In summary, information has been obtained on 48 states, the District of Columbia and Puerto Rico, representing 95 percent of the U.S. population. One is struck by three things. The first is that in more than 67 percent of the population, allowing insuling-using individuals to drive CMVs is a "non-issue" in that they are already permitted to drive. The second is the incredible variability in regulations ranging from no regulations at all to complete denial of licensing. The third point is that based upon the new guidelines, there likely will be few "new" CMV drivers who are using insulin as 67 percent already live in states where they can drive intrastate. Moreover, if regulations are'changed to permit people using insulin to drive, only a small number take this opportunity. This was verified in New Hampshire, Delaware and Michigan where fewer than 20 individuals obtained permission to drive CMVs after the laws changed in those states.

The goals of Subtask 2 were to identify countries that allow insulin-using diabetics to drive and to 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 the performance of diabetic drivers are monitored.

4. If special licensing procedures, specific operations or vehicle conditions, such as installation of specialized medical equipment in their vehicles to monitor their condition, are required.

5. The type of administrative and medical mechanism(s) used to manage and/or enforce the program.

In collaboration with members of the FHWA a second set of questions was developed for this information. A copy of these questions is included in the Appendix. Sixteen countries and Quebec, Canada returned information on their CMV licensing practices with regards to insulin using-drivers. Six countries do not allow an insulin-treated person to hold a CMV license, five countries do if special requirements are met, and five countries allow licensing with no special requirements (Table 5). Quebec, Canada is currently changing its licensing practices. At the present time a non-insulin-deuendent, insulin-using individual is allowed to obtain a CMV license under certain criteria. Insulin-deuendent individuals are not permitted to acquire a CMV license. However, it is difficult to distinguish between these two conditions and some insulin-dependent individuals have been able to obtain licenses. The Canadian laws will soon be changed to allow both types (IDDM and NIDDM) of insulin-users to become licensed. A more in-depth description of the Quebec experience is provided in the appendix.

None of these countries has been able to approximate the number of insulin-using Cmv drivers in their country. There is no additional information kept in these countries as to the medical or accident record of their insulin-using CMV drivers.

Table 5

CMV Licensing of Insulin-Using Individuals in Foreign Countries

Yes	Yes, if special requirements are met	No
Argentina Brazil Japan Tanzania Thailand	Australia Austria New Zealand United Kingdom Chile	Czechoslovakia Greece Italy Mexico Poland Sweden

The special requirements in the five countries vary greatly from those in the U.S. In Austria, the law states that a person with a severe disease is unable to safely drive a car and should not be allowed to drive any type of motor vehicle. The law does not clearly state which diseases are included as a reason for rejection. Therefore, the final decision is made by the local public health officer who may or may not be well informed about diabetes. In most cases, when a CMV license is granted in Austria, the only requirement consists of a time limit being placed on the license. New Zealand's special requirement is a letter from any registered medical practitioner stating that the illness is not sufficiently severe to prevent licensing. The United Kingdom indicated that it recommends no insulin-using individual be granted a CMV license; however, some determined individuals were able to acquire a license by legal means. In April 1991, the ability to acquire a CMV license will change. No new insulin-using applicants will be licensed and those using insulin who hold a license will have their license revoked.

There is variability in what occurs when a person's medical status changes (Table 6). Some countries indicated that it was mostly at a doctor's discretion as to whether persons could maintain their CMV license once they began using insulin. As in the United States, there is a difference in the frequency of physical exams, with one country indicating that only one exam is ever needed (Table 7). None of the countries that permit insulin-using individuals to drive CMVs require maintaining blood glucose logs or returning to their normal work reporting location at the end of each work day (Table 8). This is fairly consistent with what was found in the U.S.

Overall, as with that seen in the U.S., there is considerable cross-country variability in the licensing of individuals who require insulin. There did not appear to be an overall discernable pattern. For example, in Europe, some countries permit licensing where others refuse licensing. It is disappointing that no country could be identified where it would be possible to readily evaluate data concerning insulin use and accident risk.

