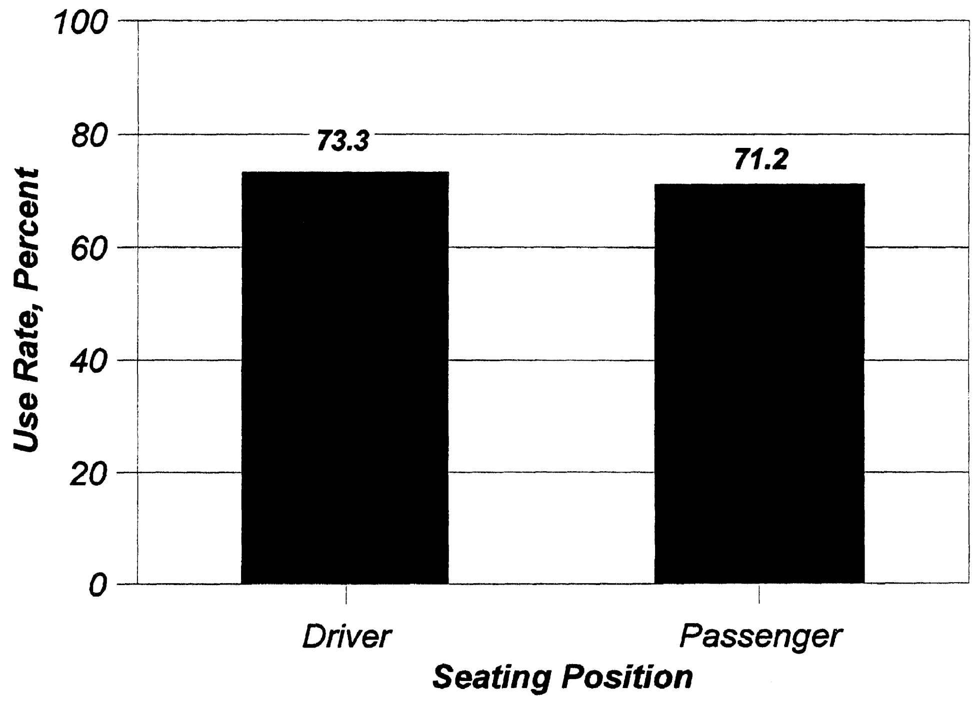

Figure 2. Front-Outboard Shoulder Belt Use by Seating Position in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Sex

Estimated safety belt use rates by sex for the six community area of Wayne County, Michigan are shown in Figure 3. Female belt use is higher than male belt use, with a difference of 12.2 percentage points. This finding is consistent with a large body of research on safety belt use by sex (see Eby, Molnar, & Olk, 2000; Eby, Vivoda, & Fordyce, 2002, for a review).

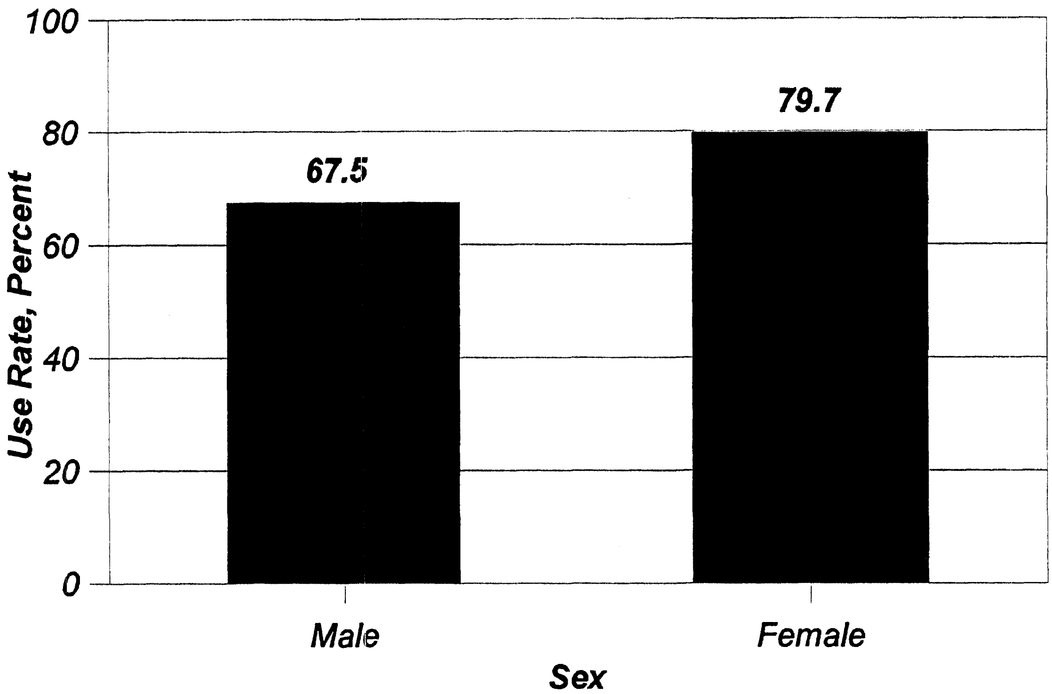

Figure 3. Front-Outboard Shoulder Belt Use by Sex in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Time of Day

The estimated safety belt use rates in the six community area of Wayne County, Michigan by time of day are shown in Figure 4. Safety belt use was lowest between 9 am and 11 am and remained relatively consistent throughout the rest of the day.

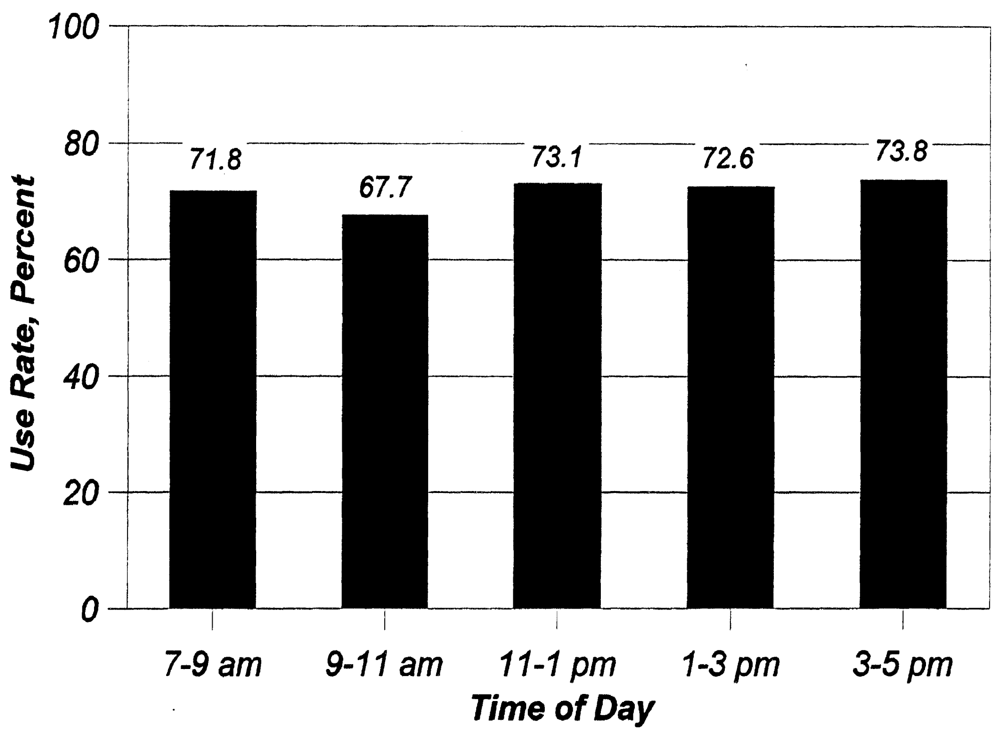

Figure 4. Front-Outboard Shoulder Belt Use by Time of Day in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Age

Estimated safety belt use rates by age are shown in Figure 5. Following NHTSA (1998) guidelines, children traveling in child safety seats (CSSs) are not included in this survey. Only one child in the 0-to-3-year-old age group not seated in a CSS was observed in the study, thus no meaningful interpretations can be made concerning belt use in this age group. Consequently, all figures exclude this age group. Additionally, there were only 108 children in the 4-to-15-year-old age group observed in the front-outboard position. Therefore, the rates calculated for these age groups should be interpreted with caution. Excluding these age groups, we find that belt use is lowest for 16-to-29-year olds, with higher rates of safety belt use observed in the older age groups. This trend was also found in the recent statewide survey of safety belt use (Vivoda & Eby, 2002).

