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Mandatory Safety-Belt Law: The Saskatchewan Experience

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The results of five surveys conducted in Saskatchewan to determine rates of safety-belt use are summarized. On July 1, 1977, legislation was passed requiring all front-seat occupants of motor vehicles to use the available safety restraints. The survey results indicate the changes in rates of safety-belt use from May 1977, the period just before the law was passed (when there was an intensive campaign to educate the public to the use of safety belts), to May 1979, two years after enactment of the law. Information was gathered on various driver, vehicle, restraint-system, and trip characteristics to determine what relations exist between these characteristics and safety-belt use. Among the characteristics considered were driver age and sex, educational level, level of driver education, frequency of safety-belt use, accident experience, and number of miles driven per year; roadway speed limit; length of trip; and vehicle size, model, and year of manufacture. Rates of safety-belt use were higher for various conditions, including drivers between the ages of 26 and 36; male drivers; drivers with a high school education or better; and compact, foreign-made, and/or newer vehicles. It was found that, since the passage of the safety-belt law, injury and fatality rates have decreased in the province even though total accidents and miles driven per year have increased.

In an effort to increase the use of safety belts in vehicles, the province of Saskatchewan passed a law on the mandatory use of safety belts on July 1, 1977. To measure the effects of the law and of publicity campaigns and enforcement, five surveys of safety-belt use were conducted and analyzed to obtain an unprecedented picture of safety-belt use before, during, and after the introduction of the law.

Table 1 indicates the extent of the major surveys, which were conducted in the month of May in 1977, 1978, and 1979. The surveys were made at sampling stations throughout the province, on urban streets, provincial highways, and municipal roads. All vehicles except emergency vehicles, buses, and trucks with a gross vehicle weight (GVW) greater than 10 000 lb were included in the surveys.

RATES OF SAFETY-BELT USE

The May 1977 survey indicates the rate of safety-belt use before the law was passed and reflects the effects of an intensive educational program conducted during that period. The average rate of use at that time was slightly less than 20 percent.

Rates of safety-belt use appeared to be a function of a number of factors. Various driver and vehicle characteristics had a favorable effect. Rates of use were better for post-1974 vehicles, American Motors vehicles, compact and subcompact models, vehicles equipped with safety-belt warning systems, drivers under the age of 45 and particularly between the ages of 26 and 35, and drivers with a high school education or better.

A limited survey conducted in July 1977 indicated the effects of the safety-belt legislation. The average rate of use had increased to more than 52 percent. A second limited survey conducted in October 1977 indicated the effects of enforcement and ongoing publicity campaigns. On an overall basis, the rate of safety-belt use had increased to more than 70 percent.

During May 1978, a fourth survey was conducted to determine the effects of ongoing publicity and varying levels of enforcement. Rates of safety-belt use had declined to slightly more than 55 percent. The effect of enforcement was more significant in larger urban centers than in smaller urban centers that had more nonlocal and out-of-province traffic. Nonlocal drivers may have been less aware of local laws and police policy.

A fifth survey was conducted in May 1979 as part of the continuing program to monitor safety-belt use. Rates of use had leveled off to an average of 64 percent. Enforcement levels were also being monitored and were compared with corresponding rates of use at specific locations.

The total number of accidents and miles driven in the province have increased each year, whereas since July 1977 injury and fatality rates have decreased. In order to keep injuries and fatalities to a minimum, it will be necessary to maintain a high rate of safety-belt use by means of publicity campaigns and enforcement.

SURVEY DESIGN

The design for the Saskatchewan surveys attempted to

1. Establish profiles of vehicle, driver, and environmental characteristics;

Table 1. Extent of three major surveys of safety-belt use.