Quebec, Canada appears to be an appropriate model as it is approximately five years ahead of the U.S. and will shortly have retrospective and prospective data. It is likely that the U.S. should pay considerable attention to the developments in Quebec, as much can be learned from its experiences.

Table 6

License Status When An Existing Driver Develops Diabetes (Foreign Countries)

Treatment for Diabetes	Lose License	Restrictions and/or Medical Requirements	No Change	No Response
Begin Insulin	4 (25%)	6*,** (38%)	4 (25%)	2 (13%)
Begin Oral Medication		7* (44%)	6 (38%)	3 (19%)
Begin Dietary Restrictions		4 (25%)	9 (56%)	3 (19%)

* Nothing is done if the driver doesn't report a change in medical status. If driver does report, there is a time limit placed on the license (Austria)

** On April 1, 1991 all CMV drivers who develop diabetes and use insulin will have their license revoked (United Kingdom)

Table 7

Medical Examinations and Licensing for Insulin-Using Drivers (Foreign Countries)

	Yes	No	Doesn't Apply
Medical Exam	6 (38%)	4 (25%)	6 (38%)
Every Year	3		
>Every 2 Years	2		
Varies by Individual	1*		

* New Zealand only required one medical exam at the time of application.

Table 8

Work Restrictions Placed on Insulin-Using Drivers (Foreign Countries)

	Yes	No	Don't Know, No Response	Doesn't Apply
Limited Work Hours	0	10 (63%)		6 (36%)
No Shift Work	0	9 (56%)	1 (6%)	6 (36%)
Must Return to Starting Location by Day's End	0	8 (50%)	2 (13%)	6 (36%)
Lower Retirement Age	0	10 (63%)		6 (36%)

APPENDIX

_____
Name of Respondent

_____
Telephone Number

Commercial Motor Vehicle Driving and Insulin-Using Diabetes

These questions evaluate the operation Commercial Motor Vehicles (CMVs) (heavy goods vehicles, trucks (lorries) over 10,000 lbs.) by drivers using insulin for the treatment of their diabetes.

1. What agency/institute is in control of licensing commercial motor vehicles in your state?

_____

_____

_____

2. **Are persons using insulin for the treatment of diabetes in your state currently allowed to hold a license to operate large** trucks?

_____ Yes Yes, **if special requirements are met** _____ **No**

(a) **If yes, about how many insulin-using truck drivers have been licensed in your state?**

_____ _____ **unknown**

(b) **Do you have information on the licensed CMV drivers who have diabetes?**

_____**Yes** _____**No**

If yes, what information is maintained?

_____

_____

_____

3. Are persons using insulin for the treatment of diabetes in your state currently allowed to hold a license to operate a:

(a) Public bus _____Yes _____Yes, if special requirements are met _____No

(b) Taxi _____Yes _____Yes, if special requirements are met No

Special Requirements:

_____

_____

_____

_____

4. If a licensed CMV driver develops diabetes, what happens to their driving privileges for individuals who:

(a) Begin taking insulin_____

_____

(b) Begin taking oral medication_____

_____

(c) Begin dietary restrictions only_____

_____

If insulin-using individuals are allowed to drive CMVs in your state, are the current requirements different than for individuals who do not have diabetes?

_____ Yes _____ No

Please indicate the current requirements for licensing of insulin-using individuals in your state

5. Undergo a complete medical exam _____ Yes _____ NO

If yes, how frequently? _____

If yes, does this exam include:	Yes	NO	Don't Know
Pasting blood/glucose	_____	_____	_____
Chest X-ray	_____	_____	_____
Urinalysis	_____	_____	_____
Glycosylated Hemoglobin (HbA,)	_____	_____	_____
If yes, how frequently?	_____		
Retinopathy exam	_____	_____	_____
If yes, how frequently?	_____		
Peripheral neuropathy	_____	_____	_____
Circulatory deficiencies of extremities		_____	_____
Medications or drugs used	_____		
Maximal exercise stress test (over 40 years of age)	_____	_____	_____
Recording of insulin dosages and types	_____	_____	
Recording of diet	_____	_____	_____
Assessment of smoking habits	_____	_____	_____
Assessment of alcohol drinking habits	_____	_____	_____
Assessment of hypoglycemic attacks	_____	_____	_____

If individuals are permitted to drive, are they required to:

6. Maintain a log of blood glucose monitoring? _____ Yes _____ No

If yes, how frequent are the blood tests? _____

How long are the logs kept? _____

7. Maintain a record of accident and/or violations? _____ Yes _____ No _____ Don't Know

8. Are there any special restrictions/rules for insulin-using drivers as to:

(a) Number of working hours _____ Yes _____ No _____ Don't Know

If yes, what are the restrictions?

