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Insulin-Using Commercial Motor Vehicle Drivers

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16. This document represents the outcome of a synthesis sponsored by the Office of Motor Carriers to review the current medical standard covering commercial drivers with diabetes mellitus. The Standard (49 C.F.R. section 391.41(b)(3)) permits qualification of individuals to drive a commercial motor vehicle if that person has no established medical history or clinical diagnosis of diabetes mellitus currently requiring insulin for control.

A literature review of accidents involving diabetic drivers was conducted along with a review of the current state laws regulating insulin-using CMV drivers. The effectiveness of current diabetes treatment was presented. A risk assessment was developed and applied to the information available concerning insulin-using drivers. Public comments submitted to the FHWA in response to the Notice of proposed Ruiemaking on the qualification of drivers with insulin-treated diabetes for CMV operation were tallied (125) and summarized. The role of a medical advisory board in individual petitions, development of regulations and the estabiishment of monitoring procedures was discussed.

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Table of Contents

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LITERATURE REVIEW

LITERATURE REVIEW

Insulin-Using Commercial Vehicle Driving

Employment opportunities for individuals with diabetes have historically been restricted because of the belief that persons with diabetes (particularly those using insulin) are at higher risk for occupational accidents. This **risk** lies in their susceptibility to hypoglycemia, visual impairments, and cardiovascular complications. As the treatment patterns for diabetes continue to improve, there is increasing pressure to eliminate these earlier restrictions. However, due in part to the previous restrictions, there is insufficient reliable information available to consider whether persons with diabetes actually are at higher risk for accidents than those without diabetes.

Currently persons with diabetes are excluded from operating commercial motor vehicles (CMVs) in interstate commerce. Previous investigations into the accident risk of CMV drivers with diabetes have been virtually non-existent; however, several case reports (Christian 1972, Stumer 1983, Cockram 1986) have shown that hypoglycemia occurring in diabetic truck drivers resulted in road accidents. Recent risk analyses suggest that authorizing insulin-using diabetic drivers to operate CMVs could increase the overall number of accidents considerably (Federal Highway Administration 1988, FHWA 1989).

Case reports reveal little about the extent to which these accidents would be likely to occur in a population of drivers. The risk analyses available have also been based upon a number of assumptions, particularly with regards to the frequency of hypoglycemia-related accidents, that may or may not turn out to be true if tested in practice. Currently there are no known data that describe the actual accident experience of diabetic drivers with regards to CMVs. For this reason, much interest has been focused upon the studies evaluating accident risk for diabetic drivers operating private automobiles.

Licensure for private automobiles has been more widely available for individuals with diabetes. As a result, data on the accident experience of these drivers can be evaluated and a number of investigators have done so. There are a series of limitations in these automobile accident studies that bias the extrapolation of data to a CMV driving population. Chief among the limitations is the real difference noted between operating an automobile and operating a CMV as an occupation. CMV operation typically involves long hours of driving, at times in irregular intervals and inclement weather conditions, physical exertion in loading and unloading the freight, economic pressures to arrive at a delivery site on schedule, and a series of unique skills necessary to manipulate a large vehicle.

The reports published on the accident experience of diabetic automobile drivers have also been influenced, to a large extent, by the definitions of accidents, source of diabetic drivers, and study designs employed. A number of different definitions of road accidents have been described in the accident literature including fatal accidents, police-reported accidents, insurance-reported accidents, tow-away accidents, and injury-producing accidents.

The collisions described with regards to diabetes have been confined primarily to police-reported, self-reported, and injury-producing accidents. It is unclear as to what extent fatal accidents were included in these studies. Because of the differences in the defintion of accidents, comparison between the studies is difficult.

Each accident definition includes special circumstances with regard to diabetes. Police-reported accidents include, as their name implies, all accidents that are reported to the police. There have been reports that many nonfatal accidents are not reported to state and local authorities (WHO 1979, Greenblatt 1981, National Center for Statistics and Analysis 1984). Individuals with diabetes may be reluctant to report accidents that may result in medical examination and/or loss of driving privileges. Self-reported accidents include, by definition, only those accidents reported by the respondents on surveys and questionnaires. Finally, injury-producing accidents, such as those taken from hospital records, include only accidents that result in injury serious enough to warrant medical attention. Persons with diabetes may be hospitalized more often than non-diabetics with similar injuries just by the presence of their disease (DeKlerk 1983).