Type of Roadway	No. of Sampling Sites			No. of Vehicle Occupants Surveyed			Percentage of Provincial Travel
	1977	1978	1979	1977	1978	1979	
Highway system[a]							
1	11	12	5	1901	1828	641	26.08
2	7	5	2	669	580	162	7.18
3	3	4	2	178	360	94	5.92
4	6	5	3	559	298	178	6.74
5	3	9	2	117	484	43	9.26
6	0	3	2	0	171	84	1.08
Grid roads	3	7	3	54	142	64	9.40
City streets	10	13	6	3352	3760	1797	22.30
	0	7	5	0	1633	785	
Urban streets in communities with more than 500 people	0	7	2	0	1223	680	2.80
Nongrid roads	0	0	0	0	0	0	9.30

[a]Highway systems range from major high-volume highways (system 1) to northern low-volume highways (system 6).

Table 2. Relation between type of reminder device and driver use of safety belts.

Reminder Device	Driver Use of Safety Belts			
	Did Use		Did Not Use	Total
	Number	Percent		
None	25	58.5	16	41
Several-second buzzer	18	69.2	8	26
Continuous buzzer	13	81.3	3	16
Instrument panel light	4	80.0	1	5
Unknown	13	52.0	12	25
Total	73	64.4	40	113

2. Allow correlation between self-professed attitudes and observed use of safety belts;
3. Relate enforcement levels to rates of use; and
4. Relate changes in injuries and fatalities caused by motor-vehicle accidents to rates of safety-belt use.

Survey locations were randomly selected from the road systems in the province. Usage rates were determined by stopping each vehicle and obtaining the following information: vehicle make, model, year, and province of registration and the types of safety restraints available to and in use by each occupant. Every tenth driver was interviewed in more detail. The questions included the following: the driver's age, sex, and education level; level of driver education; frequency of safety-belt use; accident experience; number of miles driven per year; opinion of the safety-belt law; opinion of the practicability of his or her safety-belt system and whether he or she had ever been fined for not using a safety belt; the vehicle make, model, year, province of registration, and type of safety-belt buzzer (continuous or not); length of trip and whether the occupants were within 25 miles of home; and the type of safety restraints available to and in use by each occupant of the vehicle.

ANALYSIS OF SURVEY RESULTS

A computer data analysis of the survey results was carried out by using the cross-tabulation subprogram of the Statistical Package for the Social Sciences (1).

May 1978 Survey

The results of the May 1978 survey reflect safety-belt use during the intensive education program conducted prior to passage of the safety-belt law. There was a significant increase in safety-belt use under certain circumstances:

1. All devices installed in vehicles to remind drivers to use restraint devices were effective in increasing the driver's rate of safety-belt use. The effects of reminder devices on safety-belt use are summarized in Table 2. The most effective system was the continuous buzzer [it is significant to note that only 5 percent of drivers had disconnected this buzzer (2)]. The instrument panel light also served as an effective reminder device. It should be noted that the type of reminder device is also a function of vehicle type and year of manufacture. Vehicles with no reminder devices were likely to be older models or "nonpassenger cars".
2. The rate of use of some type of restraint system by drivers was found to increase in a cyclic fashion in relation to the year of vehicle manufacture (see Table 3). The extemely low rate of use prior to 1964 probably reflects the unavailability of such restraint systems in vehicles as then supplied by the manufacturer.
3. A dramatic change in the type of restraint used is shown for vehicles manufactured since 1973. Drivers' rate of use of the lap belt decreased only with a corresponding increase in use of the lap-and-shoulder restraint. This change in type of use corresponds to a change in restraint-system design, the result of which is that a large portion of the vehicle population now have permanently attached lap-and-shoulder restraints. Rates of driver safety-belt use and year of vehicle manufacture were found to have a high degree of correlation for the general vehicle population (see Table 4). No significant deviation was noted when specific subgroups, consisting of North American manufacturers or foreign countries of manufacture, were examined except in the case of vehicles built in the Scandinavian countries.
4. Vehicles manufactured in Scandinavia showed the lowest correlation between year of manufacture and rate of safety-belt use. However, as Table 5 indicates, the same group showed an extremely high rate of safety-belt use throughout the year-of-manufacture range considered. Vehicles in the categories of specific North American manufacturers or specific countries of origin did not show rates of safety-

Table 3. Driver use of safety belts by year of vehicle manufacture estimated from May 1978 survey.

