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Safety Belt Use in Five Wayne County Communities: Fall 2000

David W. Eby, Ph.D.
Tiffani A. Fordyce, B.A.
Jonathon M. Vivoda, B.A.

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16. Abstract

Reported here are the results of a direct observation survey of safety belt use in a five city area of Wayne County, Michigan, conducted in the fall of 2000. The five cities included in the survey area were: Dearborn, Detroit, Livonia, Taylor, and Westland. In this study, 1,685 occupants traveling in four vehicle types (passenger cars, sport-utility vehicles, vans/minivans, and pickup trucks) were surveyed September 16 to September 21, 2000. 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 74.7 percent. Belt use was 76.4 percent for passenger cars, 71.0 percent for sport-utility vehicles, 78.1 percent for vans/minivans, and 66.3 percent for pickup trucks. Overall belt use was higher for females than for males and higher for drivers than for passengers. In general, belt use was highest during the morning commute, 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 five cities, and to assess the effects of Public Information and Education programs. This study is superior to the statewide survey for assessing the effects of local programs in the five cities since it focuses entirely on local traffic.

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David W. Eby, Ph.D.
Tiffani A. Fordyce, B.A.
Jonathon M. Vivoda, B.A.

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INTRODUCTION

Of the 83 counties in Michigan, Wayne County represents close to 23 percent of the state's total population (US Bureau of the Census, 1990). In 1997, Wayne County represented 22 percent of the 425,793 reported traffic crashes in Michigan, the highest number of crashes of any county in the state. The total cost of motor vehicle crashes in Michigan has been estimated at $9,707,518,300 (Michigan Office of Highway Safety Planning, OHSP, 1998). Given the fact that Wayne County makes up such a significant proportion of these crashes, the estimated loss to this community is very high. In the aforementioned automobile crashes, safety belt use was directly related to the level of injury sustained. Occupants in automobile crashes were twenty-five times more likely to be killed if they were not wearing safety belts, than if they were properly using safety belts (OHSP, 1998). Historically, Wayne County has had one of the lowest safety belt use rates in the state (Eby, Molnar, & Olk, 2000), leading to a higher number of automobile-related injuries and fatalities.

For years, Michigan has implemented enforcement and public information and education (PI&E) programs to increase safety belt use statewide. While these programs have been effective in increasing safety belt use rates, more specific programs are necessary to meet the needs of Wayne County's diverse population. Community-based programs may have the greatest potential for reaching segments of the population that disregard safety belt use. To be most effective, these PI&E programs must be tailored to the specific characteristics of Wayne County communities.

For many years, Michigan has devoted a concerted effort in Wayne County to increase belt use, thereby reducing the number of fatalities and injuries that are caused by traffic crashes. In March, 2000, Michigan received additional funding from the National Highway Traffic Safety Administration (NHTSA) to enhance the efforts in Wayne County.

The Wayne County Safety Belt Project is a broad based, multi-year education and enforcement campaign specifically designed to meet the diverse needs of the Wayne

County population. The project focuses on five communities: Dearborn, Detroit, Livonia, Taylor, and Westland. During the first year of the project, community support for the effort will be established by developing and distributing materials that emphasize the importance of safety belt use and child passenger safety (OHSP, 2000a).

All five communities participated in the distribution of yard signs that read, "It's there (picture of a safety belt) to wear". The signs aim to raise community awareness of safety belt use. Neighborhood coalitions are promoting the signs and assisting with community outreach activities (OHSP, 2000a). In addition, a public education group is marketing safety belt use to local churches and medical groups to ensure that minority populations in Wayne County are aware of the benefits of safety belt and car safety seat use (OHSP, 2000b).

In addition to the Wayne County Safety Belt Project, the "Click It or Ticket" campaign was also designed to increase safety belt use of motorists in Wayne County and to increase public awareness of the standard enforcement safety belt use law statewide (OHSP, 2000b). This campaign keeps the focus of safety belt enforcement on fewer deaths and serious injuries, not more tickets (NHTSA, 2000).

This study provides data for both assisting in the development of appropriate safety belt promotion programs in Wayne County, and evaluating the effectiveness of existing programs. The design of this survey focuses exclusively upon belt use on local roads in five Wayne County communities: Dearborn, Detroit, Livonia, Taylor, and Westland. Thus, the survey provides data to closely track changes in belt use in the populations most likely to be influenced by the programs developed by the Michigan Office of Highway Safety Planning.

METHODS

Sample Design

The sample design for the present 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 the modifications noted.

The purpose of the study was to assess the safety belt use rate in a five-city area in Wayne county. This area consisted of the following cities: Dearborn, Detroit, Livonia, Westland, and Taylor. Because cities were sampled collectively, individual safety belt use rates calculated for each city may not be representative of a city's belt use rate. Separate city safety belt use rates are presented only as a way of tracking the effectiveness of belt use programs in each of the five cities.

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 five cities. To begin, detailed equal-scaled road maps of the Detroit Metropolitan Area were obtained. The five cities were included in 30 of the 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 (or *x*) coordinate and a vertical (or *y*) coordinate.

The 36 sites in the survey were chosen sequentially, by first randomly selecting a map number containing one of the cities in the sample[1]. To select a map, 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

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[1]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.

the chosen grid square contained an intersection that was within the boundary of one of the five cities, 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 five cities. This process was repeated until an eligible intersection was identified. Site numbers were assigned in numerical order, following this same process, until 36 sites had been selected.

Once all of the sites were selected, the street and direction of traffic flow to be observed was chosen. 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 as the observation lane. If the street designated as the observation street did not have a traffic control device, the other street in the intersection was then assigned as the street to be observed. In a similar manner, if it was not possible to observe the traffic flow in the direction that had been chosen during site selection, the opposite direction was assigned as the direction to be observed. For example, if northbound Second Street was to be observed, and Second Street was a one-way street with traffic flowing south only, the southbound traffic was assigned as the direction to be observed.

For each primary intersection site, an alternate site was also selected. The 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 1 and the total number of eligible intersections, 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, a 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 in which the cluster was to be observed was randomly determined. After taking into consideration the time required to finish all sites before darkness, 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. The important issue about the randomization is that the day and time assignments to the sites were not correlated with belt use at a site. This method is random with respect to this issue.

Table 1 shows descriptive statistics for the 36 observation sites. As shown in this table, the observations were fairly well distributed over time of day and day of week, with the exception of Friday, and between 5pm and 7pm. The random assignment of times for data collection did not yield safety belt observations times after 5pm. 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, then it was included in the later time slot. This table also shows that every site observed was the primary site and the vast majority of observations occured on sunny days.