The source(s) of the diabetes populations under study have also biased the interpretation of the results reported concerning private automobiles. Most of the earliest studies focused upon diabetics previously known to the licensing authorities. They were known, for the most part, by either voluntary admission upon license application or by police reports. There has been the suggestion that relatively few persons with diabetes are identified to the authorities by medical personnel (Waller 1965). Two reports (Frier 1980, Steel 1981) documented that 43 percent and 80 percent of the diabetics surveyed, respectively, did not disclose their diabetic condition to the licensing authorities. It was noted that individuals identified by police records were generally involved in a previous accident or moving violation. Thus, they may be more accident prone. The end result is that diabetics known to licensing authorities tend to be a rather select group and their accident experience may not reflect the true experience of a diabetic population.

Finally, the study'designs employed in the literature have, to a great extent, been quite limited. A number of reports have failed to include a comparison group to allow for the evaluation of a diabetes accident risk in relation to that of the non-diabetic population. Most have also failed to consider the role that driving exposure (mileage driven), sex distribution, and age distribution in their samples may have had on the results. It is difficult to evaluate the role of diabetes in accidents when other risk factors for accidents have not been considered.

Tables 1 and 2 depict results of the current studies available concerning diabetes and automobile accidents. While accidents in these cohorts appear to be a relatively rare phenomenon (as expected), the data conflict over the relative risks for accidents conferred to drivers with diabetes. Studies comparing the traffic accident patterns of a group of diabetic drivers to a control group of non-diabetic drivers (Table 1) have reported an increased (Waller 1965, Crancer 1968, Songer 1988), decreased (Ysander 1966, Eadington 1989), and similar (Davis 1973, DeKlerk 1983, Stevens 1989) frequency of collisions for the

Table 1

Studies Evaluating Accident and/or Violation History among Diabetic Drivers and a Comparison Group

Study	N	Time	Type of Dbx	Accidents		Violations		Units	Comments
				Dbx	Ctl	Dbx	Ctl		
Ysander, (1966)	256	4.7 yrs	Bott	5.0 %	7.7 %	6.7 %	7.6 %	%	Assessed medically restricted drivers No adjustment for driving exposure Accidents/violations based upon police-reported accidents/incidents
Waller, (1965)	257	3 years	?	15.5*	8.7	46.0	33.0	per 10^6 miles	Evaluated diabetic drivers known to licensing authorities Rates adjusted for driving exposure Police-reported accidents/incidents
Crancer, (1968)	7646	6 years	Both	31.4*	26.5	73.3	68.5	per 100 drivers	Evaluated diabetic drivers known to licensing authorities Not adjusted for driving exposure Matching of comparison group may not be exact Police-reported accidents/incidents
Ysander, (1970)	219	6 years	Both	3.7 %*	6.4 %	8.3 %	5.9 %	%	Diabetics identified from clinic No adjustment for driving exposure Only considered diabetics with unrestricted licenses Police-reported accidents
Davis, (1973)	108	1 year	?	7.4	7.1	38.0	26.4	per 100 drivers	Evaluated diabetic drivers known to licensing authorities Small sample size Not adjusted for driving exposure Police-reported accidents/incidents

Study	N	Time	Accidents			Violations		Units	Comments
			Type of Dbx	Dbx	Ctl	Dbx	Ctl		
DeKlerk, (1983)	8623	9 years	Both	72	73			hospital admissions for road trauma	Hospital-recorded accidents Does not consider driving exposure Diabetic males had more hospital admissions than expected
Songer, (1988)	127	1 year	IDDM	14.2	1.1			per 100 drivers	Self-reported accidents Small sample size for l-year time
	121	1 year	IDDM	10.4	3.9			per 100 drivers/10^6 miles	Adjusted for driving exposure
Eadington, (1989)	166	8 years	IDDM	5.4	10.0	-	-	per 10^6 miles	Self-reported accidents Control was not age or sex matched
Stevens, (1989)	354	5 years	ITDM	7.9	7.8	-	-	per 1.5 x 10^6 km	Self-reported accidents Adjusted for driving exposure
				7.1	7.1	-	-	per 100 drivers/vr	
Chantelau, (1990)	241	2 years	ITDM	-		11 %	16 %	%	Comparison not matched on age, sex or driving exposure