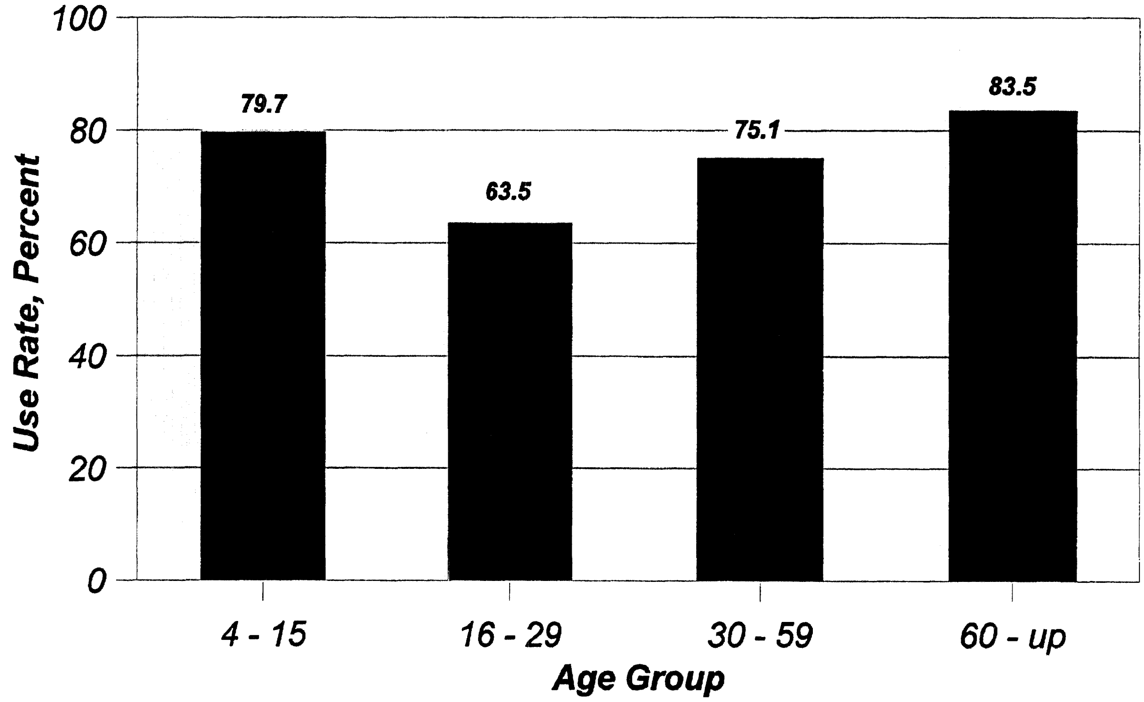

Figure 5. Front-Outboard Shoulder Belt Use by Age Group in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Age and Sex

Figure 6 shows the estimated safety belt use rates by age group and sex. Again, the rates for the 4-to-15 year old age group are based on very low observation numbers; these calculated rates are not statistically meaningful and should be interpreted with caution. Male safety belt use rates are lower than female rates in all age groups. Figure 6 also indicates that for each sex, safety belt use rates are higher for occupants in the 30-to-59 and 60-years and older age groups, than for the 16-to-29 year old age group.

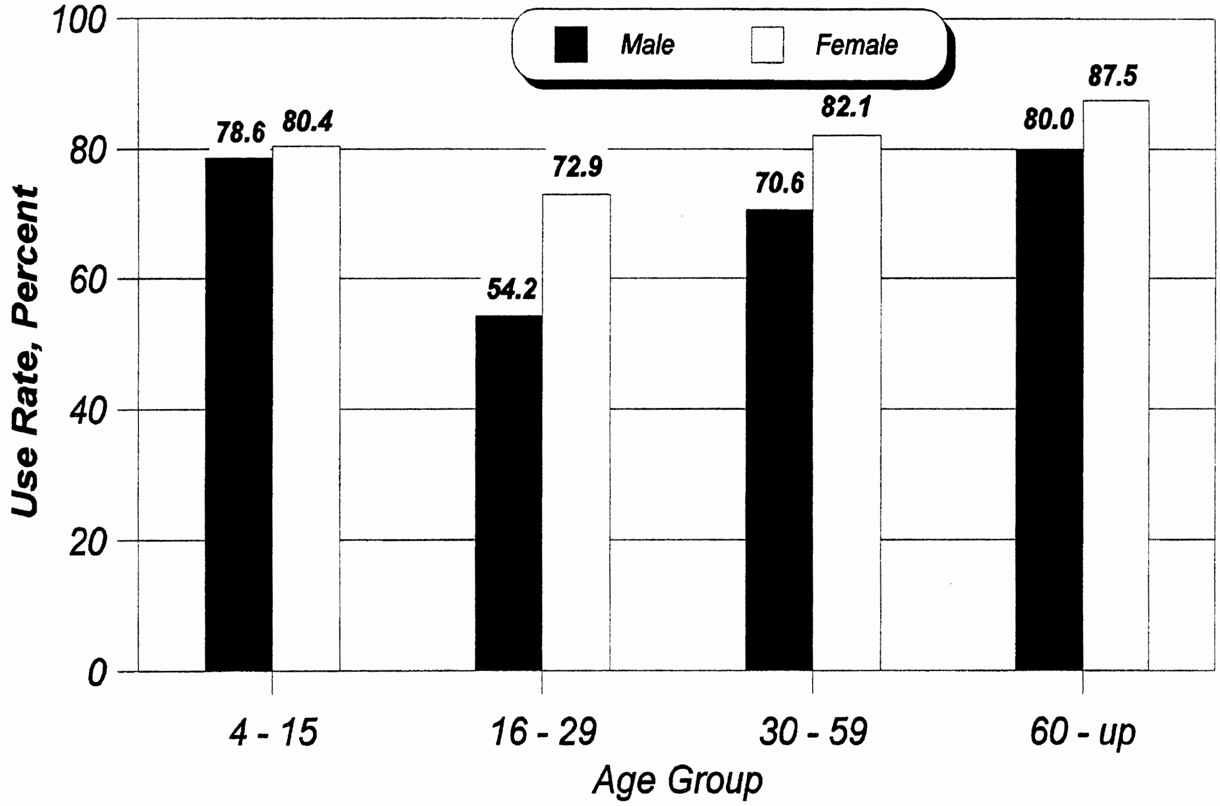

Figure 6. Front-Outboard Shoulder Belt Use by Age and Sex in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Community

In order to measure the effects of community specific safety belt use programs, we have calculated safety belt use rates for each community separately. It should be noted that the sample was designed to determine safety belt use across the entire six-community area as a whole. The unweighted N within each community is quite low. Consequently, the community-by-community numbers reported here may not be representative of community wide belt use, and must be interpreted with caution. Table 3 shows the safety belt use rates and unweighted numbers of observations by community. The highest safety belt use rate was observed in Livonia, and the lowest was noted in Detroit. The statistical analysis reveals that the safety belt use rates in Brownstown Township, Dearborn, Livonia, and Taylor were significantly higher than the rate in Detroit. The rate observed in Livonia was also significantly higher than the rate in Dearborn. However, given the relatively small number of observations in several communities and the resulting large margins of error, no other significant differences were observed.