_____

_____

(b) Shift work _____ Yes _____ No _____ Don't Know

If yes, what are the restrictions?

_____

_____

(c) Return to their normal work reporting location at the end of each work day? _____ Yes _____ No _____ Don't Know

(d) Driving test _____ Yes _____ No _____ Don't Know

If yes, how is it different?

_____

_____

_____

9. Is there a lowered retirement age for insulin-using diabetics?

Yes NO Don't Know

10. Are there any differences in requirements for insulin-using CMV drivers according to age or gender?

Yes NO Don't Know

If yes, please specify:

_____

_____

_____

11. Are the insurance rules/requirements for a CMV driver using insulin different from those rules/requirements applied to persons not using insulin in your state?

Specifically, with regard to:

(a) Motorist insurance

Yes NO Don't Know

(b) Life insurance

Yes No Don't Know

(c) Health insurance

Yes No Don't Know

If yes, in what way is insurance different? _____

_____

_____

_____

12. Will there be a change in any of these regulations in your state in the near future?

Yes	No	Don't Know

If yes, when _____

_____

If yes, will these laws affect presently licensed insulin-using CMV drivers?

Yes	No	Don't Know

13. Are there any other driving restrictions?

Yes	No	Don't Know

If yes, what are they?

_____

_____

_____

_____

_____

14. Is there any additional information that you would like to present concerning CMV licensing of people who have diabetes?

_____

_____

_____

_____

_____

_____
Name of Respondent

_____
Name of Country

_____
Telephone Number

Commercial Motor Vehicle Driving and Insulin-Using Diabetes

These questions evaluate the operation Commercial Motor Vehicles (CMVs) (heavy goods vehicles, trucks (lorries) over 10,000 lbs.) by drivers using insulin for the treatment of their diabetes.

1. What agency/institute is in control of licensing commercial motor vehicles in your country?

_____

_____

_____

2. Are persons using insulin for the treatment of diabetes in your country currently allowed to hold a license to operate large trucks?

_____ Yes _____ Yes, if special requirements are met _____ No

(a) If yes, about how many insulin-using truck drivers have been licensed in your country?

_____ _____ unknown

(b) Do you have information on the licensed CMV drivers who have diabetes?

_____Yes _____No

If yes, what information is maintained?

_____

_____

_____

3. Are persons using insulin for the treatment of diabetes in your country currently allowed to hold a license to operate a:

(a) Public bus _____Yes _____Yes, if special requirements are met _____No

(b) Taxi _____Yes _____Yes, if special requirements are met _____No

Special Requirements:

_____

_____

_____

_____

4. If a licensed CMV driver develops diabetes, what happens to their driving privileges for individuals who:

(a) Begin taking insulin_____

_____

(b) Begin taking oral medication_____

_____

(c) Begin dietary restrictions only_____

_____

If insulin-using individuals are allowed to drive CMVs in your country, are the current requirements different than for individuals who do not have diabetes?

_____ Yes _____ No

Please indicate the current requirements for licensing of insulin-using individuals in your country.