* Significantly different from controls
N Sample size
Dbx Diabetics
Ctl Comparison group
IDDM Insulin-dependent diabetes mellitus
ITDM Insulin-treated diabetes mellitus
Both ITDM and non-insulin treated diabetics

drivers with diabetes. Given these results and the limitations mentioned, it is not clear how the results of these studies on automobile accidents would translate to accidents while driving CMV.

The last 15 to 20 years have seen the introduction of new technology in the treatment of diabetes. The technology that impacts the most, at the level of the individual, has been the home blood glucose meters and testing strips. These materials allow an individual to monitor blood glucose levels on a daily basis and adjust insulin dosages accordingly. They also allow for the verification of hypoglycemia if symptoms suggest a decrease in blood glucose levels. There have been questions raised in the last few years over the potential impact that this equipment may have upon accidents. Examination of the studies prior to and after the introduction of this technology suggested no specific trend to reduction or increase in accidents (assuming a 1977 introduction).

Table 2

Studies Evaluating Accidents Among Diabetic Drivers
- No Comparison Group Provided -

Study	N	Time Period	Type of Diabetes	% with accident	Comments
Copplestone, 1959	28	5 years	Both	14.3	Definition of accidents is unknown Very small sample size
Pannhorst, 1961	72,008	?	Both	0.09	Police-reported accidents No assessment of driving exposure
Frier, 1980	250	?	IDDM	13.6	Self-reported accidents No measure of driving exposure Includes all accidents since starting insulin

The central issue relating to motor vehicle accidents among drivers with diabetes is the role that their disease, specifically hypoglycemia, plays in their propensity for accidents. As mentioned previously, there have been a number of case reports linking hypoglycemia to truck accidents. There are no data, however, concerning the frequency with which hypoglycemia may result in an accident while operating CMVs. For this reason, risk analyses and evaluation of hypoglycemia while driving automobiles have garnered attention with respect to the issue of licensing insulin-using diabetics to operate CMVs.

In the risk analyses conducted, the number of excess accidents estimated to be related to diabetes and hypoglycemia ranged from 228 to 5,829 in one study (FHWA 1988) and from 320 to 5,600 in another (FHWA 1989). Both estimates assumed that a certain percentage of hypoglycemic events would result in accident. This may or may not be the case in reality. Both estimates are based upon previous studies examining the frequency of hypoglycemic events in an insulin-using population. There was little information available in these reports concerning the frequency that hypoglycemia occurred while driving and the likelihood that such an event would subsequently result in accident. Secondly, it was assumed that all accidents related to hypoglycemia would be in excess of the accidents expected to occur under normal circumstances (the accident rate of the non-diabetic population). It may also be possible that diabetic drivers, concerned over their chance for hypoglycemia-related accidents, would be more careful with regards to the other risks associated with accidents in general.

A listing of the role of hypoglycemia in automobile accidents is shown in Table 3. Additionally, there has been a number of case reports linking hypoglycemic events to road accidents (Leyshon 1972, Haunz 1984, and Lashe 1985, among others). Further reports have noted that the frequency of hypoglycemia-related accidents is minimal with respect to the occurrence of all accidents. Herner (1966) has mentioned that of 44,000 accident reports to the police in one area of Sweden, only 41 were caused by sudden illness. Three were due to hypoglycemia. Grattan (1968) found only 15 accidents due to sudden illness out of 9,390 accidents reported to the police in one county of England. Only one was related to hypoglycemia.

These studies suggest that the likelihood of hypoglycemia leading to an accident is quite small; on the order of 1 in 10,000. Potential biases, including the reluctance to report accidents due to hypoglycemia and a low prevalence of diabetes in the areas studies, affect this estimate. Another study cited by Frier (1980) found that out of 1,000 medical collapses leading to an accident, 17 percent were due to hypoglycemia. No figure for the total number of accidents in the areas was given.