Table 3. Percent Shoulder Belt Use and Unweighted Number of Occupants by Community in Wayne County, Michigan

Community	Percent Use	Unweighted N
Brownstown Township	75.2 ± 3.4 %	669
Dearborn	73.4 ± 1.4 %	320
Detroit	65.6 ± 5.3 %	670
Livonia	79.7 ± 4.6 %	260
Romulus	72.4 ± 2.7 %	629
Taylor	74.8 ± 2.5 %	365

TRENDS

Overall Safety Belt Use by Year

As shown in Figure 7, 72.9 ± 1.9 percent of all front-outboard occupants traveling in commercial/noncommercial passenger vehicles, sport utility vehicles, vans/minivans, or pickup trucks on local roads in the six community area of Wayne County, Michigan during September 2002 were restrained with shoulder belts. While the overall rate appears to have declined since last year, this difference is not statistically significant. However, an analysis of the current rate compared to the rate observed prior to standard enforcement, implemented March 10, 2000, reveals an increase of 18.4 percentage points[4].

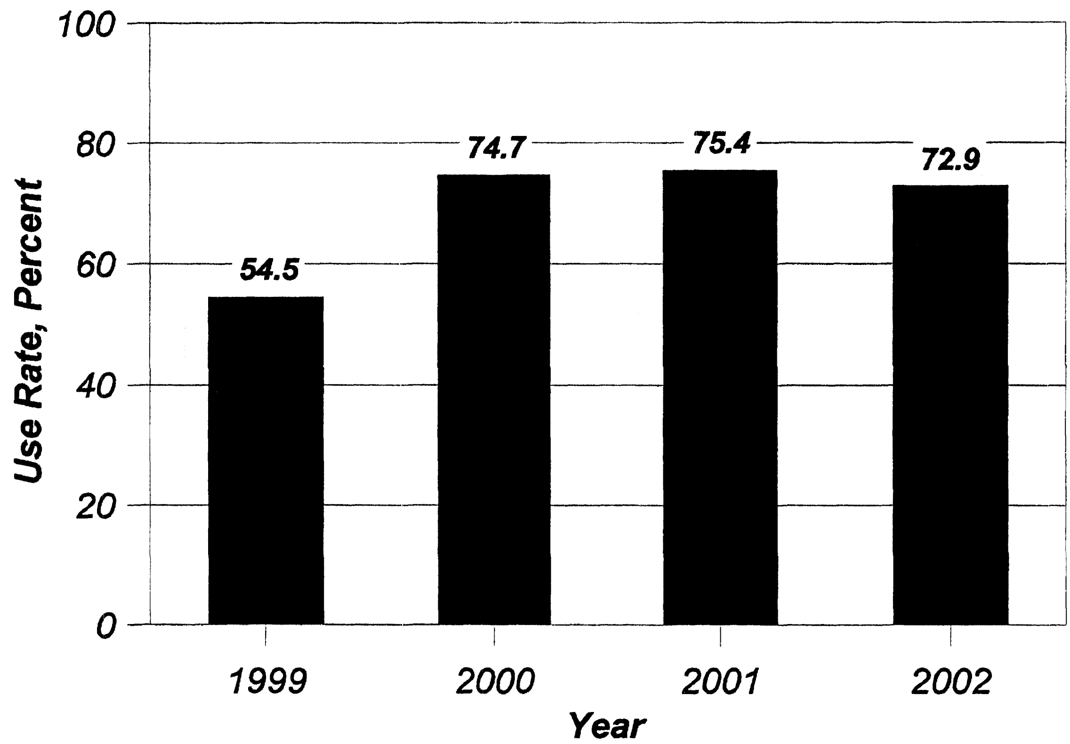

Figure 7. Front-Outboard Shoulder Belt Use by Year in a Six Community Area of Wayne County, Michigan.

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[4]The surveys conducted in 1999 and 2000 included the city of Westland. The addition of Brownstown Township and Romulus, along with the removal of Westland in 2001, make overall comparisons between the two most recent surveys with the first two years difficult.

Estimated Safety Belt Use by Seating Position and Year

Estimated safety belt use rates by seating position and year are shown in Figure 8. As is typically found in Michigan (Eby, Molnar, & Olk, 2000; Eby, Vivoda, & Fordyce, 2002), driver belt use was higher than passenger belt use for all four survey years. A significant increase over the pre-standard enforcement level has been observed in both seating positions.

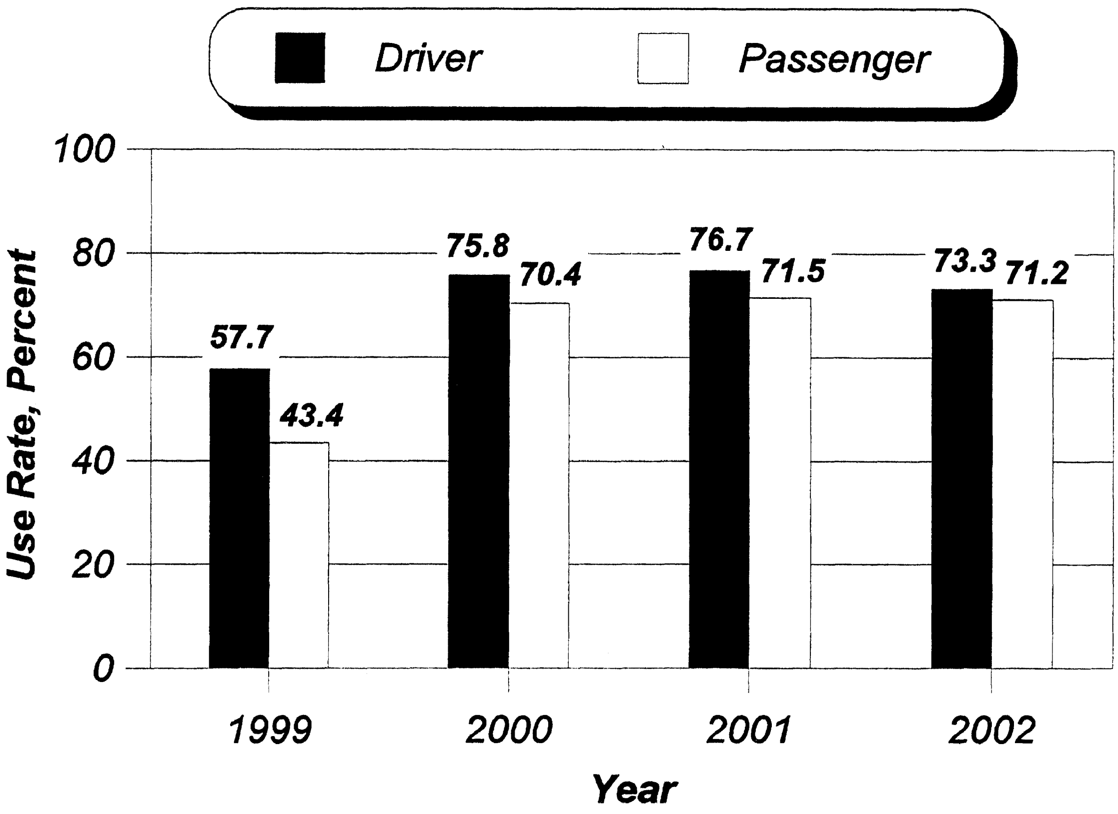

Figure 8. Front-Outboard Shoulder Belt Use by Seating Position and Year in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Sex and Year

The estimated safety belt use rates by sex and year for the six community area of Wayne County, Michigan are shown in Figure 9. Belt use has increased for both sexes when compared with 1999, but the rates have remained relatively consistent since then. In September, 2001, it was noted that the difference between males and females had declined, but the large difference is once again observed in the current survey.