Vehicle Year	Driver Use of Safety Belts: Lap-and-Shoulder Number	Lap-and-Shoulder Percent	Lap Number	Lap Percent	None Number	None Percent	Unknown	Total
Pre-1963	2	1.9	14	13.1	81	75.7	10	107
1964	1	1.8	19	34.5	35	63.6	-	55
1965	2	1.9	52	50.5	49	47.6	-	103
1966	1	0.8	65	51.6	59	46.8	1	126
1967	2	1.2	92	57.1	67	41.6	-	161
1968	15	8.0	101	54.0	71	38.0	-	187
1969	23	10.8	110	51.9	79	37.3	-	212
1970	32	15.1	96	45.3	84	39.6	-	212
1971	42	15.0	126	45.0	112	40.0	-	280
1972	93	20.9	189	42.4	164	36.8	-	446
1973	100	19.8	266	52.6	139	27.5	1	506
1974	220	56.7	76	13.5	168	29.8	-	464
1975	376	50.9	121	16.4	241	32.6	1	739
1976	520	57.5	89	9.8	295	32.6	1	905
1977	566	60.1	64	6.8	311	33.1	-	941
1978	384	64.1	24	4.0	190	31.7	1	599
1979	2	66.7	0		0		1	3
Unknown	-		-		-		139	139
Total	3281	53.1	1504	24.3	2145	34.7	155	6185

Table 4. Correlation coefficients between year of vehicle manufacture and driver use of safety belts for vehicles from various sources of manufacture.

Source of Vehicle Manufacture	r	Mean	Standard Deviation	n
North America	0.258 99	1.03	0.8815	5247
General Motors	0.268 27	1.03	0.8935	2283
Ford	0.245 37	0.99	0.8738	1646
Chrysler	0.288 22	1.06	0.8752	1179
American Motors	0.431 62	1.20	0.8097	106
Foreign	0.233 57	1.24	0.8956	938
England	0.484 70	1.31	0.9029	48
France	0.261 40	1.44	0.8819	9
Germany	0.494 47	1.34	0.8899	125
Italy	0.520 97	1.33	0.8165	15
Japan	0.173 93	1.28	0.8620	456
Scandinavia	0.171 35	1.75	0.6530	52
Overall	0.248 41	1.06	0.8869	6185

belt use that were significantly different from the norm.

5. Although drivers between the ages of 36 and 65 had the highest level of safety-belt use, there is no statistically significant difference in the rate of use between various age groups.

6. Proximity to home had no noticeable effect on safety-belt use.

7. The effect on usage rates of receiving a fine for violation of the safety-belt law was not significant.

8. Driver education had a favorable though not statistically significant effect on safety-belt use.

May 1979 Survey

A fifth survey conducted in May 1979 indicated the effects of continuing enforcement and publicity. The overall rate of safety-belt use had reached a level of 64 percent. This survey included all roadway systems but was not as detailed as the previous surveys.

ANALYSIS OF VARIANCE

A three-way analysis of variance was carried out to investigate the effects on safety-belt use of safety-belt availability and vehicle model, year, and manufacturer.

The first part of the analysis considered only vehicles manufactured in North America. Only the difference in safety-belt use between the various types of passenger vehicles was shown to be significant even after correcting for model, year, and safety-belt availability. A similar result was observed when manufacturer was substituted for model. However, when both manufacturer and model were considered along with year of manufacture and safety-belt availability, it was found that manufacturer and model were not significant to safety-belt use (see Table 6). When a similar analysis was carried out for cars of European and Japanese manufacture, it was found that country of origin was a significant variable whereas vehicle type was not. This probably indicates that in the Saskatchewan driving population there is a considerable degree of homogeneity among the drivers purchasing vehicles from each of the countries of origin.