Table 1. Descriptive Statistics for the 36 Observation Sites							
Day of Week		**Observation Period**		**Site Choice**		**Weather**	
Monday	27.8%	7-9 a.m.	11.1%	Primary	100.0%	Sunny	83.3%
Tuesday	19.4%	9-11 a.m.	30.6%	Alternate	0.0%	Cloudy	16.7%
Wednesday	11.1%	11-1 p.m.	19.4%			Rain	0.0%
Thursday	19.5%	1-3 p.m.	25.0%			Snow	0.0%
Friday	0.0%	3-5 p.m.	13.9%				
Saturday	11.1%	5-7 p.m.	0.0%				
Sunday	11.1%						
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 16 through September 21, 2000. 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 furnished for observers to sketch the intersection and to 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 each 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. In addition to this information, it was also recorded whether or not the vehicle was used for commercial purposes. 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

All sites in the sample were visited by one observer for a period of 1 hour, with the exception of sites in the city of Detroit, and sites in other cities observed during 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 arriving at a site, observers determined whether observations were possible at the site. 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 (either 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 they could observe. If traffic flow was heavy, observers were instructed to record data for the first eligible vehicle they saw and 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 single-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. Also included in the manual was a listing of the sites for the study that identified the location of each site and the traffic leg to be observed (see Appendix B for a listing of the sites), as well as a site schedule identifying the date and time each site was to be observed.

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 lanes 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. 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 interobserver reliability of at least 85 percent for all measures on drivers and front-right passengers for each pair of observers.

Each observer was provided with 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 pinpointed. 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 three 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 the site description form about site-specific characteristics that might affect future surveys (e.g., traffic flow patterns, traffic control devices, site access).

Data Processing and Estimation Procedures

The site and data collection 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 in this safety belt survey was to estimate belt use for the five city area in Wayne County, Michigan based on 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 first adding each of the two 5-minute counts and then multiplying this number by five so that it would represent a 50-minute duration.[2] 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 five city 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:

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

[2] 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 36 sites after weighting, and occupants refers to only 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, 74.7 ± 5.0 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 five city area of Wayne County, Michigan during September 2000 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 69.7 percent and 79.7 percent.

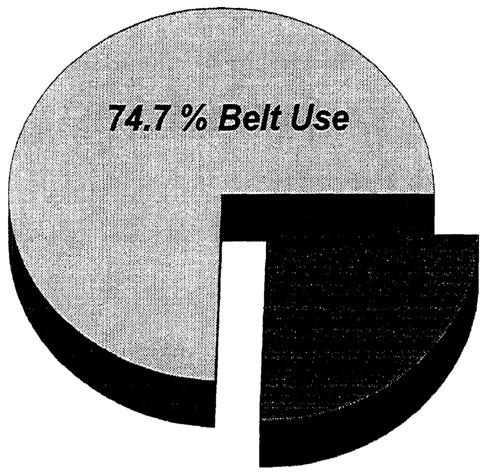

Figure 1. Front-Outboard Shoulder Belt Use in a Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

Table 2 shows the shoulder belt use rates and unweighted number of occupants by vehicle type in the five city area of Wayne County, Michigan. A statistical analysis reveals that belt use does not statistically differ between the four vehicle types. Note that the unweighted number of occupants is fairly low for all vehicle types except for passenger vehicles. Thus, it is not possible to calculate meaningful safety belt use rates by those vehicle types for any subcategories. Therefore, 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 Five City Area of Wayne County, Michigan		
Vehicle Type	**Percent Use**	**Unweighted N**
Passenger	76.4 ± 4.3 %	1,040
Van/Minivan	78.1 ± 8.5 %	251
Sport Utility	71.0 ± 9.1 %	188
Pickup Truck	66.3 ± 6.7 %	206
All Vehicles Combined	**74.7 ± 5.0 %**	1,685

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, Fordyce, & Vivoda, 2000), driver belt use was higher than passenger belt use.

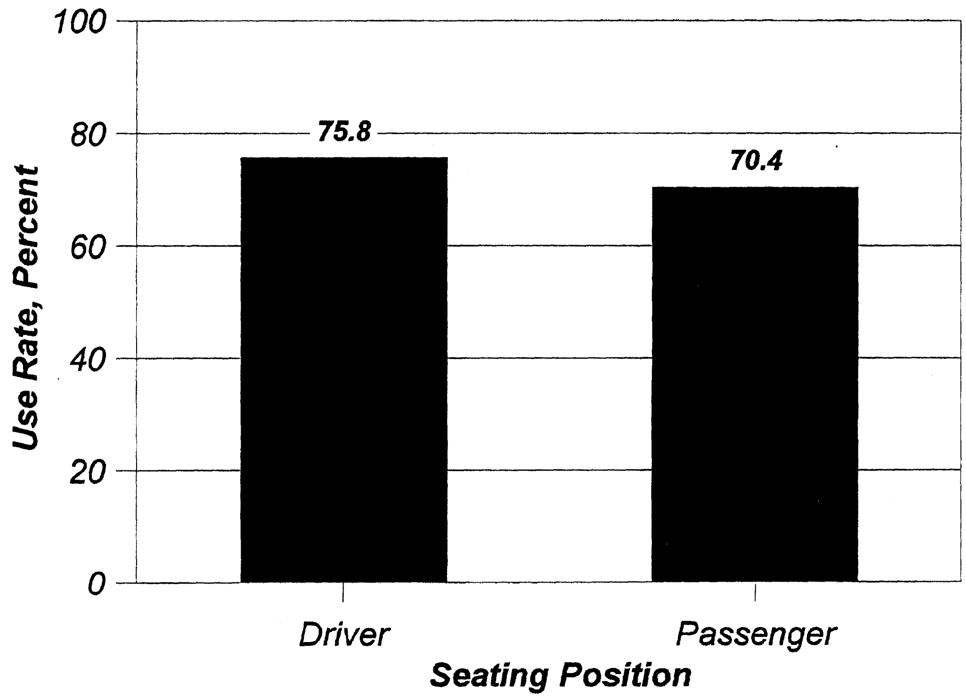

Figure 2. Front-Outboard Shoulder Belt Use by Seating Position in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

Estimated Safety Belt Use by Sex

The estimated safety belt use rates by sex for the five city area of Wayne County, Michigan are shown in Figure 3. Female belt use is clearly higher than male belt use, a difference of 11.8 percentage points. This finding is consistent with a large body of research on safety belt use by sex (see Eby, Molnar, & Olk, 2000, for a review).