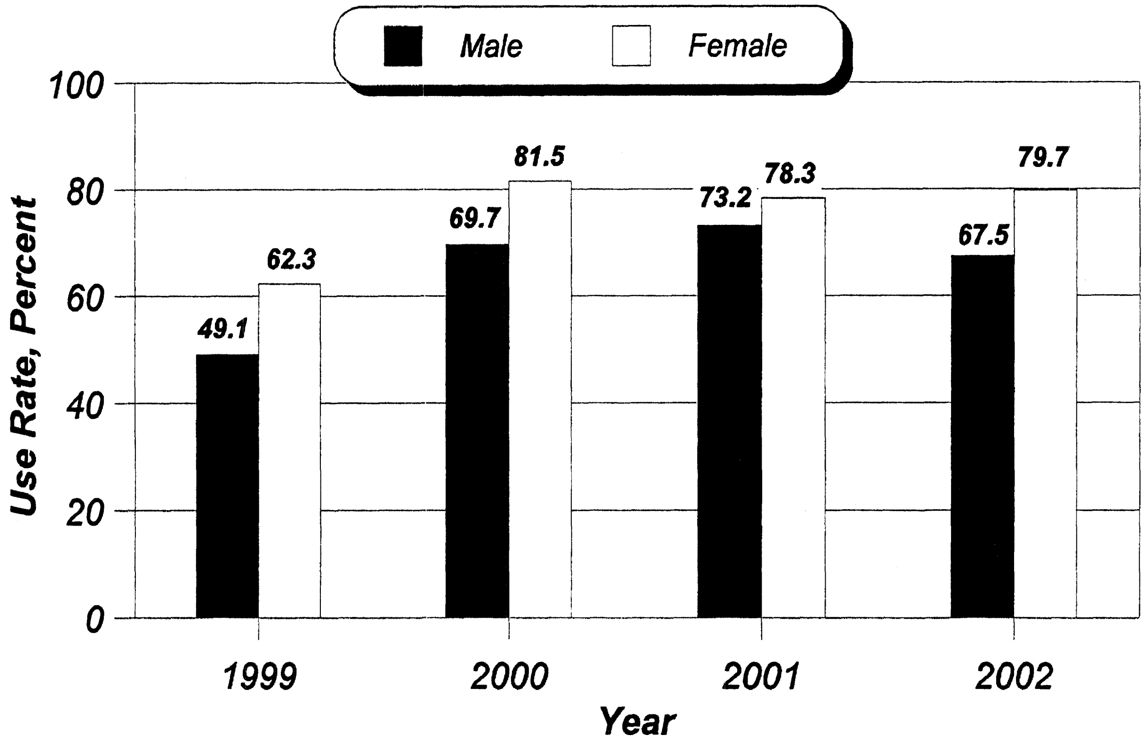

Figure 9. Front-Outboard Shoulder Belt Use by Sex and Year in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Time of Day and Year

The estimated safety belt use rates in the six community area of Wayne County, Michigan by time of day and year are shown in Figure 10. Safety belt use rates were significantly higher at all times in all three surveys conducted since the implementation of standard enforcement. Similar trends were noted in the first three surveys; safety belt use was highest during the morning rush hour and declined near the end of the day. However the current survey does not follow this trend, but there is no obvious explanation for this finding.

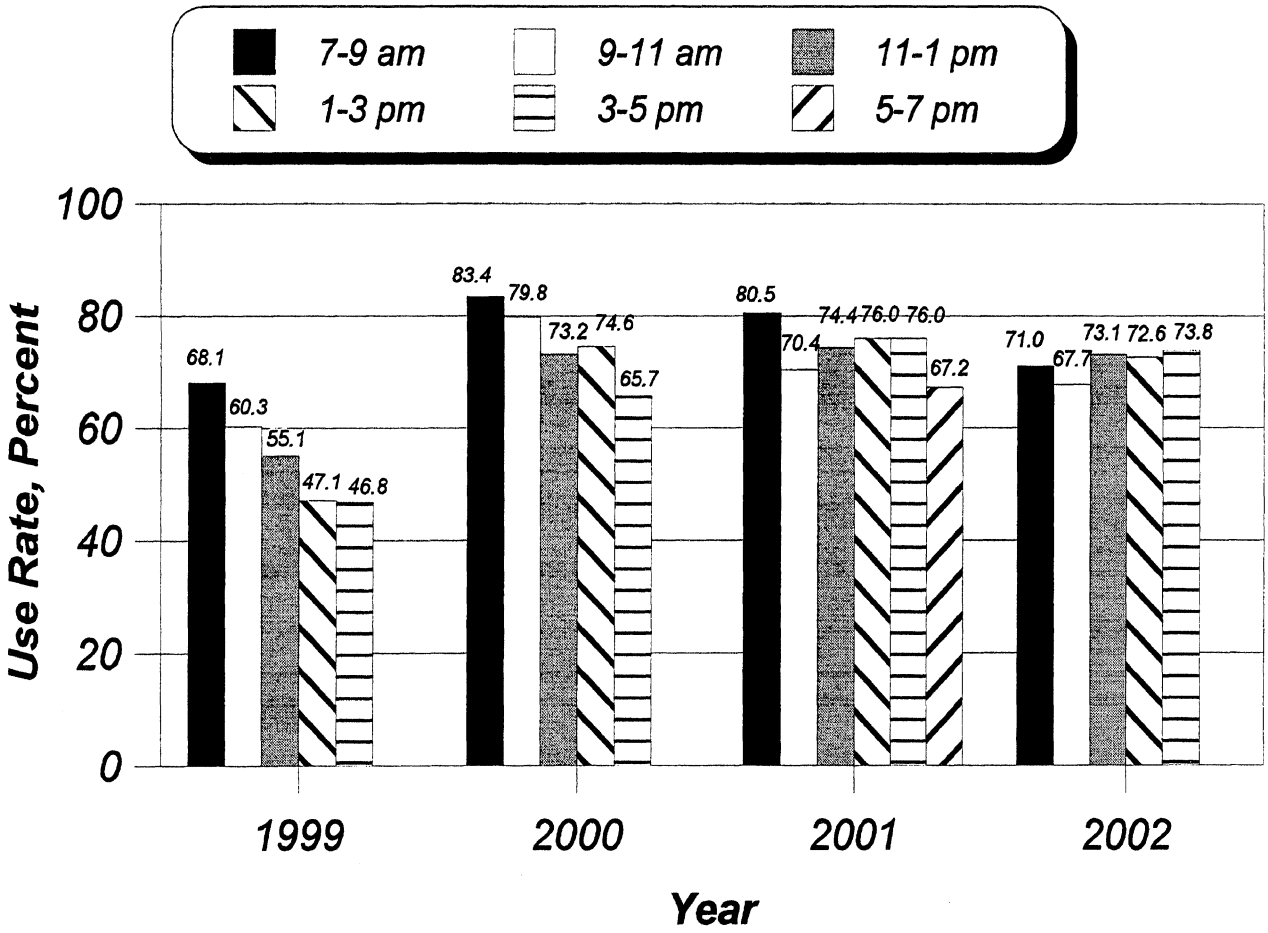

Figure 10. Front-Outboard Shoulder Belt Use by Time of Day and Year in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Age and Year

Estimated safety belt use rates by age is shown in Figure 11. Excluding the two youngest age groups, for reasons previously discussed, belt use is lowest in the 16-to-29-year old age group for each year surveyed. The highest belt use was consistently observed in the two oldest age groups. While safety belt use rates for 2000, 2001, and 2002 were significantly higher than rates for 1999, the most notable differences over the past year are observed in the 60-up and 16-to-29 year old age groups. Belt use appears to have increased for the 60-up age group and declined somewhat for 16-to-29 olds.