The results of thestudies listed in Table 3 are widely divergent. Four reports have noted that hypoglycemia occurred while individuals were driving. The number of individuals reporting such an event ranged from 5 percent in one study (Haunz 1984) to 20 percent (Eadington 1989), 29 percent (Stevens 1989) and 40 percent (Clarke 1980) in other studies. Estimates for the frequency of this occurrence were not available because none of the reports considered the role of mileage driven in their findings. Some also did not include the period of time over which these events were surveyed.

Hypoglycemia-related accidents were recorded in four surveys. Frier, in 1980, noted that 5 percent of the survey sample reported an accident due to hypoglycemia since they began insulin therapy for diabetes. There was no presentation of the reference period involved since the onset of insulin therapy and the driving exposure of this group. Similarly, Stevens reported that 3.3 percent of the diabetics sampled had been in a hypoglycemia-related accident in their lifetime. Eadington found that 16 percent of all reported accidents among a group of IDDM drivers over an 8-year period were due to hypoglycemia. The majority iccured among males. Finally, in a recent study, Chantelau (1990) suggests that the annual incidence of hypoglycemia-related accident is auoroximatelv 3 oer 100 diabetic **driven.**

Table 3

Studies Evaluating Hypoglycemia and Driving among Persons with Diabetes

Study	N	Time Period	Type of Diabetes	Comments
Copplestone (1959)	28	5 years	Both	None of the accidents in this cohort was due to hypoglycemia Very small sample size
Ysander (1970)	219	6 years	Both	No accidents related to diabetes were observed in this group A highly selected group of "non-restricted" drivers
Clarke (1980)	157	?	IDDM	40% reported hypoglycemia while driving No report given of related accidents No adjustment for driving exposure Hypoglycemia defined by patients' symptoms
Frier (1980)	250	?	IDDM	5% were in accidents due to hypoglycemia since starting insulin No adjustment for driving exposure No description of the severity of hypoglycemia resulting in accident
Steel (1981)	120	?	NIDDM	No one was on insulin when surveyed No admitted accidents due to diabetes
Haunz (1984)	85	?	IDDM	5% reported a nonwarning insulin reaction while driving or operating machines No report given of related accidents No adjustment for driving exposure Not population-based
Eadington (1989)	166	8 years	IDDM	20% admitted to episodes of hypoglycemia while driving. Most occurred among males Nine accidents among 7 males due to hypoglycemia (16% of all reported accidents) Males drove more than females
Stevens (1989)	354	5 years	ITDM	29% recognized hypoglycemia while driving in the last year. These patients were more likely to report an accident over 5 years. 3.3% said that hypoglycemia had caused an accident in their lifetime
Chantelau (1990)	241	2 years	IDDM	Sixteen of 27 accidents were thought to be due to hypoglycemia (10 definite) Annual incidence of hypoglycemia-related crash = 3/100 drivers

So what does this all reveal about the potential role of hypoglycemia in CMV accidents? Again, relatively little, other than the possibility of more accidents related to hypoglycemia. Stress, exercise, and irregular hours have all been considered as part of the job in operating CMVs. Each has been suggested to be related to hypoglycemia in one way or another. It is unlikely that these three characteristics are very similar with respect to operating CMVs and private automobiles.

An in-depth description of the diabetes and driving literature follows.

Couulestone

Copplestone examined the accident history of 28 individuals with diabetes over a 5-year time period. These individuals were part of a larger study examining the employment characteristics of a diabetes cohort. Eighteen were being treated with insulin. Over five years, only five of the individuals were involved in accidents, one as a pedestrian. None was related to hypoglycemia. The sample size in this study was sufficiently small enough to render the results inconclusive, since accidents, in general, are relatively rare events. The population was also a rather select group of working individuals.