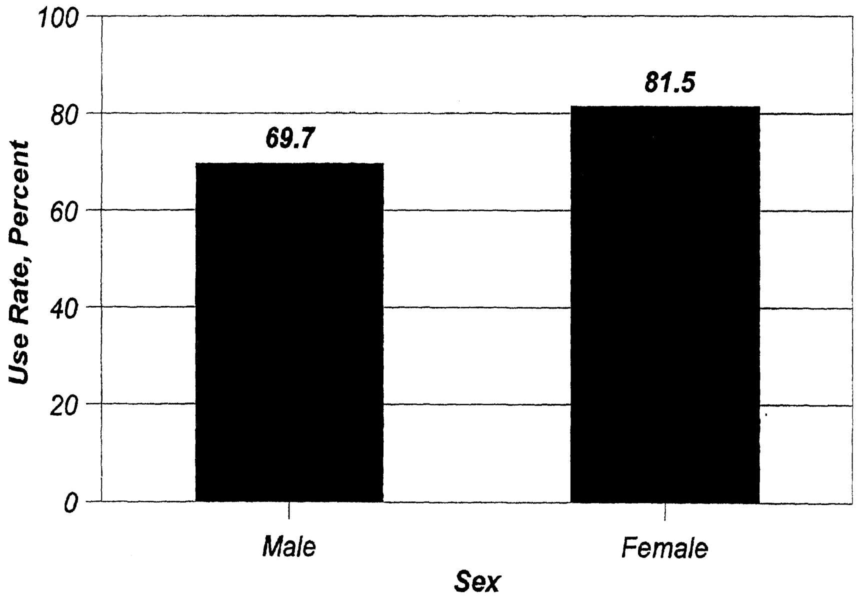

Figure 3. Front-Outboard Shoulder Belt Use by Sex in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

Estimated Safety Belt Use by Time of Day

The estimated safety belt use rates in the five city area of Wayne County, Michigan by time of day are shown in Figure 4. Safety belt use was highest during the morning rush hour and declined throughout the day. Unfortunately, the random assignment of times for data collection did not yield safety belt observation times after 5 pm. Thus, we cannot determine whether safety belt use increased, decreased, or stayed the same during the evening rush hour.

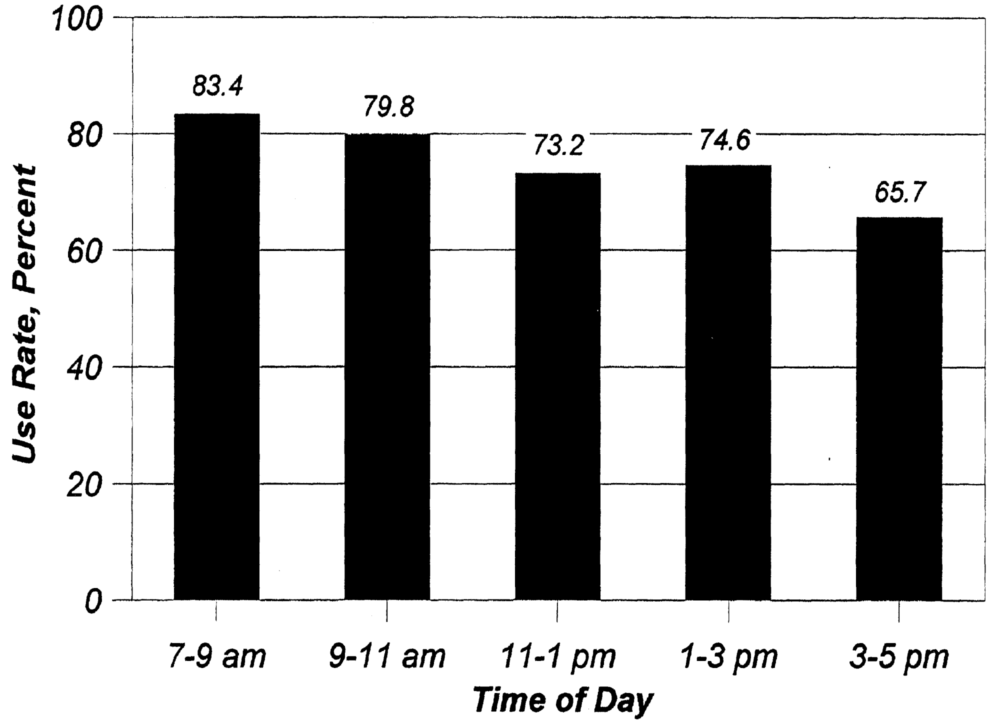

Figure 4. Front-Outboard Shoulder Belt Use by Time of Day in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

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 are not included in this survey. As such only one child in the 0-to-3-year-old age group was observed in the study. There were also only 52 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 great caution. Excluding these age groups, we find that belt use is lowest for the 16-to-29-year olds, with higher rates of safety belt use observed in the older age groups. This same trend is found in the recent statewide survey of safety belt use (Eby, Fordyce, & Vivoda, 2000).

