

suffering from tuberculosis within the period of this review. In each of these two cases, contact had been with a person elsewhere whose disease was active. We would like to think that the absence of cases among contacts identified locally was the result of our preventive therapy program, but the numbers of cases are too small to justify such a claim. In addition, as is true of all preventive procedures, failures are much easier to identify than successes, which usually go unnoticed.

There are some areas where our program can be strengthened with a reasonable chance of success. Adequate histories need to be obtained from all persons reported to have tuberculosis. When people are treated solely by private physicians or hospitals, information should also be obtained at frequent intervals to assure that adequate treatment is being prescribed and that patients are adhering to their regimens. Infants and children from high prevalence areas need to be tuberculin tested, and if positive, put on preventive therapy. Presenting the findings of this review to the local medical society should strengthen the argument for this minimal intrusion into medical practice.

Perhaps a major lesson for areas where tuberculosis cases are few and scattered is that both the medical profession and the public need to be reminded periodically that tuberculosis is still with us. For the medical profession, an annual review of the reported cases during a year and the missed opportunities for prevention of disease, disability, or death could be made, somewhat along the lines of the once successful maternal mortality committees (3). For the public, this annual review could be used as a framework for a news article that would include hints for minimizing the risk of tuberculosis and improving personal health in general.

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## Use of Seatbelts in Cars with Automatic Belts

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**Synopsis**.....

*Use of seatbelts in late model cars with automatic or manual belt systems was observed in*

*suburban Washington, DC, Chicago, Los Angeles, and Philadelphia. In cars with automatic two-point belt systems, the use of shoulder belts by drivers was substantially higher than in the same model cars with manual three-point belts. This finding was true in varying degrees whatever the type of automatic belt, including cars with detachable non-motorized belts, cars with detachable motorized belts, and especially cars with nondetachable motorized belts.*

*Most of these automatic shoulder belts systems include manual lap belts. Use of lap belts was lower in cars with automatic two-point belt systems than in the same model cars with manual three-point belts; precisely how much lower could not be reliably estimated in this survey. Use of shoulder and lap belts was slightly higher in General Motors cars with detachable automatic three-point belts compared with the same model cars with manual three-point belts; in Hondas there was no difference in the rates of use of manual three-point belts and the rates of use of automatic three-point belts.*

**A**LL 1990 and newer model passenger cars are required by Federal regulations to be equipped with automatic restraints (1). This requirement was phased in, starting with 10 percent of 1987 model year cars, 25 percent of 1988 cars, and 40 percent of 1989 cars. Two types of automatic restraints have been used to meet the requirements: air bags that inflate automatically in frontal crashes and seatbelts that automatically fasten around occupants when they enter or start the car. Although air bags are increasingly available, most 1987-90 cars with automatic restraints have belt systems. The percentage of automatic restraint cars with automatic seatbelts was about 90 percent in the 1987 model year, 94 percent in the 1988 model year, and 87 percent in the 1989 model year; it is projected to be about 70 percent in 1990 models (2).

Four basic types of automatic seatbelts have been offered: detachable nonmotorized three-point (lap and shoulder) belts, nondetachable motorized two-point (shoulder) belts, detachable motorized two-point (shoulder) belts, and detachable nonmotorized two-point (shoulder) belts. Features of these systems are described in the box, page 185.

An observational survey of seatbelt use in 1987 indicated that Ford and Toyota (nondetachable motorized two-point belt), Nissan (detachable motorized two-point belt), and Volkswagen (detachable nonmotorized two-point belt) passenger cars all had shoulder belt use rates around 90 percent (3). These rates of use of shoulder belts were about 25 to 35 percentage points higher than shoulder belt use in the same cars with manual belts. However, in cars with automatic two-point belts that had manual lap belts, only about half of the drivers were using the lap belt.

The use of shoulder belts in Chrysler LeBarons and Dodge Daytonas with automatic detachable nonmotorized two-point belts was lower than in the same car models with manual systems. In General Motors (GM) automatic belt cars with detachable three-point belts, belt use was 9 percentage points higher than in equivalent cars with manual belts. Based on these data and estimates of seatbelt effectiveness from the U.S. Department of Transportation, the automatic two-point belts that achieved very high rates of use of shoulder belts should produce greater reductions in fatalities than the automatic three-point belts provided by GM (3).