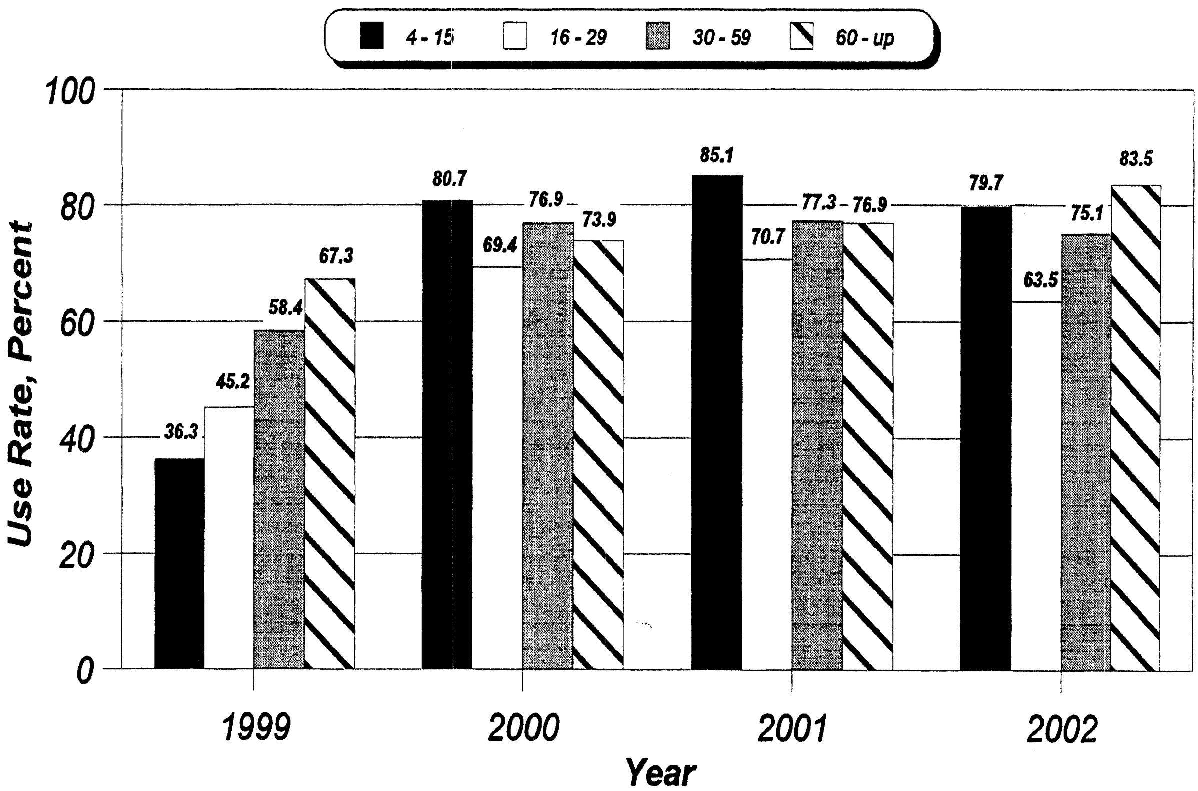

Figure 11. Front-Outboard Shoulder Belt Use by Age Group and Year in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Sex, Age, and Year

Shown in Figures 12 and 13 are the estimated safety belt use rates by sex, age group, and year. For all years, the rates for the youngest age group are based on very low observation numbers and therefore are not meaningful. Excluding this age group, we find that male belt use rates are considerably lower than the rates for females in all age groups for all survey years. An analysis of the decrease in belt use within the 16-to-29 year old age group reveals that most of this decrease was observed in males. Within each sex and across all years, the use rates are highest for the two oldest age groups.

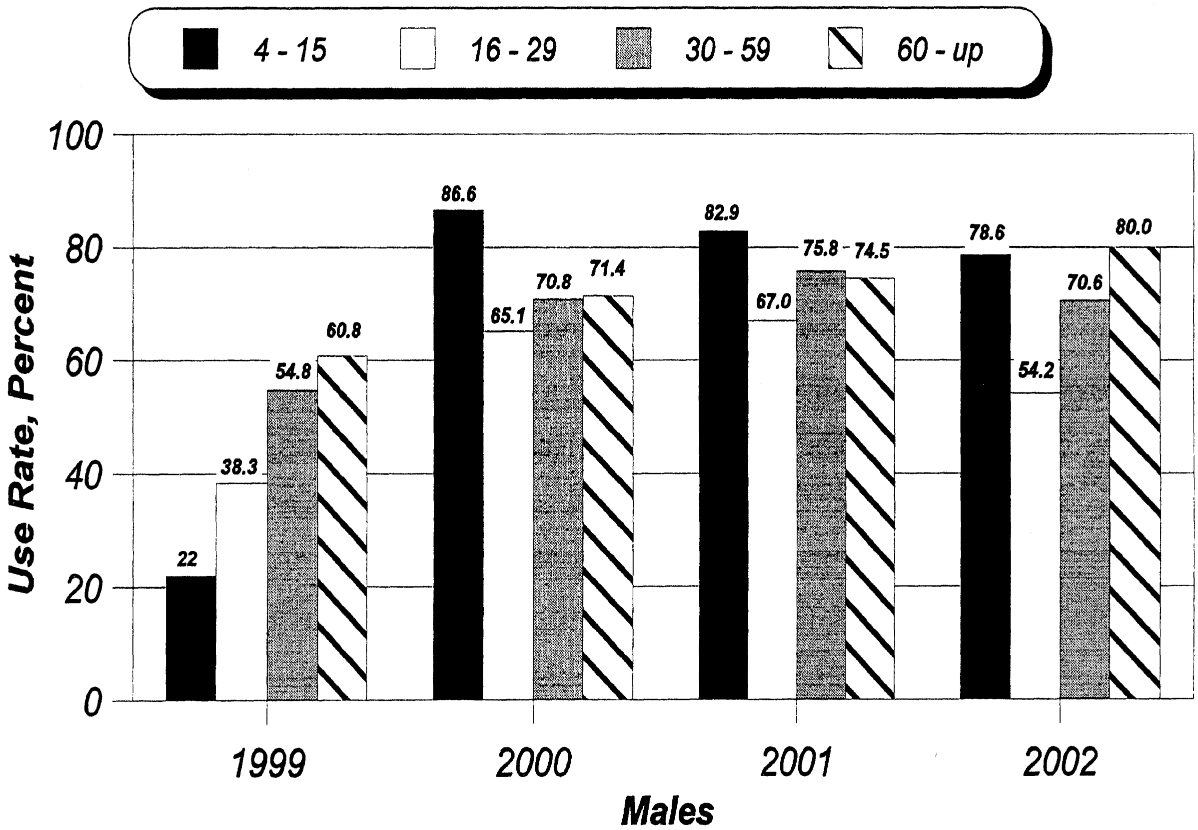

Figure 12. Front-Outboard Shoulder Belt Use for Males by Age and Year in the Six Community Area of Wayne County, Michigan.

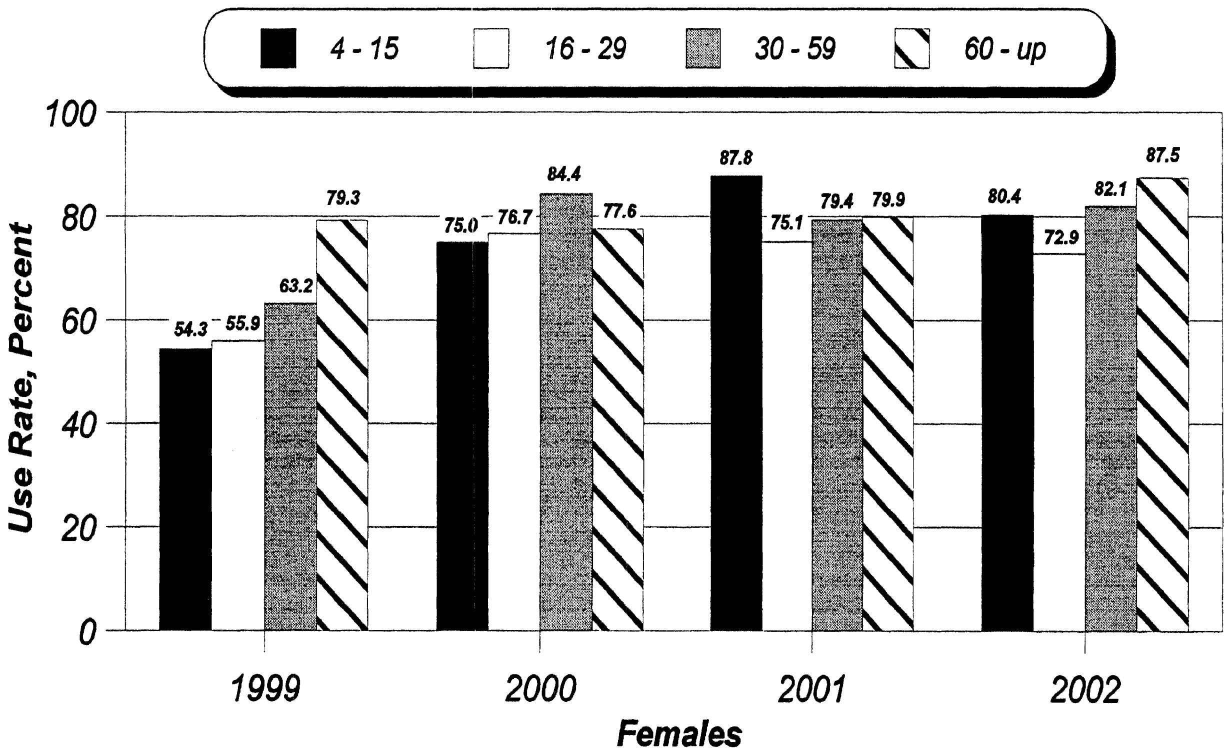

Figure 13. Front-Outboard Shoulder Belt Use for Females by Age and Year in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Community and Year

Figure 14 shows the safety belt use rates by community and year.[5] In the current survey, Livonia had the highest belt use rate. There appear to be increases in belt use over the past year in Dearborn, Livonia, and Taylor, while slight declines were noted in Brownstown Township and Detroit. However, these changes were not statistically significant. The only statistically significant change over the last year occurred in Romulus where a slight decline was observed. The current rates for the four original communities continue to be much higher than the rates observed prior to the implementation of standard enforcement.