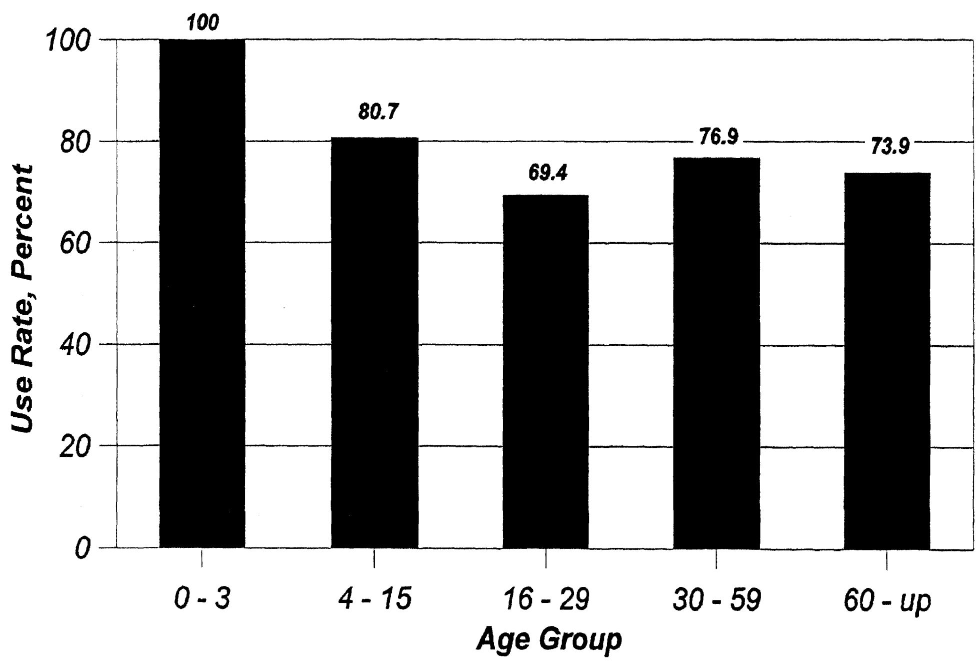

Figure 5. Front-Outboard Shoulder Belt Use by Age Group in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

Estimated Safety Belt Use by Age and Sex

Shown in Figure 6 are the estimated safety belt use rates by age group and sex. Again, the rates for the two youngest age groups are based on very low observation numbers; these calculated rates are not statistically meaningful and should be interpreted with caution. Excluding these age groups, we find that male safety belt use rates are considerably lower than the rates for females for all age groups. Figure 6 also indicates that safety belt use rates are higher for occupants in the 30-to-59 and 60-years and older age groups, than for the younger age group, consisting of 16-to-29 year olds.

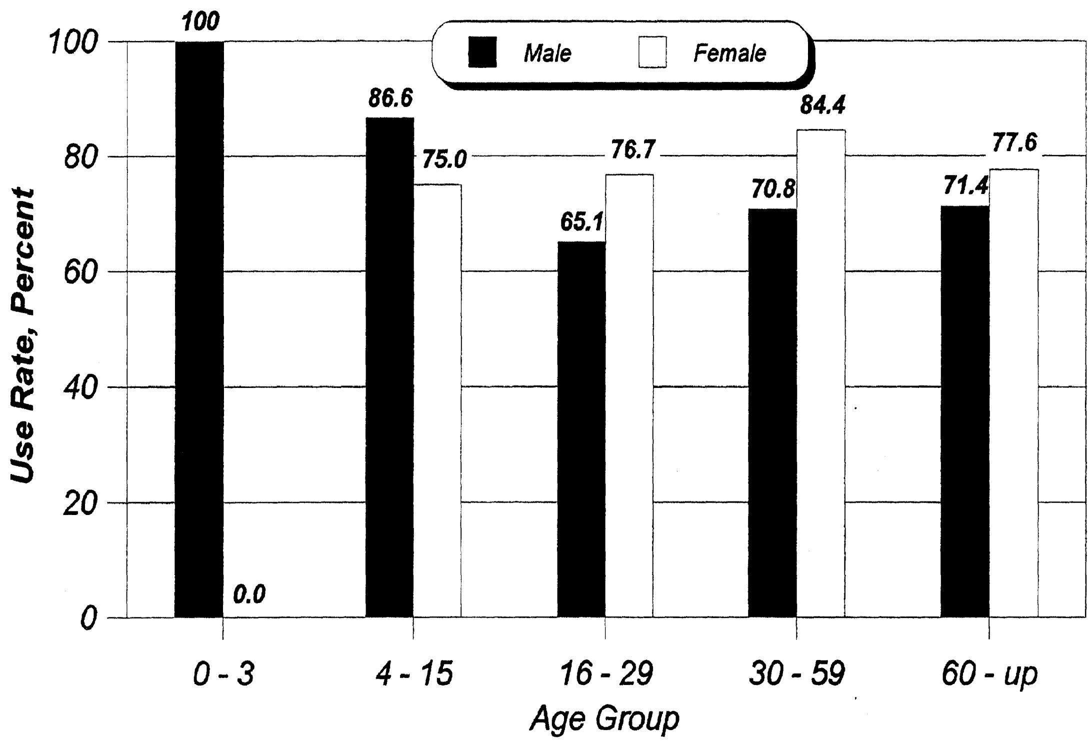

Figure 6. Front-Outboard Shoulder Belt Use by Age and Sex in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

Estimated Safety Belt Use by City

In order to measure the effects of safety belt use programs that are city specific, we have calculated safety belt use rates for all vehicle types combined, for each city separately. It should be noted that the sample was designed to determine safety belt use across the five-city area. Therefore, the city-by-city numbers reported here may not representative of citywide belt use, and must therefore be interpreted with caution. Table 3 shows the safety belt use rates and unweighted numbers of observations by city. The highest safety belt use rate was observed in the city of Westland, and the lowest was noted in Dearborn. However, given the small number of observations and the resultant large margins of error, no statistically significant differences are observed in the safety belt use rates between Dearborn, Detroit, Livonia, and Taylor. The statistical analysis reveals that the safety belt use rate in the city of Westland is slightly higher than the rates in Detroit and Taylor, but is not significantly different than the rates in Dearborn and Livonia.

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

City	Percent Use	Unweighted N
Dearborn	70.2 ± 13.3 %	237
Detroit	71.8 ± 6.3 %	706
Livonia	74.6 ± 11.1 %	216
Taylor	74.6 ± 4.3 %	315
Westland	87.6 ± 8.2%	211

TRENDS

Overall Safety Belt Use by Year

As shown in Figure 7, 74.7 ± 5.0 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 five city area of Wayne County, Michigan during September 2000 were restrained with shoulder belts. This is an increase of more than 20 percentage points over the safety belt use rate of 54.5 ± 6.2 percent in 1999.