Ysander 1966

Ysander examined the accident history of individuals with a number of different medical conditions. Two hundred fifty-six individuals with diabetes were identified from the licensing bureau of the Goteberg area. All were granted licenses on special conditions and were identified either at the time of application or through police reports. Accidents were defined as all events resulting in damage and reported to the police. About 5 percent of the diabetes cohort was involved in an accident over an average follow-up of 4.7 years. This figure was lower than that found among a group of non-diabetic control drivers matched on age, sex, driving experience, and having similar driving exposures and conditions of driving (night/day, urban/rural).

Ysander 1970

In a similar study, Ysander examined the accident history of 219 diabetic individuals who had no restrictions on their licenses. These individuals were identified from a diabetes outpatient clinic based in a hospital and represented a selected group of diabetic subjects to study. Almost all were NIDDM patients (48 percent were on insulin) and the majority were over 50 years of age. Not surprisingly, their accident experience was relatively low. Only 3.7 percent had been involved in an accident over a reference period on averaging 6 years. This percentage was lower than that found in a control group of non-diabetic drivers (6.4 percent had an accident). The controls were followed over shorter periods of time and drove less miles than the diabetics. Note was also made of a number of individuals with diabetes who voluntarily abstained from driving when their medical condition was quite poor. Accidents in this study were followed through a licensing bureau's records.

Waller

In a very advanced study for its time, Waller examined the frequency of accidents and moving vehicle violations in a group of individuals identified to the California licensing authorities by their medical conditions. This was the first report to consider the role of mileage driven as a possible confounder in the accident rates reported. There were 257

diabetic individuals in the study who had mileage information available for study. Accidents were defined as those that came to the attention of the licensing agency, often through police reports. The accident rate of the diabetic cohort was nearly two times higher (15.5/1,000,000 miles) than that observed among a group of age, sex, and driving exposure matched controls. This difference was statistically significant. Violation rates were also higher. Both accidents and violations were assessed over a 3-year period. One potential reason the accident rate might have been higher among the diabetics was that 35 percent had been identified to the licensing authority by previous accidents or violations. The number of individuals taking insulin was not given.

Crancer

With another controlled study, Crancer evaluated the rate of accidents among 7,646 diabetic individuals known to the Washington licensing agency and a control group using the experience of all Washington drivers. Drivers with diabetes were identified by either self-report, police-report, relative-report, or on questioning by license authorities. The accident rate per 100 drivers was significantly higher for those with diabetes (31.5/100 drivers vs. 26.5/100 drivers for the rest of the state). The control group utilized in this study was not nearly as well matched on potential confounders as in Waller's study. First, there was no measure of driving exposure used in the report. Second, the age and sex distributions of the control drivers may have been markedly different from that in the diabetic drivers. It was impossible to tell from the information provided. Accidents considered in this report were those known to the licensing agency and were monitored over a 6-year period of time. The number of diabetics using insulin was not provided.

Davis

Davis evaluated the driving records of 108 diabetic individuals who were granted a license through the Oklahoma medical board. Controls were provided, matched on age and sex, to examine the difference in accident risk between the two groups. Accidents included those known to the licensing agency over a one-year period of time. A total of eight accidents were observed among the diabetic drivers. This translated into an accident rate of 7.4 per 100 drivers and was very similar to the 7.1 per 100 drivers seen among the controls. No measure of driving exposure was collected in this study. Most of the sample surveyed was brought to the attention of the agency by driver's license examiners. However, some were also identified by police reports. Davis noted a general problem in comparing rates between states because of differences in the definition of medical categories used between the states.

Clarke

Clarke surveyed 157 patients with IDDM identified at random from outpatient clinics. A questionnaire concerning hypoglycemia and driving was distributed. Forty-nine percent of the males reported experiencing hypoglycemia while driving, compared to 19 percent of the females. Overall, 40 percent had such an event. Hypoglycemia was defined by the presence of symptoms in the patient. The frequency with which hypoglycemia occurred while driving, driving exposure, and the number of accidents related to hypoglycemia were not queried. Fifty percent reported that they did not keep a carbohydrate source in their car in case of emergency.