Various factors that were thought to have an effect on rates of safety-belt use were analyzed to find linear regression models for restraint use (see Table 7). Once again, year of manufacture emerged as a favorable factor in increasing the rate of use when the overall North American and foreign samples and the source-of-manufacture subsamples were considered. An exception to this relation was vehicles manufactured in France and Sweden. This may have resulted from the small sample size of the vehicles manufactured in France and the consistently high rate of safety-belt use for vehicles manufactured in Sweden.

As one would expect, the rate of safety-belt use showed a high positive correlation with availability. To ensure that this relation did not overshadow other possible usage relations, an availability category was defined and coded as follows: 0 for no belt available, 1 for lap restraint available, and 2 for lap-and-shoulder restraint available.

The light-duty truck was noted to have a negative effect on the level of safety-belt use. This appeared to be true for all subgroups in which light-duty trucks were included.

USE OF PREDICTOR EQUATIONS

The probable rates of driver use of safety belts for specific vehicles in the overall population or in various subpopulations can be evaluated by using the linear equations given in Table 6. For example, for

Table 5. Observed relation between source of vehicle manufacture and driver use of safety belts.

Source of Vehicle Manufacture	Driver Use of Safety Belts							
	Lap-and-Shoulder		Lap		None			
	Number	Percent	Number	Percent	Number	Percent	Unknown	Total
General Motors	903	37.3	643	26.5	872	36.0	4	2422
Ford	658	37.4	431	24.5	669	38.1	0	1758
Chrysler	497	40.9	308	25.3	409	33.6	2	1216
American Motors	47	44.3	33	31.1	26	24.5	0	106
International Harvester Company	1	3.6	12	42.9	15	53.6	0	28
England	29	60.4	5	10.4	16	33.3	0	48
France	6	66.7	1	11.1	2	22.2	0	9
Germany	78	62.4	12	9.6	35	28.0	0	125
Italy	8	53.3	4	26.7	3	20.0	0	15
Japan	251	55.0	82	18.0	123	27.0	0	456
Sweden	45	86.5	1	1.9	6	11.5	0	52

Table 6. Effect of model class on driver use of safety belts.

Vehicle Class	No. of Vehicles in Class	Class Effect	
		Raw	Adjusted[a]
Intermediate			
A-body	861	0.12	0.07
Specialty	169	0.08	-0.08
Standard or full size	1668	0.02	0.05
Luxury			
C- or D-body	97	0.14	0.00
E-body	76	0.06	-0.10
Mini specialty	46	-0.01	-0.11
Specialty	187	-0.08	-0.15
Compact	611	0.18	0.15
Subcompact			
Foreign	488	0.28	0.21
U.S.	162	0.21	0.08
Super sport	11	-0.06	0.03
Small van	165	-0.36	-0.22
Pickup	961	-0.38	-0.28
Utility	28	-0.13	-0.09
Carry-all	10	0.44	0.39
Pickup car	19	-0.69	-0.78
Foreign sports car	22	0.12	0.11

[a]Class effect when adjustments have been made for confounding effects of model year and belt availability.

Table 7. Predictor equations for safety-belt use for sample groups.

Source of Vehicle Manufacture	Predictor Equation to Determine Driver Rate of Safety-Belt Use
North America	0.3153 (availability) + 0.035 019 (year) -0.3227 (pickup) - 0.7894 (Ranchero) -0.3096 (van) - 0.2004 (compact) - 2.0206
General Motors	0.3627 (availability) + 0.0334 (year) -0.3050 (pickup) - 0.2083 (specialty) -1.9799
Ford	0.3689 (availability) + 0.029 43 (year) -1.0337 (Ranchero) - 0.2543 (pickup) -0.2129 (compact) - 0.3445 (Mustang) -0.2725 (van) - 1.7325
Chrysler	0.1569 (availability) + 0.059 02 (year) -0.5362 (pickup) - 0.6807 (van) -1.3808 (U.S. mini) - 0.4310 (compact) -3.4780
American Motors	0.0849 (year) - 4.9496
Foreign	0.4073 (availability) + 0.014 88 (year) -0.2988 (full size) - 0.4250 (pickup) -0.3214 (intermediate) - 0.5053
England	0.0884 (year) - 5.1264
France	1.4444
Germany	0.4892 (availability) + 0.051 92 (year) -3.2859
Italy	0.1854 (year) -12.17
Japan	0.4645 (availability) + 0.042 31 (year) -0.3456 (pickup) - 2.7496
Sweden	1.75
Overall	0.3372 (availability) + 0.0314 (year) -0.3121 (pickup) - 0.7866 (Ranchero) -0.2675 (van) + 0.4337 (Swedish) -0.1998 (compact) + 0.2552 (Volkswagen) -1.7826