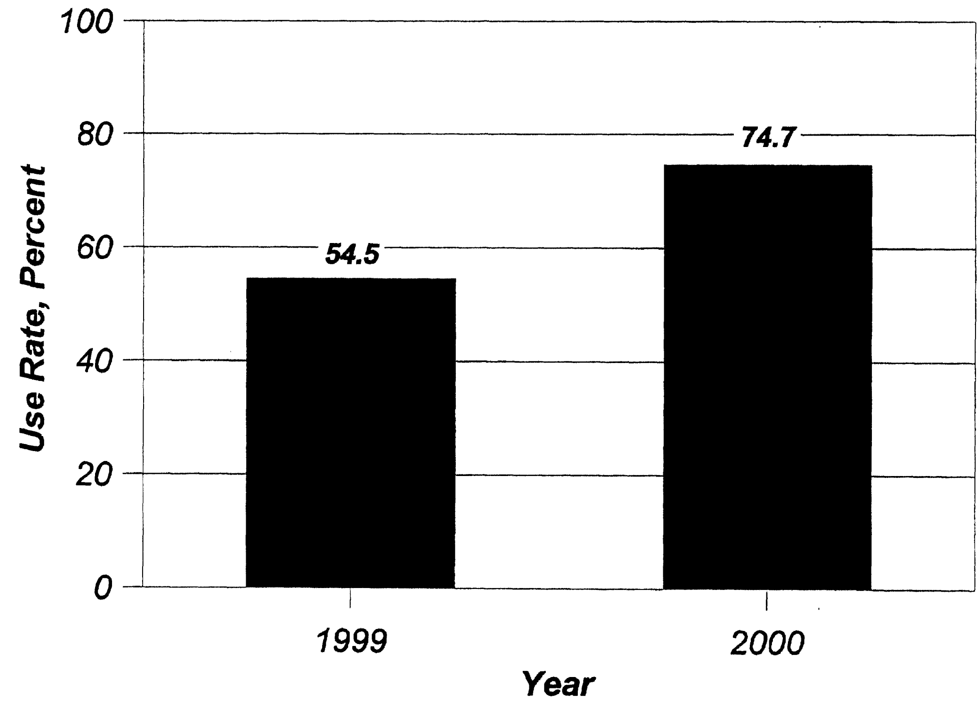

Figure 7. Front-Outboard Shoulder Belt Use by Year in a Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

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, 1999), driver belt use was higher than passenger belt use for both 1999 and 2000. A significant increase was noted for both seating positions over the last year.

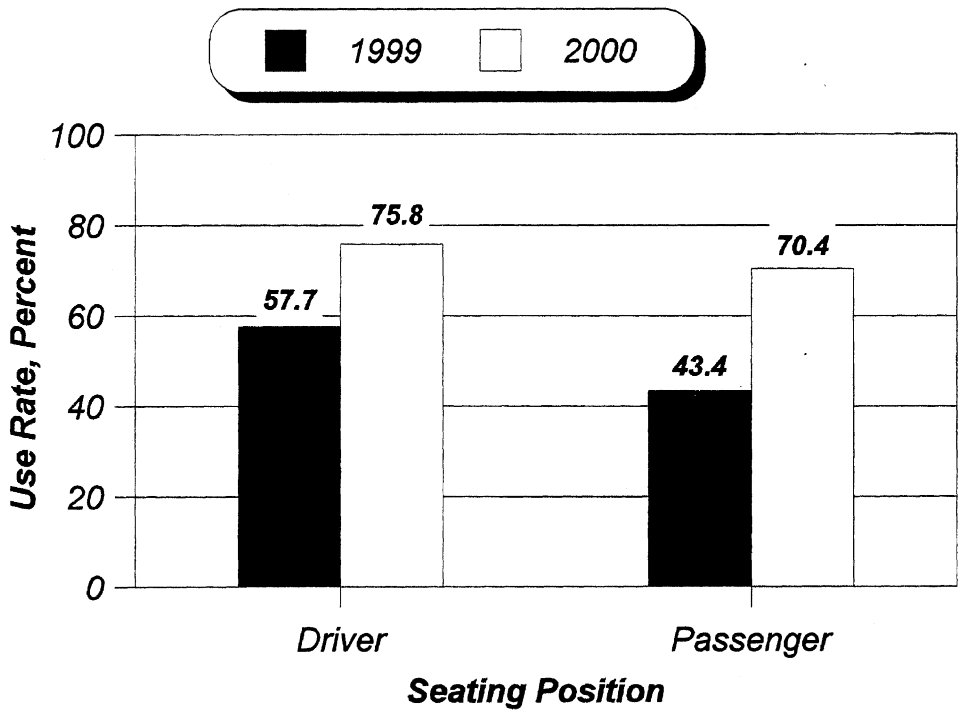

Figure 8. Front-Outboard Shoulder Belt Use by Seating Position and Year in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/ Noncommercial Combined).

Estimated Safety Belt Use by Sex and Year

The estimated safety belt use rates by sex and year for the five city area of Wayne County, Michigan are shown in Figure 9. While safety belt use has increased for both sexes, female belt use is significantly higher than male belt use for both 1999 and 2000. As previously mentioned, this finding is consistent with a large body of research on safety belt use by sex (see Eby, Molnar, & Olk, 2000, for a review).

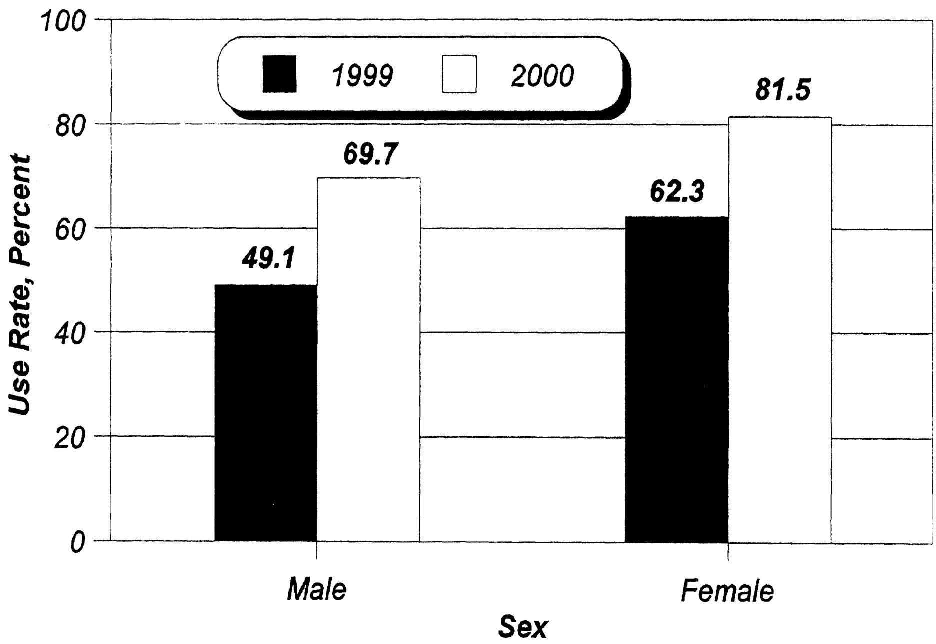

Figure 9. Front-Outboard Shoulder Belt Use by Sex and Year in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

Estimated Safety Belt Use by Time of Day and Year

The estimated safety belt use rates in the five city area of Wayne County, Michigan by time of day and year are shown in Figure 10. While safety belt use rates were significantly higher for all times of day in 2000, similar trends were noted in both years; safety belt use was highest during the morning rush hour and declined throughout the day in both 1999 and 2000.