In 1989, many more cars with automatic belt systems were on the roads, including some that had been on the roads for several years and may have

Table 1. Use of shoulder belts by drivers by type of automatic belt

Belt type	Number	Percent
Nondetachable motorized two-point belt .....	2,591	92
Detachable motorized two-point belt .....	1,545	83
Detachable nonmotorized two-point belt .....	491	75
Detachable nonmotorized three-point belt .....	3,624	66

owners other than the original ones. Therefore, the 1987 survey was repeated—comparing belt use in late model cars with automatic belts with belt use in late model cars with manual belts—to examine whether the use patterns observed in 1987 had changed.

## Methods

The use of seatbelts by drivers was observed at 64 sites in each of four metropolitan areas in the fall of 1989: Chicago, Los Angeles, Philadelphia, and the Maryland and Virginia suburbs of Washington, DC. In each area, the use of seatbelts is required by State law. (These were the same sites that were used in the 1987 survey; at that time, belt use had not been required in Philadelphia and the Virginia suburbs.)

To obtain a sample of late model cars with and without automatic belts, observations were restricted to cars with high center mounted brakelights including 1986 models having only manual belts. These brakelights have been required only since the 1986 model year. Some 1985 cars also had them, but these cars were subsequently eliminated from the sample. The observation sites were typically intersections with traffic lights, distributed throughout the metropolitan areas, but concentrated in affluent areas to maximize the likelihood of observing late model cars. To maximize the number of observations, the survey was conducted—as was the 1987 survey—only during morning (7:00-9:30 a.m.) and evening rush hours (4:00-6:30 p.m.).

It should be noted that voluntary belt use has been found to be higher among drivers in higher income neighborhoods and drivers in newer cars (4,5). Thus, the overall belt use rates observed in this study focusing on late model cars in rush hours in affluent neighborhoods are likely to be higher than belt use rates in the general population. Until

Table 2. Use of shoulder belts by drivers of cars with nondetachable motorized automatic two-point belts and of cars with manual three-point belts by model year

Manufacturer and belt type	Model year									
	1986		1987		1988		1989-90		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
<i>Ford—Escort, Tempo, and Topaz</i>										
Manual	403	60	248	59	...	...	...	...	651	60
Automatic	...	...	203	88	627	90	472	91	1,302	90
<i>Toyota Camry</i>										
Manual	232	78	...	...	...	...	...	...	232	78
Automatic	...	...	295	95	361	95	398	95	1,054	95
<i>Total</i>										
Manual	635	67	248	59	...	...	...	...	883	65
Automatic	...	...	498	92	988	92	870	93	2,356	92

Table 3. Use of shoulder belts by drivers in cars with detachable automatic three-point belts and in cars with manual three-point belts by model year

Manufacturer and belt type	Model year									
	1986		1987		1988		1989-90		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
<i>General Motors<sup>1</sup></i>										
Manual	1,059	58	694	57	593	60	37	65	2,383	58
Automatic	...	...	381	60	1,057	63	1,492	66	2,930	64
<i>Honda<sup>2</sup></i>										
Manual	558	73	592	75	545	77	384	75	2,079	75
Automatic	...	...	78	71	303	75	224	77	605	75
<i>Total</i>										
Manual	1,617	63	1,286	65	1,138	68	421	74	4,462	66
Automatic	...	...	459	62	1,360	66	1,716	68	3,535	66

<sup>1</sup> Chevrolet Baretta/Corsica, Buick LeSabre, Buick Regal, Buick Skylark/Somerset, Buick Electra, Oldsmobile Cutlass, Oldsmobile Cutlass Calais, Oldsmobile

88, Oldsmobile 98, Pontiac Bonneville, Pontiac Grand AM, Pontiac Grand Prix.

<sup>2</sup> Honda Accord, Honda Prelude.

cars with automatic belts have been available for more years and comprise a larger segment of the overall vehicle fleet, it will not be possible to estimate the effects of different belt systems on rates of belt use in the general driving population.

In the 1987 survey, observers were trained to identify target vehicles and distinguish between cars with manual and automatic belt systems. In the 1989 survey, observers recorded license plate numbers of the vehicles that were used to obtain vehicle identification numbers (VINs) from the State motor vehicle departments in Illinois, California, Pennsylvania, Maryland, and Virginia. VINs provide information on car model, model year, and type of restraint system. Using this technique, errors in identifying the vehicle observed are possible only in rare instances, for example, the license number was recorded incorrectly or the owner had transferred

the license plate from another car to the one observed and the Department of Motor Vehicles had not yet updated its files.