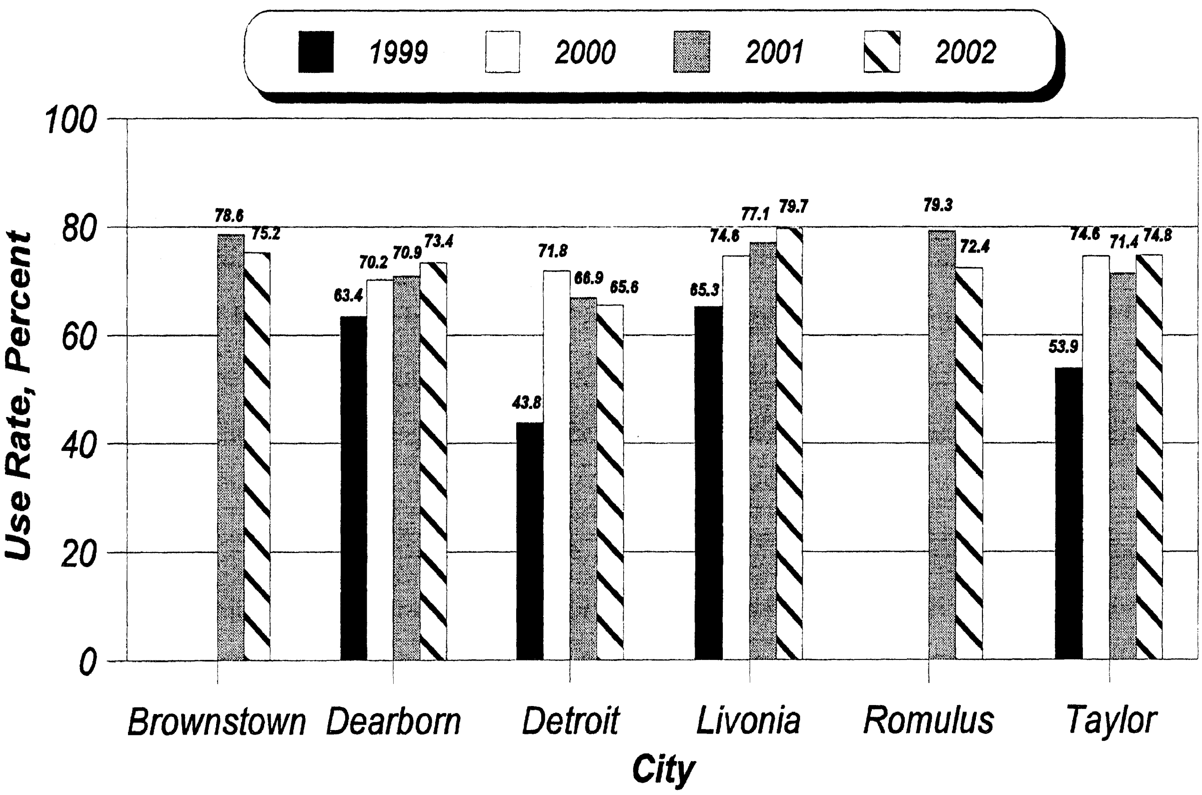

Figure 14. Front-Outboard Shoulder Belt Use by Community and Year in the Six Community Area of Wayne County, Michigan.

[5]The City of Westland was part of the survey in 1999 and 2000, but has been removed from the figure as they did not participate in the two most recent surveys. Brownstown Township and Romulus were added in the 2001 survey, thus rates for 1999 and 2000 are not available.

DISCUSSION

The estimated safety belt use rate for front-outboard occupants of passenger cars, sport-utility vehicles, vans/minivans, and pickup trucks combined in the six community area of Wayne County, Michigan was 72.9 ± 1.9 percent. When compared with the estimated rate for all of Wayne County in the most recent annual statewide survey (Vivoda & Eby, 2002), we find that the rate from the current survey is 7.1 percentage points lower. At least part of this disparity results from the fact that in the present study, belt use on freeway exit ramps was not observed. Across Michigan, freeway belt use is usually one or two percentage points higher than for local intersections (see, e.g., Eby, Molnar, & Olk, 2000; Eby, Vivoda, & Fordyce, 2002), however in the most recent statewide survey, belt use was almost seven percentage points higher for freeway traffic (Vivoda & Eby, 2002).

While changes in the communities participating in the survey make overall comparisons between the most recent two surveys and the surveys conducted in 1999 and 2000 difficult, we find that the rate from this survey is not statistically different than the one observed in 2001 (Vivoda & Eby, 2001). However, a comparison with the observed rate from September 1999, reveals an increase of 18.4 percentage points (Eby, Vivoda, & Fordyce, 1999). This significant increase can most likely be jointly attributed to the implementation of standard enforcement legislation in Michigan on March 10, 2000, extensive Public Information and Education (PI&E) programs, and multiple enforcement campaigns that have been implemented in Wayne County.

An examination of safety belt use patterns in the current survey showed many trends that are often observed in Michigan (Eby, Molnar, & Olk, 2000; Eby, Vivoda, & Fordyce, 2002). The survey showed that the belt use rate for drivers continues to be higher than for passengers. However, in the three studies conducted since the change to standard enforcement, this difference appears to have decreased somewhat. The motorists that still remain unbelted in either seating position are likely to be the most difficult to reach. Block (2000) investigated the belt use difference in seating position and suggests that drivers and passengers wear safety belts, and fail to wear safety belts, for different reasons. For example, drivers indicate that they buckle up because "it's a habit" more often than passengers. The belt use of other people in the car is given as a reason for buckling up more often by passengers than drivers. Reasons for non-use are similar, with passengers being less likely to buckle up if others in the vehicle are also not wearing safety belts. Finally, "traveling only a short distance" is indicated as a reason for non-use by drivers more often than passengers (Block, 2000). While this information provides a framework for future PI&E efforts, further research to identify the age difference and relationship between the driver and passenger to determine which combinations are at a higher risk for safety belt non-use would also be of particular interest. For example, front-outboard passengers may be less likely to use safety belts if they are a friend of the driver rather than a family member. This type of information would be invaluable for constructing effective PI&E programs to promote safety belt use.

Belt use was also higher for females than for males. Again, this finding is consistent with years of safety belt research both in Michigan (Eby, Molnar, & Olk, 2000; Eby, Vivoda, & Fordyce, 2002) and elsewhere (e.g., Lange & Voas, 1998; Williams, Wells, & Lund, 1987). While this difference appeared to have decreased somewhat in the study conducted in 2001, the difference of 12.2 percentage points in the current survey is very similar to the 1999 and 2000 surveys. Over the past year, male belt use has slightly decreased while female belt use has slightly increased; this does not follow the trend that occurred from 2000 to 2001. Further analysis reveals that the majority of this change occurred within the 16-to-29 year old age group for males (12.8 percentage point decrease), and the 60-up age group for females (7.6 percentage point increase). There is no obvious explanation for this change, as young males were one of the targets of the safety belt promotion programs. Regardless of the individual changes within age groups, female belt use was higher than male belt use in all age groups. These findings highlight the need for traffic safety professionals to continue to explore ways to increase safety belt use among male motorists. However, females should not be ignored by these efforts, as their safety belt use rate still does not reflect total compliance with Michigan's safety belt use law.