Note: Year was coded as follows: 1900 = 0, 1975 = 75.

a Ford compact built in 1976, safety-belt use can be predicted by using the overall regression, the fit for American vehicles, or the equation that predicts safety-belt use for Ford vehicles. Since the car is a 1976 model, it will be equipped with a lap-and-shoulder belt combination, which gives an availability of 2. Thus,

$$\text{Overall use} = 0.3372\,(2) + 0.031\,41\,(76) - 0.1998 - 1.7826 = 1.08 \quad (1)$$

$$\text{American use} = 0.3153\,(2) + 0.035\,019\,(76) - 0.2004 - 2.0206 = 1.07 \quad (2)$$

$$\text{Ford use} = 0.3689\,(2) + 0.029\,43\,(76) - 0.2129 - 1.7325 = 1.03 \quad (3)$$

If one uses the Chrysler use equation, a 1975 Dodge van would be expected to have a use of 0.1569 (1) + 0.059 02 (75) - 0.6807 - 3.4780 = 0.42.

It was found that detailed examination of these data did not provide an answer to what kind of active safety-belt system had the highest rate of use among drivers. Apparently identical belt systems in two classes of vehicles were observed to have greatly different rates of use. This was noted particularly for vehicles of the Chevelle-El Camino type: Safety-belt use appears to be much lower in the El Camino type of vehicle. This difference may be attributable to either a difference in trip type or a difference in attitudes toward safety and legal compliance between the two subgroups of drivers.

Cars manufactured in Sweden were observed to have a consistently high rate of safety-belt use. There are no other safety-belt combinations that are directly comparable to the ones in Swedish vehicles, but it would seem likely that the usage rate is only partly attributable to the particular restraint mechanism. It may also be caused by other factors, such as attitudes toward safety or compliance with traffic laws.

As noted previously, in May 1977 the use of lap-and-shoulder belts increased in vehicles manufactured since 1974, when the belts became a permanent combination. Foreign cars, American Motors vehicles, and compact and subcompact models still had higher rates of use.

EFFECT OF ENFORCEMENT OF SAFETY-BELT LAW

The effects of enforcement on safety-belt use can be illustrated as follows:

Size of Urban Center	No. of Tickets per 1000 Population	Rate of Safety-Belt Use (%)
Large	0.10	58
	1.59	68
Small	3.34	61
	17.21	60
	28.80	63

It can be seen that enforcement level has a significant effect on rates of safety-belt use in large urban centers.

The effects of enforcement in rural and small urban centers may not be significant because of the greater number of out-of-town and out-of-province drivers. The composition of vehicle registrations in large and small urban centers is given below:

	Vehicle Composition (%)		
Roadway System	Local	Saskatchewan	Out of Province
Larger urban centers	95.0	98.1	1.9
Small urban centers	87.5	99.1	0.9

Clearly, there are more nonlocal vehicles in the small urban centers. The difference, however, is not statistically significant.

Seatbelt use is also affected by local police department policy; i.e., some police detachments issue warning tickets for safety-belt violations or issue tickets only if the violator has been involved in a motor-vehicle accident. Abrupt or nonpublicized changes in enforcement policy had a noticeable effect on safety-belt use. During the October 1977 survey, safety-belt use on the municipal grid road system was found to be higher than anticipated from past trends (2). This was later found to be the effect of several police "roadblock safety-belt checks" that had been set up in the area during a two-week period before the survey.