In both surveys, observers were stationed on the side of the car opposite the driver; they observed and separately recorded the use of lap belts and shoulder belts by the drivers as the car slowed or stopped at intersections. In the 1987 survey, observers had been trained to look for specific cars and knew the types of belts in those cars (whether separate lap belt, lap belt attached to shoulder belt, or no lap belt). In the current survey, observers obtained license plates numbers but did not identify vehicles as part of their task. A review of the data indicated that use of lap belts was incorrectly listed for Volkswagen models that have no lap belts. Thus rates of use of the lap belt obtained in this study are likely to be overestimated, and they are

## Types of Automatic Seatbelt Systems

<i>Belt type</i>	<i>Use characteristics</i>
Nondetachable motorized shoulder (two-point) belt; manual lap belt and knee bolster	Shoulder belt moves along guide rail in roof of car and positions itself around occupant when door is closed and ignition is turned on; minimal or no contact with occupant entering or exiting car; can be disabled permanently by cutting or unbolting; shoulder belt cannot be used as a manual belt.
Detachable motorized shoulder (two-point) belt; manual lap belt and knee bolster	Shoulder belt moves along guide rail in roof of car and positions itself around occupant when door is closed and ignition is turned on; minimal or no contact with occupant when entering and exiting car; can be detached from the guide rail and used as a manual belt.
Detachable nonmotorized shoulder (two-point) belt; knee bolster with or without manual lap belt and ignition interlock on Volkswagen models	Shoulder belt attached to door and wraps around occupant when door is closed; some contact with occupant when entering or exiting car; can be detached where the belt attaches to the door and used as a manual belt; for Volkswagen models, shoulder belt must be attached to start car but can be detached after car is started.
Detachable nonmotorized lap and shoulder (three-point) belt	Three-point lap and shoulder belt system attached to door and wraps around occupant when door is closed; some contact with both lap and shoulder portions when entering and exiting car; can be disconnected via conventional buckle and used as a manual lap or shoulder belt.

discussed but not presented separately in the results.

The statistical significance of observed differences in rates of belt use was assessed by simple  $\chi^2$  tests of independence between belt use and the independent variable of interest (for example, restraint type). Differences that could be expected to occur by chance less than 5 percent of the time were accepted as statistically significant. Because of the large number of observations for most restraint types and manufacturers, differences of as little as 5 percentage points were typically significant.

### Survey of Parked Cars

When automatic belt systems are in use, it is not possible to know whether the occupant is using the belt in its automatic mode or as a manual belt. To provide some information on this topic, a separate survey was conducted of cars with automatic belts parked at office parking lots and shopping malls in the Maryland and Virginia suburbs of Washington, DC. Belts that were detached in parked cars were considered to be used as manual belts.

### Results

Seatbelt use was observed in 45,466 1986-90 model year cars; complete VIN information was available for 97 percent of these vehicles. Use of shoulder belts by drivers was higher in the 8,251 cars with automatic belts (78 percent) than in the

34,223 cars with manual belts only (63 percent) and the 1,628 cars with air bags plus manual belts (66 percent). The information from this survey on seatbelt use in cars with air bags has been reported elsewhere (6).

Table 1 indicates that there were considerable differences in shoulder belt use by automatic belt type. Drivers in cars with detachable nonmotorized three-point belts, the automatic belt system seen most frequently in the survey, had the lowest use rate (66 percent); the nondetachable motorized two-point belt, the next most frequently seen automatic belt system, had the highest use rate (92 percent). All pairwise comparisons of rates of use among the restraint types in table 1 were statistically significant.

Tables 2-5 address the question of the extent to which providing an automatic belt system changes use rates from that achieved with manual belts by comparing the same car models with and without automatic belts. Cars that had only manual belts in 1986-90 model years and cars with automatic (or manual) belts that were seen infrequently are not included in these tables.

Table 2 indicates that there is a sizable and statistically significant increase in use of shoulder belts by drivers in cars with nondetachable motorized two-point belts, and use of automatic belts is about 90 percent or greater in all model years.