Frier

Frier surveyed 250 patients with IDDM who were attending a diabetes clinic. This survey was particularly concerned with revelation of diabetes to licensing authorities, severe hypoglycemia, and the role of automobile insurance in diabetes. Overall, 43 percent of the patients did not declare diabetes to the licensing agency; 70 percent of them knowingly. Nearly 34 percent had at least one severe hypoglycemic reaction in the preceding 6 months. Severe reactions were defined as one or more episodes of coma, reactions treated by a family member or relative, or more than two episodes of moderate hypoglycemia. Mild events were not recorded. The frequency of severe reactions did not differ by sex. With regards to accidents, 14 percent gave mention of an accident since the initiation of insulin therapy, although no timeframe was given to evaluate this figure against. Thirteen of the 34 respondents with accidents stated that hypoglycemia was a major reason for the accident.

Eadington

In an eight-year follow-up of the Frier cohort, Eadington found that a number had died 0 moved away. Another survey of accidents and hypoglycemia was undertaken among those who remained. Overall, 89 percent responded to the questionnaire providing 166 surveys to analyze. Twenty-four patients were no longer driving. The majority have stopped voluntarily rather than having their license revoked. Thirty-four (25 male, 9 female) admitted to having one or more episodes of hypoglycemia while driving in the previous eight years. The episodes were mild and self-treated for 23 cases and of moderate severity requiring outside help in seven cases. Four men declined to describe the details of their reactions. With regards to accidents (self-reported), 39 persons (29 male, 10 female) admitted to 55 accidents. Nine accidents among the males were related to hypoglycemia. None were among the females. The overall accident rate of this cohort over 8 years was 5.4 per million miles driven. This was lower than a control figure provided of 10 per million miles driven. The controls, however, were not matched on age or sex.

Steel

This report strictly evaluated those individuals with diabetes who were not using insulin. By definition all were Type II diabetics. A total of 120 individuals were surveyed with regards to license declaration and hypoglycemia. They were selected at random from an unidentified source. Eighty percent did not declare their diabetes to a licensing agency. Some mild hypoglycemia was associated with sulfonylurea drugs; none while driving.

DeKlerk

In a different study, DeKlerk evaluated admissions to hospital for road trauma with respect to diabetes. These accidents were not evaluated. Overall, no difference was found between the observed admission rates for trauma among diabetic patients and that expected, when the admission rates of the general population were considered. A higher number of admissions was found in men aged 15 to 54. This study only considered those crashes that led to hospital admission. Patients with diabetes who did not have diabetes listed on the hospital record were not included in this study. No driving exposure data were available to evaluate these rates against; nor were driving conditions and type of vehicle considered.

Haunz

This report described a series of case reports linking non-warning hypoglycemia to road accidents. Eighty-five patients were questioned on the occurrence of hypoglycemia while driving. Five percent responded positively to this question, but no information was provided by the authors to assess the relationship of hypoglycemia to accidents. Mention was made of the different thresholds to hypoglycemia that were present by individual.

Songer

This study evaluated the motor vehicle accident experience of 158 persons with IDDM identified from a IDDM registry. Siblings matched by age and sex were used as controls in the evaluation of accident risk. Overall, IDDM persons had more accidents and a higher accident rate than their siblings when adjusted for driving exposure. The difference in accident risk was not statistically significant. An excess of accidents was particularly noticed among female drivers with diabetes. Accidents were self-reported in this study and considered over a one-year period of time. The sample sixes available for study were not very large for a study of this time length.

Stevens

Stevens identified 354 individuals using insulin from a diabetes clinic and assessed their accident experience over five years. All accidents were self-reported. A control group of 302 individuals matched on age and sex was available for comparison. Driving exposure was also assessed. Overall, there appeared to be no difference in the accident rates of the diabetic and non-diabetic cohorts, whether adjusted for mileage driven or not. Twenty-nine percent of the diabetics recognized hypoglycemia while driving in the previous year. About 3.3 percent reported that hypoglycemia had caused an accident in their lifetime. Alcohol consumption was also assessed and found to be much higher among the controls, prompting stevens to write "The reason that hypoglycemia was not translated into an increased overall accident risk may be that diabetics, being aware of the risk, are more careful drivers."