In the vicinity of larger urban centers, combined enforcement by urban police and rural police forces had a significant effect on safety-belt use:

No. of Tickets per 1000 Population	Area Level of Safety-Belt Use (%)
0.26	55.4
6.12	75.1

INJURY AND FATALITY RATES

As Figure 1 shows, although the total number of accidents and miles driven per year increased in 1978, injury and fatality rates decreased (3,4). To keep injuries and fatalities to a minimum, it will be necessary to maintain a high rate of safety-belt use through publicity campaigns and enforcement.

In 1976, Ontario passed a mandatory safety-belt law and reduced speed limits on their provincial highways. During 1976, the injury rate declined 13.7 percent and the fatality rate declined 16.1 percent (5). In 1977, Manitoba had an increase in injuries and fatalities caused by motor-vehicle accidents. Without the safety-belt law, use of restraint devices has remained at 18 percent (6).

SUMMARY

During the period from May 1977 to May 1979, rates of safety-belt use in Saskatchewan varied significantly. The changes are shown in Figure 2. In May 1977, during an extensive publicity campaign and educational program, overall rates of safety-belt use were approximately 18 percent. Several driver and vehicle characteristics had a beneficial effect on rates of use: vehicles with safety-belt buzzers, drivers between the ages of 26 and 35, male drivers, and drivers with a high school education or better.

In July 1977, shortly after a mandatory law on safety-belt use had been passed, another survey was done. The overall rate of use had increased to more than 52 percent. During the period from July to October, the safety-belt law was in effect but was not being enforced. On October 1, enforcement began, and shortly thereafter rates of safety-belt use were again surveyed. The rate had increased to more than 70 percent.

Between October 1977 and May 1978, the safety-belt law was enforced at varying levels throughout the province. By May 1978, the rate of use had decreased to approximately 55 percent.

From May 1978 to May 1979, the safety-belt law continued to be enforced at varying levels. Publicity campaigns continued, and membership in the "Seatbelt Survivor's Club" grew considerably. In May 1979, rates of safety-belt use had increased to 64 percent.

Although total accidents and miles driven per year in the province have increased, injury and fatality rates have decreased. If rates of safety-belt use can be maintained at a high level, this trend should continue.

A higher level of law enforcement increases usage rates, particularly in larger urban centers. The effect of enforcement is somewhat diminished in smaller urban centers, where there is more nonlocal and out-of-province traffic.

CONCLUSIONS

As a result of the research reported in this paper, the following conclusions can be drawn:

1. The existence and enforcement of Saskatchewan's safety-belt law seem to have had a major effect on patterns of safety-belt use in the province. The safety-belt legislation originally increased the rate of use from 18 to 52 percent. After enforcement began in October 1977, the rate increased to 70 percent. After eight months of varying levels of enforcement, the usage rate decreased to 55 percent in May 1978. By May 1979, with increased enforcement and continuing publicity, the rate had increased to 64 percent.
2. Many vehicle, driver, and environmental factors had a favorable effect on rates of safety-belt use, including (a) vehicles of recent manufacture, subcompact and compact models, vehicles with buzzer or warning-light reminder systems, and foreign models; (b) male drivers and drivers with a high school education or better; and (c) high-speed, high-volume roadways and long trip distances.
3. Although total accidents and miles driven in the province have increased, safety-belt use has helped to decrease injury and fatality rates.
4. High levels of law enforcement increase usage rates, particularly in urban centers. In rural areas, the greater numbers of nonlocal drivers decrease the effects of local enforcement levels.

It is quite probable that attitudes toward safety and compliance with traffic laws, along with socioeconomic factors, affect both the type of vehicles that people buy and their use of restraint systems. This seems to be a severe confounding effect that serves to mask much of the change in use that can be attributed to more convenient safety-belt systems. In spite of this, however, it is clear that the use of safety belts is

Figure 1. Saskatchewan accident statistics: 1971-1979.