The analysis of safety belt use by vehicle type showed that occupants of passenger cars, sport-utility vehicles, and vans/minivans in the six community area of Wayne County did not significantly differ. However, the use rate for occupants of pickup trucks was significantly lower than the rates for occupants of the other vehicle types. This was not noted in previous years because of large confidence bands. Additionally, over the past year, the largest decline in belt use between occupants of different vehicle types was observed among pickup truck occupants. This suggests that occupants of pickup trucks may represent a unique population in Michigan, and therefore could benefit from specially designed programs. Research has shown that the main demographic differences between the driver/owners of pickup trucks and passenger cars is that driver/owners of pickup trucks are more likely to be male, have higher household incomes, and lower educational levels (Anderson, Winn, & Agran, 1999). This information provides a starting point for the development of programs designed to influence pickup truck occupant safety belt use.

The present study also examined safety belt use by time of day and found that belt use was lowest between 9 am and 11 am and remained relatively stable throughout the rest of the day. This finding is somewhat unusual in Michigan because belt use is typically higher in the morning (before 1:00 pm) than in the afternoon (see Eby & Olk, 1998; Eby & Vivoda, 2001). Since morning driving is frequently related to commuting to work, the decision to use a safety belt may be related to the purpose of the trip. Research directed toward understanding the relationship between frequency of belt use and purpose of automobile trip could yield valuable information for developing more effective belt promotion programs.

Analysis of belt use by age group showed the pattern consistently observed in Michigan. When the two youngest age groups are excluded because of low representation in the sample, safety belt use for the 16-to-29-year-old age group was the lowest of any age group. NHTSA has recognized that current traffic safety messages for this age group may not be cognitively appropriate and has begun an effort to better understand the factors that influence decision making in young drivers (see, e.g., Eby & Molnar, 1999). Additionally, Block (2000) has suggested that the reasons males give for safety belt non-use tend to be related to improper assessment of risk or simply forgetting, while females more often report discomfort as a reason. Programs developed using cognitively appropriate traffic safety messages that address these different reasons for safety belt non-use would be the most effective.

While the Community Survey provides an overall safety belt use rate for the six community area of Wayne County, Michigan, it does not provide individual community rates that can be generalized to the entire city or township. Additionally, the number of occupants observed within a specific community is also quite low, so interpretations should be made with caution. However, rates are provided for each individual community to allow for comparisons of belt use over time. Specifically, these rates can be used to measure changes in safety belt use that may result from a particular PI&E program or enforcement campaign in each specific city or township. An analysis of these rates appears to show slight increases in belt use in the cities of Dearborn, Livonia, and Taylor, however, these rates are not statistically different than the rates observed in 2001. There appear to be slight declines in belt use in Brownstown Township and Detroit over the last year, but again, these differences are not statistically significant. However, the 6.9 percentage point decline in belt use observed in Romulus is statistically significant. While it is difficult to speculate as to the reason for this decrease, it may be useful to investigate any other changes that have occurred in Romulus over the past year that may have affected belt use. Belt use was highest in Livonia and lowest in Detroit. The statistical analysis reveals that the safety belt use rates in Brownstown Township, Dearborn, Livonia, and Taylor were significantly higher than the rate in Detroit. This finding suggests that Detroit should remain a focus for programs designed to increase safety belt use. The rates observed in Livonia were also significantly higher than those observed in Dearborn. Differences in belt use rates between communities may due to many different factors and should be interpreted with caution since this survey was not designed to report individual community-wide belt use rates.

This study enables us to measure safety belt use rates in the six community area of Wayne County, Michigan. It also allows us to identify emerging trends, to examine and measure changes resulting from standard enforcement legislation, and to assess the effects of PI&E programs in this area. For the purpose of evaluating the six community area, the findings of this study can be considered superior to the findings of the statewide survey since this study focuses solely on local traffic within these communities. Collectively, the findings of this study suggest that legislation, enforcement, and PI&E programs by the Michigan Office of Highway Safety Planning, and other local programs, have generally been effective in increasing and stabilizing belt use within the six community area of Wayne County since 1999. However these programs may need to be stepped up in order to continue to increase use.

The current study also reports safety belt use rates separated into several demographic categories. These categorical belt use rates suggest that PI&E programs targeted at specific groups within the Wayne County area could be of particular benefit, especially programs aimed at passengers, males, 16-to-29 years olds, and pickup truck occupants. It is also critical that these programs account for the needs and differences of each specific target community. Safety belt use increases can be maximized in Wayne County by targeting tailored programs toward the populations in the communities most likely to benefit within each area. Given the dramatic increases in belt use that were observed after the implementation of standard enforcement, these specifically targeted programs are more important than ever to maintain and continue to increase belt use, especially in an area with historically low belt use such as Wayne County. To make these programs most effective, further research is necessary to develop PI&E programs and messages to appeal to the diverse cultural groups and communities represented in the Wayne County area.

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APPENDIX A
Data Collection Forms

SITE DESCRIPTION DO - FALL 2002

SITE # __ __ __ (1 2 3)   SITE LOCATION ____

SITE TYPE	SITE CHOICE	TRAFFIC CONTROL
1☐ Intersection	1☐ Primary	1☐ Traffic Light
2☐ Freeway	2☐ Alternate	2☐ Stop sign
4	5	3☐ None
Exit No. ________		4☐ Other ________________
		6

DATE (month/day): __ __/__ __/2002 (7 8 9 10)

OBSERVER	DAY OF WEEK	WEATHER
1☐ Steve	1☐ Monday	1☐ Mostly Sunny
2☐	2☐ Tuesday	2☐ Mostly Cloudy
3☐	3☐ Wednesday	3☐ Rain
4☐ Dave J.	4☐ Thursday	4☐ Snow
5☐ Jonathon	5☐ Friday	13
6☐ Dave E.	6☐ Saturday	
11	7☐ Sunday	
	12	

START TIME: __ __:__ __ (24 hour clock) (14 15 16 17)   END TIME: __ __:__ __ (24 hour clock) (18 19 20 21)

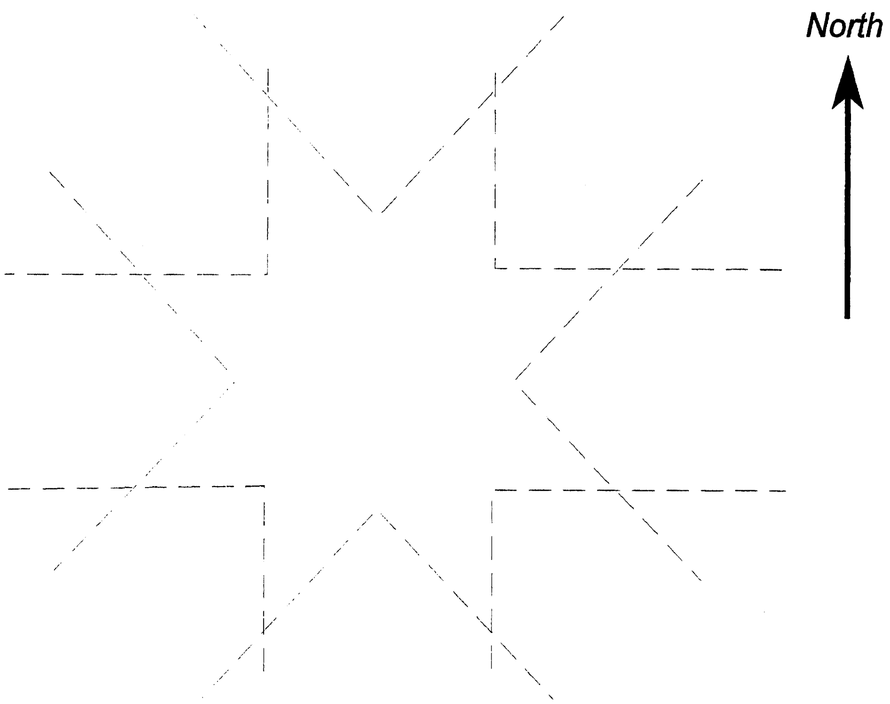
INTERRUPTION (total number of minutes during observation period): __ __ (22 23)