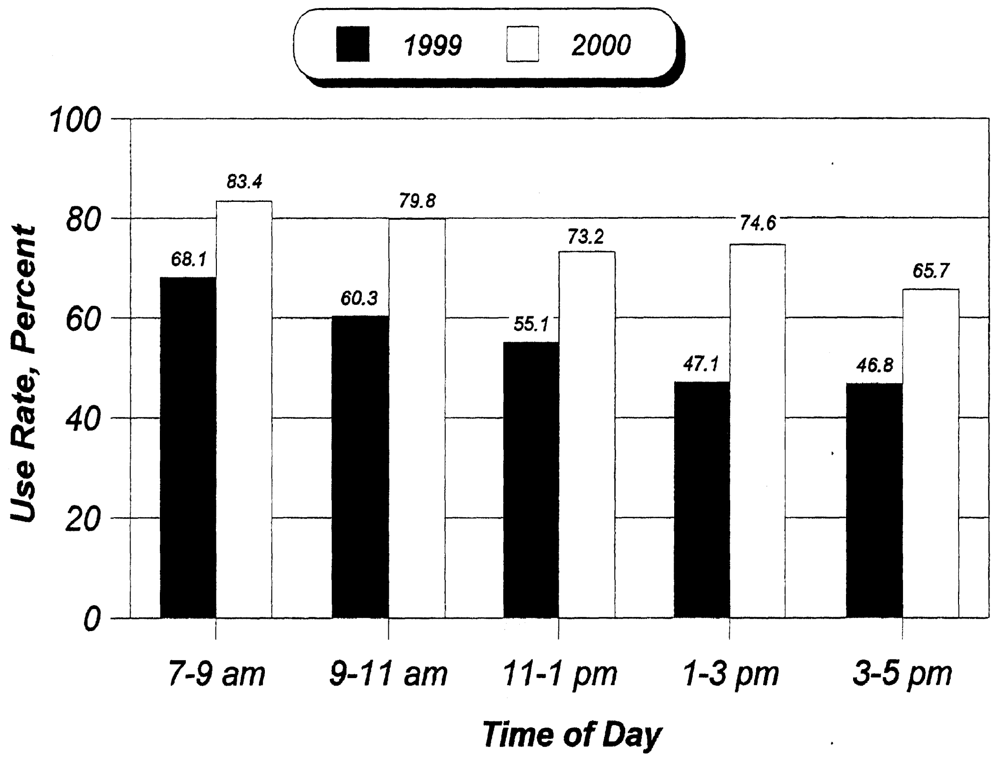

Figure 10. Front-Outboard Shoulder Belt Use by Time of Day and Year in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/ Noncommercial Combined).

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, belt use is lowest for the 16-to-29-year olds for both 1999 and 2000. For both years, higher belt use was observed in the two oldest age groups. While safety belt use rates for 2000 were significantly higher than rates for 1999, the most notable increase was evidenced in the 16-to-29 year old age group, an increase of 24.2 percentage points.

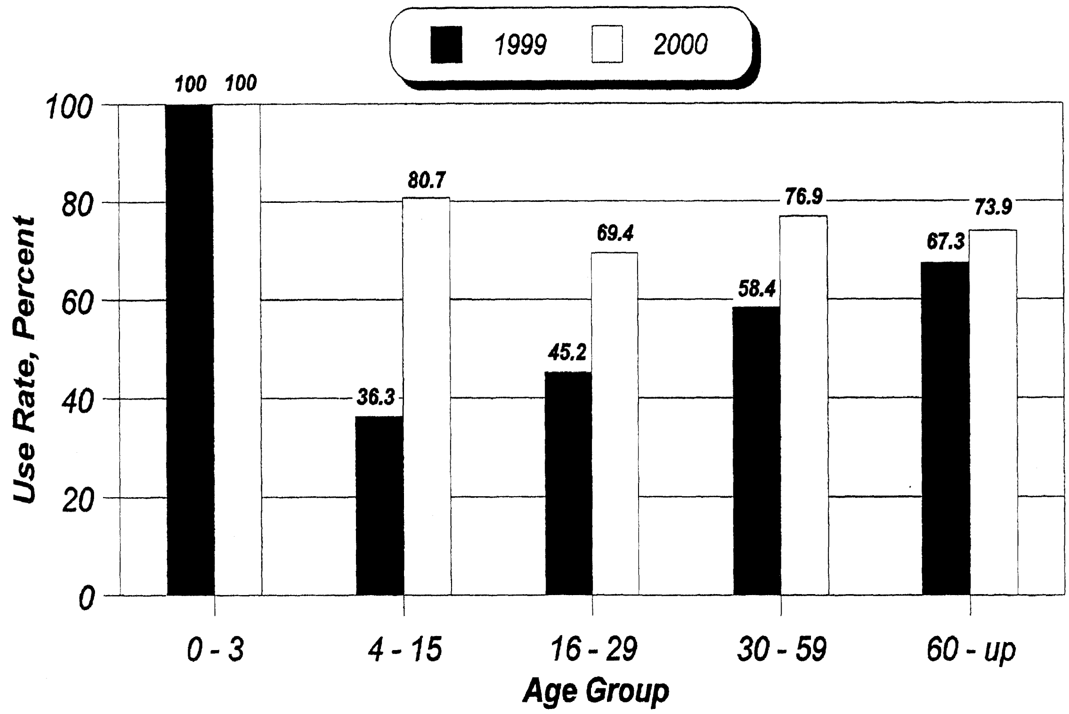

Figure 11. Front-Outboard Shoulder Belt Use by Age Group and Year in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

Estimated Safety Belt Use by Age, Sex, and Year

Shown in Figure 12 are the estimated safety belt use rates by age group, sex, and year. For both years, the rates for the two youngest age groups are based on very low observation numbers and are not meaningful. Excluding these age groups, we find that male belt use rates are considerably lower than the rates for females for all age groups in both 1999 and 2000. For both years, the use rates are higher for the two oldest age groups.