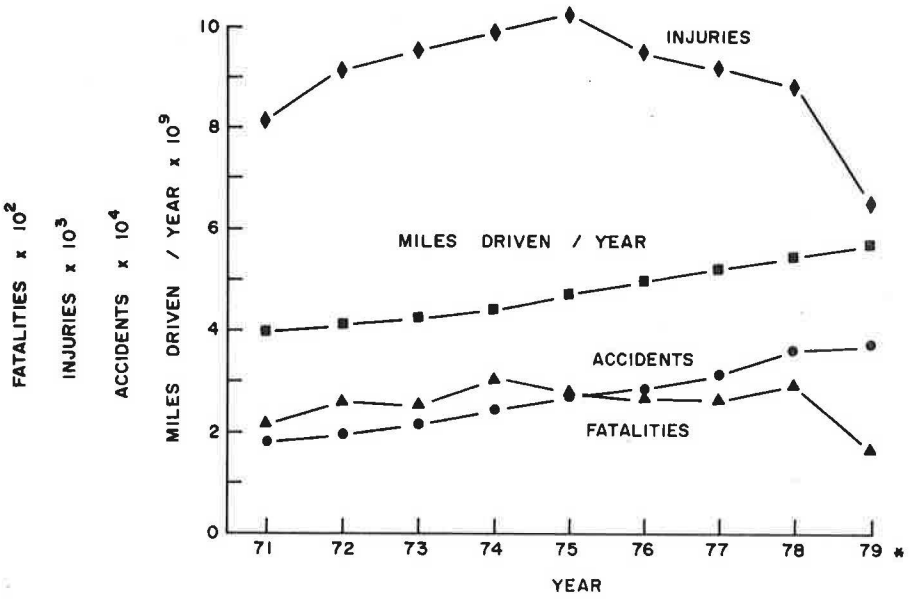
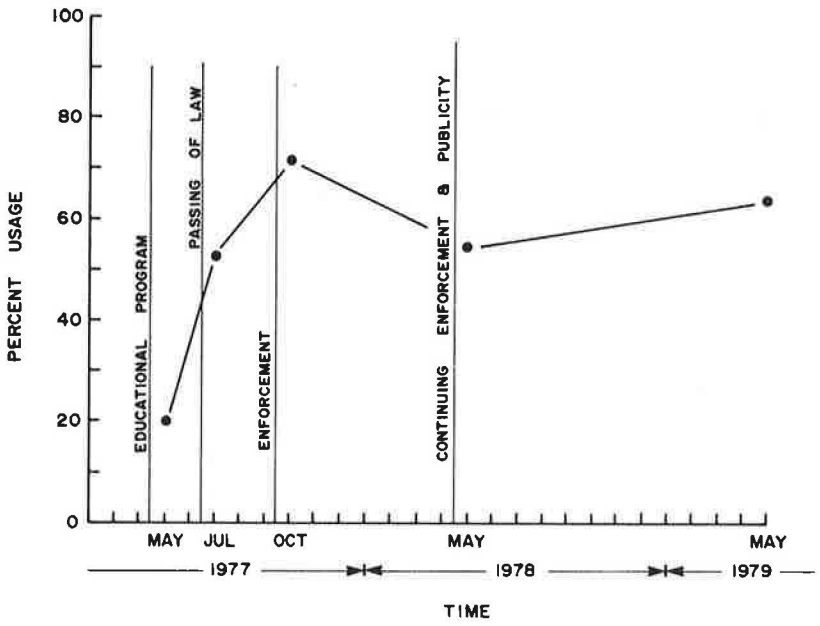


Figure 2. Safety-belt use in Saskatchewan between May 1977 and May 1979.



considerably greater among people who drive newer vehicles and thus that the changes in safety-belt systems over the past decade have favored increased use.

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