Table 3 indicates that for GM cars, there is a modest and statistically significant increase in use of shoulder (and lap) belts by drivers in cars with

Table 4. Use of shoulder belts by drivers of cars with detachable motorized automatic two-point belts and of cars with manual three-point belts by model year

Manufacturer and belt type	Model year									
	1986		1987		1988		1989-90		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
<i>Mazda 626</i>										
Manual	79	82	62	74	...	...	...	...	141	79
Automatic	...	...	25	96	69	86	77	95	171	91
<i>Nissan Maxima</i>										
Manual	73	70	130	71	...	...	...	...	203	70
Automatic	...	...	163	83	106	80	203	87	472	84
<i>SAAB 900</i>										
Manual	70	70	53	66	35	60	26	62	184	66
Automatic	...	...	6	( <sup>1</sup> )	21	( <sup>1</sup> )	10	( <sup>1</sup> )	37	92
<i>Subaru XT</i>										
Manual	42	62	16	( <sup>1</sup> )	...	...	...	...	58	66
Automatic	...	...	13	( <sup>1</sup> )	21	( <sup>1</sup> )	16	( <sup>1</sup> )	50	88
<i>Chrysler<sup>2</sup></i>										
Manual	48	71	208	62	176	64	117	62	549	63
Automatic	...	...	...	...	46	72	119	73	165	72
<i>Ford<sup>3</sup></i>										
Manual	222	55	207	54	235	44	...	...	664	51
Automatic	...	...	...	...	...	...	222	84	222	84
<i>Acura Integra</i>										
Manual	41	80	131	83	119	79	97	70	388	78
Automatic	...	...	...	...	...	...	42	88	42	88
<i>Jaguar XJ-6</i>										
Manual	34	62	23	( <sup>1</sup> )	50	52	...	...	107	62
Automatic	9	( <sup>1</sup> )	4	( <sup>1</sup> )	...	...	28	71	41	71
<i>Total</i>										
Manual	609	66	830	67	615	58	240	65	2,294	64
Automatic	9	( <sup>1</sup> )	211	84	263	83	717	84	1,200	84

<sup>1</sup> Percentage not shown when the number < 25. <sup>2</sup> Dodge Shadow, Dodge Colt, Eagle Premier, and Plymouth Sundance. <sup>3</sup> Ford Thunderbird and Mercury Cougar.

Table 5. Use of shoulder belts by drivers of cars with detachable nonmotorized automatic two-point belts and of cars with manual three-point belts by model year

Manufacturer and belt type	Model year									
	1986		1987		1988		1989-90		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
<i>Chrysler<sup>1</sup></i>										
Manual	54	44	15	( <sup>2</sup> )	1	( <sup>2</sup> )	...	...	70	44
Automatic	...	...	63	62	46	59	...	...	109	61
<i>Hyundai Excel</i>										
Manual	120	67	259	53	342	57	171	53	892	57
Automatic	...	...	23	( <sup>2</sup> )	109	70	73	67	205	68
<i>Volkswagen Jetta/Golf</i>										
Manual	231	72	165	74	48	73	43	67	487	72
Automatic	...	...	29	100	64	91	62	92	155	93
<i>Total</i>										
Manual	405	67	439	61	391	59	214	56	1,449	61
Automatic	...	...	115	72	219	74	135	79	469	75

<sup>1</sup> Chrysler LeBaron, Dodge Daytona. <sup>2</sup> Percentage not shown when the number < 25.

detachable nonmotorized three-point belts compared with use in cars without automatic belts; no difference was found for Hondas with and without automatic belts. There are generally increases in belt use for each succeeding model year in the GM and Honda manual and automatic belt cars. These data should be interpreted with caution, however, because the mix of models with manual and automatic belts changed across model years as additional models were equipped with automatic belts. Comparisons of manual and automatic belt use within model year show patterns similar to the totals for all model years combined, although the differences between GM cars with manual versus automatic restraints are smaller and not significant.

Detachable motorized automatic two-point belts are offered by many manufacturers (table 4) and increase belt use from 9 to 33 percentage points over manual systems (these differences and the average increase of 17 percent are all statistically significant). Comparisons within model years show differences very similar to those obtained when model years are totaled.

Table 5 indicates that in cars with detachable nonmotorized two-point belts—the automatic belt system least frequently seen—the use of shoulder belts by drivers was significantly higher in the automatic than in the manual system for all cars, both within model year and with model years totaled. Volkswagens, with ignition interlocks, had significantly higher automatic belt use than other manufacturers in this group (93 percent).

In the 1987 survey, typically about half the drivers in cars with automatic two-point belts and separate manual lap belts were using the lap belt. In the 1989 survey, this proportion was higher, although as indicated it was likely to have been overestimated. The lap belt observations were repeated in early 1990 in the Washington, DC, suburban areas by observers who were aware of the data problem or who received special supplemental training, or both, and lap belt use rates for Ford Escorts, Toyota Camrys, and Nissan Maximas were found to be 10–15 percentage points lower than those obtained in the fall 1989 survey. It is clear that providing an automatic two-point belt and a separate manual lap belt increases shoulder belt use (to varying degrees), compared with manual three-point belt systems, and decreases lap belt use. How much the use of lap belts decreases could not be reliably estimated in this survey.