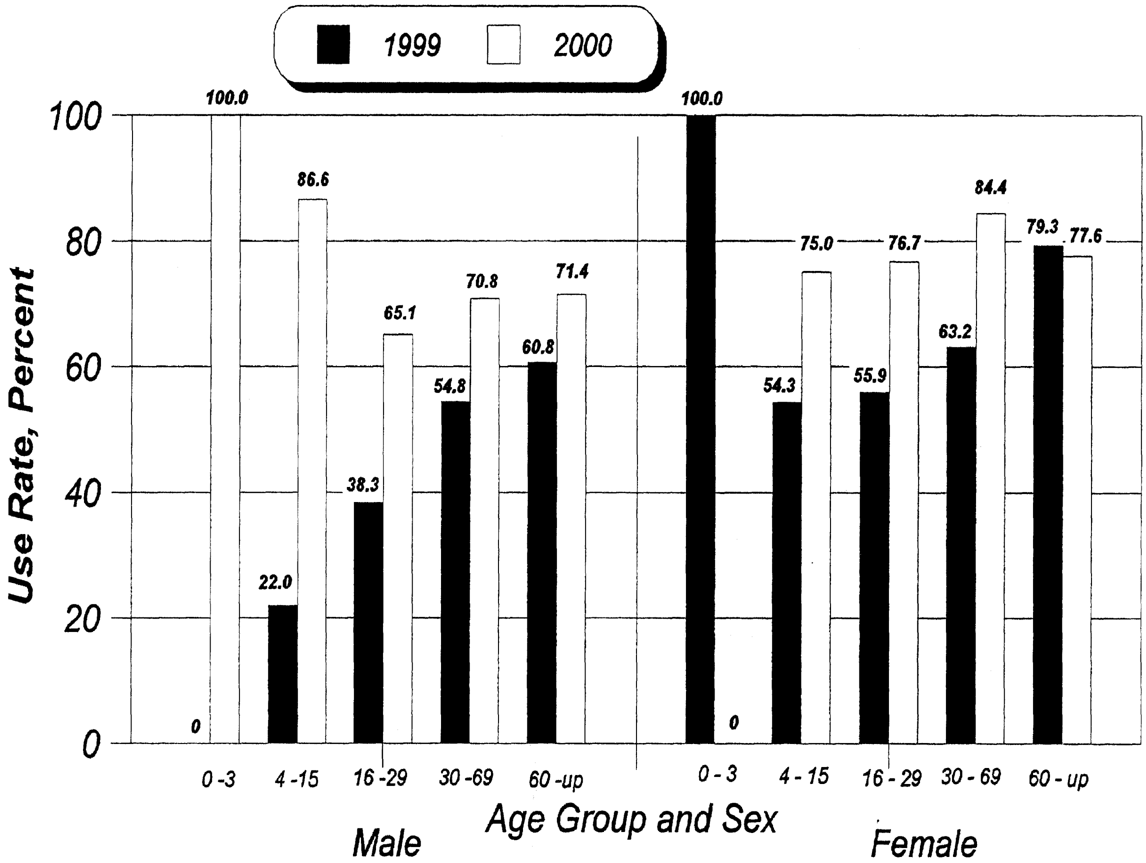

Figure 12. Front-Outboard Shoulder Belt Use by Age, Sex, and Year in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

Estimated Safety Belt Use by City and Year

Figure 13 shows the safety belt use rates by city and year. In both 1999 and 2000, the city of Westland had the highest safety belt use rate of the five city area. While all safety belt use rates increased in the year 2000, the most notable increases were seen in Detroit and Taylor, 28.0 and 20.7 percentage points, respectively.

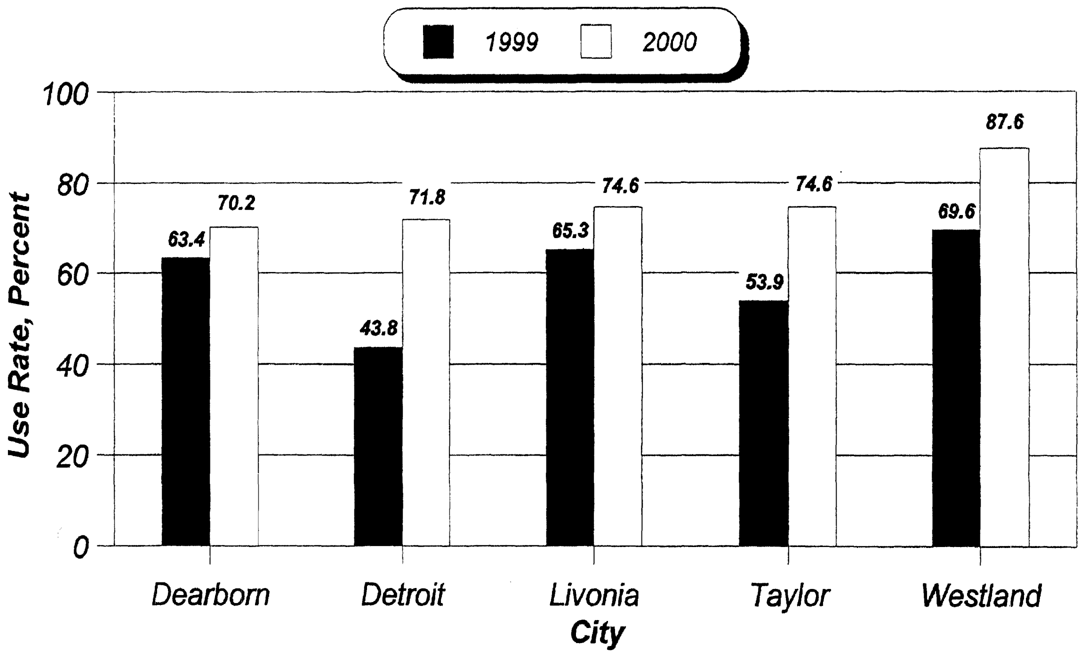

Figure 13. Front-Outboard Shoulder Belt Use by City and Year in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

DISCUSSION

The estimated belt use rate for front-outboard occupants of passenger cars, sport-utility vehicles, vans/minivans, and pickup trucks combined in the five city area of Wayne County, Michigan was 74.7 ± 5.0 percent. When compared with this year's rate for all of Wayne County estimated in the annual statewide survey (Eby, Fordyce, & Vivoda, 2000), we find that the rate from the current survey is about five percentage points lower. At least part of this disparity results from the fact that in the current survey belt use on freeway exit ramps was not observed. While belt use on freeways across Michigan is usually one or two percentage points higher than for local intersections (see Eby, Fordyce, & Vivoda, 2000), an analysis of this year's statewide survey in Wayne County showed that freeway belt use is about four percentage points higher than belt use on local roads. Thus, the present survey in the five city area of Wayne County more accurately reflects front-outboard safety belt use on local roads. When compared with last year's survey of five Wayne Community cities, we find that the rate from the current survey is about 20 percentage points higher. 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 programs, and multiple enforcement programs that have been implemented in Wayne County over the past year.