MEDIAN:
1☐ Yes
2☐ No
24

TRAFFIC COUNT 1: __ __ __ (25 26 27)

TRAFFIC COUNT 2: __ __ __ (28 29 30)

COMMENTS::



SITE # ___ ___ ___
1 2 3

PAGE #______

ATTENTION CODING: DUPLICATE COL 1 - 3 FOR ALL VEHICLES

DRIVER	1☐ Not belted 2☐ Belted 3☐ B Back 4☐ U Arm 4	1☐ Male 2☐ Female 5	2☐ 4 - 15 3☐ 16 - 29 4☐ 30 - 59 5☐ 60+ 6	VEHICLE TYPE 1☐ Passenger car 2☐ Van 3☐ Utility 4☐ Pick-up 7	
FRONT-RIGHT PASSENGER	1☐ Not belted 2☐ Belted 3☐ B Back 4☐ U Arm 5☐ CRD 8	1☐ Male 2☐ Female 9	1☐ 0 - 3 2☐ 4 - 15 3☐ 16 - 29 4☐ 30 - 59 5☐ 60+ 10	Office Use Only: ___ ___ ___ 11 12 13	COMM. VEHICLE 1☐No 2☐Yes 14

DRIVER	1☐ Not belted 2☐ Belted 3☐ B Back 4☐ U Arm 4	1☐ Male 2☐ Female 5	2☐ 4 - 15 3☐ 16 - 29 4☐ 30 - 59 5☐ 60+ 6	VEHICLE TYPE 1☐ Passenger car 2☐ Van 3☐ Utility 4☐ Pick-up 7	
FRONT-RIGHT PASSENGER	1☐ Not belted 2☐ Belted 3☐ B Back 4☐ U Arm 5☐ CRD 8	1☐ Male 2☐ Female 9	1☐ 0 - 3 2☐ 4 - 15 3☐ 16 - 29 4☐ 30 - 59 5☐ 60+ 10	Office Use Only: ___ ___ ___ 11 12 13	COMM. VEHICLE 1☐No 2☐Yes 14

DRIVER	1☐ Not belted 2☐ Belted 3☐ B Back 4☐ U Arm 4	1☐ Male 2☐ Female 5	2☐ 4 - 15 3☐ 16 - 29 4☐ 30 - 59 5☐ 60+ 6	VEHICLE TYPE 1☐ Passenger car 2☐ Van 3☐ Utility 4☐ Pick-up 7	
FRONT-RIGHT PASSENGER	1☐ Not belted 2☐ Belted 3☐ B Back 4☐ U Arm 5☐ CRD 8	1☐ Male 2☐ Female 9	1☐ 0 - 3 2☐ 4 - 15 3☐ 16 - 29 4☐ 30 - 59 5☐ 60+ 10	Office Use Only: ___ ___ ___ 11 12 13	COMM. VEHICLE 1☐No 2☐Yes 14

DRIVER	1☐ Not belted 2☐ Belted 3☐ B Back 4☐ U Arm 4	1☐ Male 2☐ Female 5	2☐ 4 - 15 3☐ 16 - 29 4☐ 30 - 59 5☐ 60+ 6	VEHICLE TYPE 1☐ Passenger car 2☐ Van 3☐ Utility 4☐ Pick-up 7	
FRONT-RIGHT PASSENGER	1☐ Not belted 2☐ Belted 3☐ B Back 4☐ U Arm 5☐ CRD 8	1☐ Male 2☐ Female 9	1☐ 0 - 3 2☐ 4 - 15 3☐ 16 - 29 4☐ 30 - 59 5☐ 60+ 10	Office Use Only: ___ ___ ___ 11 12 13	COMM. VEHICLE 1☐No 2☐Yes 14

APPENDIX B

Site Listing

Survey Sites by Number

Site #	City	Site Location
401	Livonia	SB Stamford & 5 Mile Rd.
402	Detroit	NWB Morrell & Fort St.
403	Taylor	WB Goldenridge Ave. & Pardee Rd.
404	Dearborn	NWB Greenfield Rd. & S. Commerce Dr.
405	Livonia	NB Blueskies & 5 Mile Rd.
406	Detroit	NB Hoover & State Fair
407	Livonia	SB Lyons Ave. & Jamison
408	Livonia	SB Louise Ave. & Bobrich
409	Detroit	SB Mark Twain St. & McNichols
410	Detroit	SWB Edward Ave. & Martin St.
411	Livonia	WB Puritan Ave. & Henry Ruff
412	Detroit	NB Manor & Chicago
413	Detroit	NEB Linsdale & Epworth
414	Romulus	NB Ozga Rd. & Tyler Rd.
415	Dearborn	NB N. York St. & Doxtator Rd.
416	Detroit	SB Trinity Ave. & Lyndon
417	Romulus	EB Huron River Dr./Grant Rd. & Ozga Rd.
418	Detroit	NWB Frontenac St. & Edsel Ford Rd/I-94 Service Dr.
419	Romulus	SB Merriman Rd. & Ecorse Rd.
420	Livonia	WB Richland Ave. & Stark Rd.
421	Detroit	NEB Rosemary & Roseberry
422	Detroit	SEB Elmwood & Charlevoix
423	Livonia	NB Wood Dr. & Fairlane
424	Detroit	SEB St. Jean & Kercheval Ave.
425	Romulus	WB Ecorse Rd. & Hannan Rd.
426	Detroit	EB Mogul St. & Hayes
427	Romulus	NB Middlebelt Rd. & Eureka Rd.
428	Livonia	NB Victor Park Dr. & 8 Mile Rd.
429	Taylor	WB Pinecrest & Pelham
430	Detroit	SB Winston & Grand River Ave.
431	Dearborn	NEB Dix & Vernor Hwy.

432	Detroit	WB Woodlawn Ave. & Erwin
433	Dearborn	WB Longmeadow & Brewster
434	Detroit	SB Waterman St. & South
435	Taylor	WB Eureka Rd. & Inkster Rd.
436	Taylor	NB Cape Cod St. & Goddard Rd.
437	Brownstown Township	WB Van Horn & US-24/Telegraph Rd.
438	Brownstown Township	SB Arsenal & Van Horn
439	Brownstown Township	EB West Rd. & US-24/Telegraph Rd.
440	Brownstown Township	SB US-24/Telegraph Rd. & Sibley
441	Brownstown Township	NB Allen Rd. & Sibley

APPENDIX C

Calculation of Variances, Confidence Bands, and Relative Error

The variances for the belt use estimates were calculated using an equation derived from Cochran's (1977) equation 11.30 from section 11.8. The resulting formula was:

$$var \approx \frac{n}{n-1}\sum_i \left(\frac{g_i}{\sum g_k}\right)^2 (r_i - r)^2 + \frac{n}{N}\sum_i \left(\frac{g_i}{\sum g_k}\right)^2 \frac{s_i^2}{g_i}$$

where *var* equals the variance, *n* is the number of observed intersections, g_i is the weighted number of vehicle occupants at intersection *I*, g_k is the total weighted number of occupants at all 41 sites, r_i is the weighted belt use rate at intersection *I*, *r* is the belt use rate, *N* is the total number of intersections, and $s_i = r_i(1-r_i)$. In the actual calculation of the variance, the second term of this equation is negligible. If we conservatively estimate *N* to be 2000, the second term only adds 2.1×10^{-6} units. This additional variance does not significantly add to the variance captured in the first term. Therefore, since *N* was not known exactly, the second term was dropped in the variance calculations.

The 95 percent confidence bands were calculated using the formula:

$$95\%\ Confidence\ Band = r \pm 1.96 \times \sqrt{Variance}$$

where *r* is the belt use of interest. This formula is used for the calculation of confidence bands for each each vehicle type and for the overall belt use estimate.

Finally, the relative error or precision of the estimate was computed using the formula:

$$RelativeError = \frac{StandardError}{r}$$