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STATE OF PRACTICE IN DIABETES MONITORING

STATE OF PRACTICE IN DIABETES MONITORING

Task B involved estimating the number of CMV insulin-using drivers; examined and described the policies/practices of individual states, and other countries. Subtask 1 was to identify those states currently allowing insulin-using diabetics to drive CMV and determine:

1. How many and which groups of insulin-using diabetics are allowed to drive? How are they qualified and by whom? What are the relevant regulations?

2. The processes/approvals needed, before a diabetic driver is allowed to drive,

3. How these states monitor the performance of diabetic drivers..

4. Are diabetic drivers in these states required to comply with special licensing procedures, specific operational or vehicle conditions, such as installation of specialized medical equipment in their vehicles to monitor their condition?

5. The type of administrative and medical mechanisms (e.g., medical review boards) used to manage/enforce the program.

In order to complete this task a list of questions was developed with the help of members of the Federal Highway Administration. A copy of these questions is included in the appendix.

Information has been obtained from 48 states, the District of Columbia and Puerto Rico. This represents 95 percent of the U.S. population, based on the 1988 estimated population. Figure 1 presents an overview of the U.S. requirements. Of special interest was the fact that across the U.S. insulin-using individuals are eligible to drive in 41 of the states surveyed, of which 15 had no special requirements at all. Only nine states outright refused CMV driving privileges to insulin users. Overall, in 67 percent of the population insulin-using individuals already can drive CMVs.

Information on the number of insulin-using drivers in each state was very limited. Almost none of the states were able to approximate the total number of insulin-using CMV drivers. However, three states had statistics on the number of insulin-using individuals who obtained medical waivers since changes in the state laws. The numbers were extremely small. The states were New Hampshire, Delaware and Michigan with 1, <5, and 12, respectively. These statistics indicated that although permitted to drive, only a small number had obtained waivers. Twenty percent of the states maintained medical forms for anyone seeking a waiver but did not distinguish them in such a manner that could be identified by medical condition (Table 1).