5. Undergo a complete medical exam _____ Yes _____ No

If yes, how frequently? _____

If yes, does this exam include	Yes	No	Don't Know
Fasting blood/glucose	_____	_____	_____
Chest X-ray	_____	_____	_____
Urinalysis	_____	_____	_____
Glycosylated Hemoglobin (HbA_1)	_____	_____	_____
If yes, how frequently?	_____		
Retinopathy exam	_____	_____	_____
If yes, how frequently?	_____		
Peripheral neuropathy	_____	_____	_____
Circulatory deficiencies of extremities	_____	_____	_____
Medications or drugs used	_____	_____	_____
Maximal exercise stress test (over 40 years of age)	_____	_____	_____
Recording of insulin dosages and types	_____	_____	_____
Recording of diet	_____	_____	_____
Assessment of smoking habits	_____	_____	_____
Assessment of alcohol drinking habits	_____	_____	_____
Assessment of hypoglycemic attacks	_____	_____	_____

If individuals are permitted to drive, are they required to:

6. Maintain a log of blood glucose monitoring? _____ Yes _____ No

   If yes, how frequent are the blood tests? _____

   How long are the logs kept? _____

7. Maintain a record of accident and/or violations?

   _____ Yes _____ No _____ Don't Know

8. Are there any special restrictions/rules for insulin-using drivers as to:

   (a) Number of working hours

   _____ Yes _____ No _____ Don't Know

   If yes, what are the restrictions?

   _____

   _____

   (b) Shift work

   _____ Yes _____ No _____ Don't Know

   If yes, what are the restrictions?

   _____

   _____

   (c) Return to their normal work reporting location at the end of each work day?

   _____ Yes _____ No _____ Don't Know

   (d) Driving test

   _____ Yes _____ No _____ Don't Know

   If yes, how is it different?

   _____

   _____

   _____

9. Is there a lowered retirement age for insulin-using diabetics?

Yes ____ No ____ Don't Know ____

10. Are there any differences in requirements for insulin-using CMV drivers according to age or gender?

Yes ____ No ____ Don't Know ____

If yes, please specify:

_____

_____

_____

1. Are the insurance rules/requirements for a CMV driver using insulin different from those rules/requirements applied to persons not using insulin in your country?

Specifically, with regard to:

(a) Motorist insurance

Yes ____ No ____ Don't Know ____

(b) Life insurance

Yes ____ No ____ Don't Know ____

(c) Health insurance

Yes ____ No ____ Don't Know ____

If yes, in what way is insurance different? _____

_____

_____

_____

12. Will there be a change in any of these regulations in your country in the near future?

Yes	No	Don't Know
_____	_____	_____

If yes, when _____

_____

If yes, will these laws affect presently licensed insulin-using CMV drivers?

Yes	No	Don't Know
_____	_____	_____

13. Are there any other driving restrictions?

Yes	No	Don't Know
_____	_____	_____

If yes, what are they?

_____

_____

_____

_____

_____

14. Is there any additional information that you would like to present concerning CMV licensing of people who have diabetes?

_____

_____

_____

_____

_____

7. What types of jobs are automatically denied to someone using insulin for the treatment of diabetes in your country?

	Yes	NO
Airline Pilot?		
Airline Steward/Stewardess?		
Military Service?		
Police?		
Fire Protection?		
Train Operator/Engineer?		
Work on Heavy Machinery?		
Others?		

(a) Does this vary by region or state within your country?

_____ Yes If yes, for which jobs? _____

_____ No _____

(b) Are persons with diabetes who use insulin able to operate airplanes as private pilots in your country?

_____ Yes _____ No

(c) Do persons with diabetes who are denied acceptance into military service typically face further employment difficulties because of their lack of service?

Y e s _____ No _____ Does Not Apply

(d) Do persons with diabetes who are denied acceptance into military service typically face other difficulties with their lifestyle because of their lack of service?

_____ Yes NO _____ Does Not Apply

If yes, in what way? _____

_____

_____

_____

COMMERCIAL VEHICLES DRIVING AND DIABETES MELLITUS IN QUEBEC, CANADA

by: Jean-Marie Ekoe

In the province of Quebec in Canada, driver. licensing is regulated by the Societe de l'Assurance Automobile du Quebec (SAAQ), formerly Regie de l'Assurance Automobile du Quebec (RAAQ). There is no other official or private company responsible for administrating the driving permits (licenses). The SAAQ, as in many other countries, pays special attention to drivers who may potentially increase the risk of traffic accidents. Among these people are drivers suffering from some chronic medical conditions representing a certain risk which remains to be quantified. Diabetes mellitus is one of these medical conditions that has been targeted by the SAAQ. Since 1981, special regulations pertaining to diabetes mellitus have been set forth.