Table 6 presents results of the survey of parked cars. Almost all cars with nondetachable motorized two-point belts had the belts attached, while almost

Table 6. Parking lot survey of cars with automatic belts in the Maryland and Virginia suburbs of Washington, DC

<i>Belt type</i>	<i>Driver belts connected</i>	
	<i>Number</i>	<i>Percent</i>
Nondetachable motorized two-point belt .....	474	98
Detachable motorized two-point belt .....	259	92
Detachable nonmotorized two-point belt .....	111	75
Detachable nonmotorized three-point belt .....	491	1

all cars with detachable nonmotorized three-point belts had unattached belts. More than 90 percent of the cars with detachable motorized two-point belts had attached belts and 75 percent of the detachable nonmotorized two-point belts were attached. However, of this latter group, Volkswagens with ignition interlocks had an attachment rate of 95 percent, whereas in other cars with detachable nonmotorized two-point belts the attachment rate was 64 percent. All these differences were statistically significant.

## Discussion

In all of the passenger car series surveyed that had automatic two-point or automatic three-point belts, driver shoulder belt use was considerably higher than in the same car models equipped with manual belts. This was true regardless of the automatic belt system type, including cars with detachable nonmotorized two-point belts without ignition interlocks, such as Chrysler LeBarons and Dodge Daytonas, which in the 1987 survey had rates of use of automatic shoulder belts that were lower than with the manual system. In the present survey, the highest rates of use of shoulder belts were found in Volkswagen cars with ignition interlocks and in cars with nondetachable motorized two-point belts. This finding is compatible with the parking lot data that indicate that cars with these belt systems nearly always have the belts attached.

The belt use rates observed in this survey in late model cars in affluent neighborhoods during commuting hours are probably not typical of the general population (4,5). It is not known how the differences in use rates among the belt systems observed in this survey will change as these vehicles age and are owned and driven by a more demographically diverse population. Manual belt systems and easily detached automatic belts would be

expected to have lower use rates as the cars age and the driver demographics change, while nondetachable automatic belts, like those in the Ford Escort and Toyota Camry, may show less reduction because their disconnection would require permanent modifications of the vehicle. However, further research on older vehicles with automatic belts would be needed to verify this hypothesis.

The data from the parking lot survey indicate that detachable nonmotorized three-point belts are used as manual belts. It is not surprising that these automatic belts tend to be used only slightly more than manual belts. The slight increase (observed only in GM cars) probably occurs because the GM automatic belt is somewhat easier to use in a manual mode than the regular manual belt system due to the location of the belt and other features. All cars with automatic two-point belt systems have knee bolsters to limit forward motion in a crash; most also have manual lap belts, which are used less than are lap belts in cars in which manual three-point belts are provided. The extent to which lower use rates for lap belts limits the protection provided by the increased use of shoulder belts is not known. Now that cars with automatic belts

have been on the roads for several years and have accumulated substantial crash experience, it should be possible to assess the extent to which automatic belts of various types reduce injuries and change injury patterns compared with manual belts.

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## Occupational Hearing Loss in Farmers

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## Synopsis.....

*Studies have shown that there is a great deal of high-frequency sensorineural hearing loss among farmers. The studies have failed, however, to differentiate farmers who have occupational noise exposure only from other potential hearing loss etiologies.*

*This study, through extensive case history information, has isolated a farm noise-exposure group and matched its members by age with persons with no significant noise exposure. Results indicate that farmers exposed only to noise from farming have significantly poorer hearing sensitivity than persons not exposed to noise.*

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**E**XPOSURE TO EXCESSIVE NOISE from tractors, grain dryers, bush hogs, chain saws, and even radios in enclosed cabs of tractors and combines increases farmers' risk of acquiring noise-induced hearing loss (1-3). Studies have shown farmers have greater high-frequency sensorineural hearing loss than can be accounted for by presbycusis alone

(4-6). Thelin and colleagues compared the hearing screening failure rates at 2,000 and 4,000 Hertz (Hz) of farmers and nonfarmers (office workers) (5). They found farmers had significantly higher failure rates for every 10-year age group from age 25 to age 64.

Karlovich and coworkers (7) found in their