Figure 1
Current State Laws

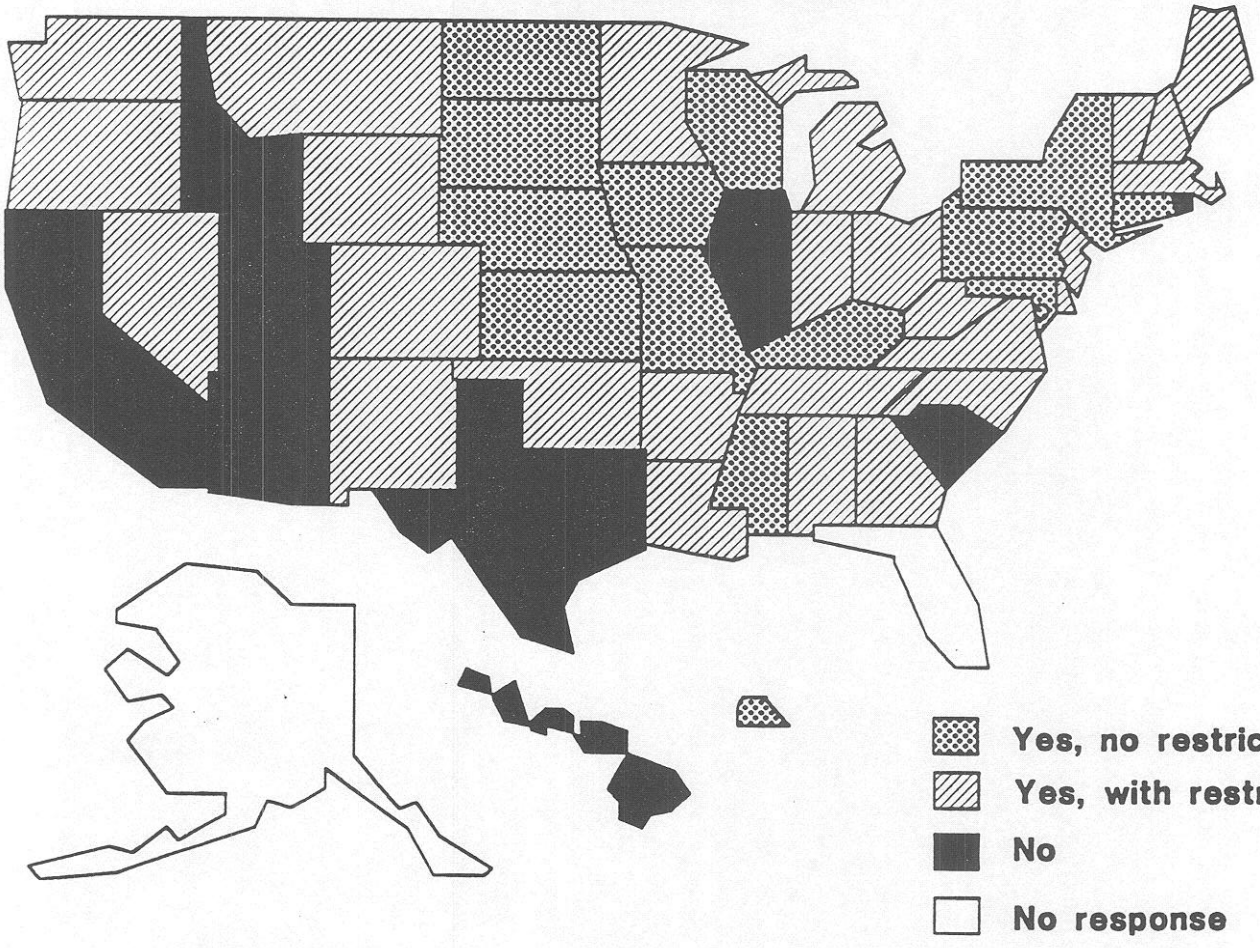

Table 1

Number of States Having Information on Licensed CMV Drivers with Diabetes

	Yes	No	N/A
Medical Information	10 (20%)	31 (62%)	9 (18%)
Accident Information	2 (4%)	39 (78%)	9 (18%)

The special requirements demanded by the 26 states were all medical requirements. The medical criteria varied from an individual's doctor submitting a letter stating that there was no reason for the person to be denied a license, to a medical review board assessing the applicant's medical records. Eleven of the states indicated that they employ the DOT physical form. Under these criteria a person is not qualified for CMV operation if they are using insulin to control their diabetes. However, there is considerable variability across states as to what is required once an individual fails the DOT physical. There is also a considerable variability in the frequency between medical exams (Table 2).

Table 2

Medical Examinations and Licensing for Insulin-Using Drivers

	Yes	No	N/A, Don't Know, No Response
Medical Exam	31 (62%)	8 (16%)	11 (22%)
Every Year	7		
Every 2 years	8		
>Every 2 Years	1		
Varies by Individual	8		
Not Stated	7		

None of the states requires that insulin-using drivers return to the starting work location at the end of each work day (Table 3) as proposed in the FHWA guidelines. Also, only two states, Michigan and New Hampshire, require maintaining blood glucose logs. Thus, blood glucose monitoring among licensed drivers is not a widely applied requirement, in contrast to that proposed by the FHWA.

Table 3

Work Restrictions Placed on Insulin-Using Drivers

	Yes	No	Don't Know, No Response	Doesn't Apply
Limited Work Hours	2 (4%)	33 (66%)	6 (12%)	9 (18%)
No Shift Work	0	36 (72%)	5 (10%)	9 (18%)
Must Return to Starting Location by Day's End	0	35 (70%)	6 (12%)	9 (18%)
Lower Retirement Age	0	32 (64%)	9 (18%)	9 (18%)

In all nine states where an insulin-using license applicant is denied a CMV license, an existing driver's license is revoked when they begin to use insulin (Table 4).

Table 4

License Status when an Existing Driver Develops Diabetes

Treatment for Diabetes	Lose License	Restrictions and/or Medical Requirements	No Change	Don't Know, No Response
Begin Insulin	9 (18%)	26 (52%)	14 (28%)	1 (2%)
Begin Oral Medication	0	22 (44%)	25 (50%)	3 (6%)
Begin Dietary Restrictions	0	14 (28%)	35 (70%)	1 (2%)