An examination of safety belt use patterns in the current study showed many of the trends that are often observed in Michigan (Eby, Molnar, & Olk, 2000; Eby, Fordyce, & Vivoda, 2000), however, current belt use rates were higher for all categories. The present study showed that the belt use rate for drivers was consistently higher than for passengers. Our analysis indicates that new efforts should be made to encourage passengers to use safety belts. Further research is essential to better understand the dynamics of passenger belt use in order to develop appropriate and effective PI&E programs. Of particular interest would be a study to determine the age difference and relationship between the driver and passenger to determine which combinations are at higher risk for safety belt nonuse. 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. Such 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) and elsewhere (e.g., Lange & Voas, 1998; Williams, Wells, & Lund, 1987). While not surprising, this finding highlights the need for traffic safety professionals to continue to explore efforts to increase belt use in the male population. However, females should not be ignored in these efforts, as their safety belt use rate, in the five city area, of 81.5 percent does not reflect total compliance with Michigan's safety belt use law.

The present study examined belt use by time of day and found that belt use was highest during the morning rush hour and declined throughout the day. This finding adds to the growing evidence that safety belt use in Michigan is typically higher in the morning (before 1:00 pm) than in the afternoon (see Eby & Olk, 1998; Eby, Fordyce, & Vivoda, 2000). Since morning driving is frequently related to commuting to work, this result suggests that the decision to use a safety belt may be related to the trip purpose. 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). This information can lead to the development of cognitively appropriate traffic safety messages to increase safety belt use among this age group. Considering safety belt use by both age and sex showed that males had consistently lower belt use than females. This finding indicates that programs designed to increase safety belt use by the male population should be addressed to males of all age groups.

This study enables us to measure safety belt use rates in the five city 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. The findings of this study can be considered superior to the findings of the statewide survey since this study focuses entirely on local traffic. 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 been effective in increasing belt use in the five city area of Wayne County over the past year.

The current study 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 a particular benefit, especially programs aimed at passengers, males, and 16-to-29 years olds. By targeting programs designed to increase safety belt use toward those populations most likely to benefit, safety belt use increases can be maximized in Wayne County. 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 2000

SITE # ___ ___ ___ (1 2 3)   SITE LOCATION ______________________________

SITE TYPE
1☐ Intersection
2☐ Freeway
4

Exit No. ________

SITE CHOICE
1☐ Primary
2☐ Alternate
5

TRAFFIC CONTROL
1☐ Traffic Light
2☐ Stop sign
3☐ None
4☐ Other ________________
6

DATE (month/day): ___ ___/___ ___/2000 (7 8 9 10)

OBSERVER
1☐ Betty
2☐ Steve
3☐ Jim D.
4☐ Jim R.
5☐ Jonathon
6☐ Tiffani
7☐ Dave
11

DAY OF WEEK
1☐ Monday
2☐ Tuesday
3☐ Wednesday
4☐ Thursday
5☐ Friday
6☐ Saturday
7☐ Sunday
12

WEATHER
1☐ Mostly Sunny
2☐ Mostly Cloudy
3☐ Rain
4☐ Snow
13

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

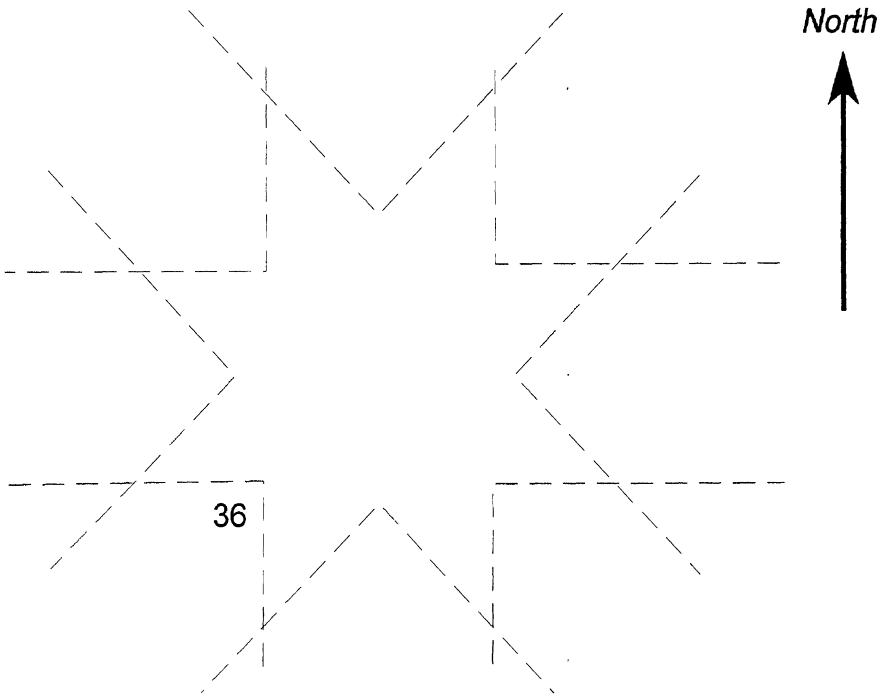
INTERRUPTION (total number of minutes during observation period): ___ ___ (22 23)

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 **2000**

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	Westland	WB Hunter Ave. & Farmington
415	Dearborn	NB N. York St. & Doxtator Rd.
416	Detroit	SB Trinity Ave. & Lyndon
417	Westland	NB Farmington Rd. & Cherry Hill Rd.
418	Detroit	NWB Frontenac St. & Edsel Ford Rd/I-94 Service Dr.
419	Westland	SB Newburgh & Marquette
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	Westland	WB Bock Rd. & Wayne Rd.
426	Detroit	EB Mogul St. & Hayes
427	Westland	SB Surrey Heights & Avondale
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.

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:

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

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 36 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:

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

In the present survey, the relative error was 5.8 percent.