In 1981, SAAQ specified that insulin-treated diabetics could not obtain a driving license for buses, minibuses, and commercial motor vehicles (CMVs). especially trucks with or without a trailer.

In 1984, SAAQ produced a new medical and optometric guide that introduced more flexibility for the issuance of licenses for diseases other than diabetes mellitus which was untouched by these new regulations. Since medical guidelines defining the ability for driving are based on empirical knowledge, clinical judgement and a higher hypothetical accident risk which is associated with medical conditions, driving restrictions were constantly questioned and challenged. Therefore, SAAQ decided to ease the norms in 1987 (the decree 864-87 of June 3, 1987). The new norms considered diabetes mellitus as relativvely incompatible with motor ***vehicle*** driving. ***Isulin-dependent diabetes mellitus (type*** 1) was still considered as ***absolutely incompatible*** with driving a bus, minibus or an emergency vehicle. However, since 1987, insulin-treated diabetics can apply for a CMV driving license but not insulin-dependent diabetics. This discrimination between the two groups was strongly criticized by the public and the physicians as well as those who were directly concerned, the diabetics. Before taking further steps, the SAAQ felt that it was time to evaluate the real impact of diabetes on traffic safety and allocated important research funds for this purpose. The funds were given to the Fonds de la Recherche sur la Sante au Quebec (FRSQ) which is roughly equivalent to HIH at the provincial level. We applied for this research and got a 4-year grant of more than half a million (Canadian) dollars. Our study is designed to investigate the relationship between the level of accidents and offenses and the health conditions of certain categories of drivers. The real risk should be distinguished from the theoretical ones. We also intend to create a methodological model for a standardized monitoring of traffic safety and medical conditions. Diabetes mellitus, hypertension, coronary heart disease, and certain visual problems are the first four conditions that are currently being studied.

The study started in 1989. More than 20,000 subjects (with the four previously mentioned medical conditions and controls included) have been identified using SAAQ data. This study has been made possible thanks to the Canadian medical system and the driver monitoring system of the SAAQ. The medical system in Canada is largely socialized.

Doctors are paid by one single institution through a computerized channel. Any patient seeking medical care will therefore be easily traced, thanks to the Regie de l'Assurace Maladie du Quebec (RAMQ), which registers all patients, physicians and all medical services in the province.

Drivers with specific medical conditions are closely followed by the SAAQ. As far as diabetes mellitus is concerned, insulin-treated diabetics are now permitted to hold a license to operate CMVs provided they fulfill the following conditions:

1. Complete medical examination before obtaining a license. This examination is usually performed by a specialist (endocrinologist) according to a standardized scheme. If performed by a general practitioner (GP), the GP is asked by the SAAQ if he feels that another specialized physician has to be consulted. The SAAQ, through its medical board (composed of two permanent physicians: cardiologist and ophthalmologist, plus two others called upon when needed), has the right to impose a specific medical examination and does this very often for diabetics taking insulin. A complete assessment of the cardiovascular, neurologic, and ophthalmologic systems is asked on an annual basis. Complete eye examinations are also required.

2. Glycosylated hemoglobin (HbA) every three months. This is not yet compulsory; may be required in the future by SAAQ in the evaluation of diabetes metabolic control.

3. A large truck driver who develops diabetes requiring insulin could not keep his license prior to 1987. Since 1987, this is possible.

In conclusion, the SAAQ has eased the norms for insulin-treated diabetics for CMVs. However, only 67 insulin-treated diabetics have applied for, and obtained, a CMV driving license. In terms of risk, this number is small. The medical board of SAAQ, which takes care of over 40,000 files of “declaration of sickness” every year and more than 70,000 medical reports, wants to evaluate the regulations it has to follow and actions it has to take regarding the different drivers groups. This can only be performed thanks to a scientific epidemiologic approach. The medical board has now opened the door to epidemiologists and other clinicians for the two main following purposes:

1. Stringent assessment of the risk associated with diabetic driving thanks to a continuous monitoring of violation and accident rates.

2. Excellent decision making, if any, based on sound and solid scientific epidemiologic evidence.

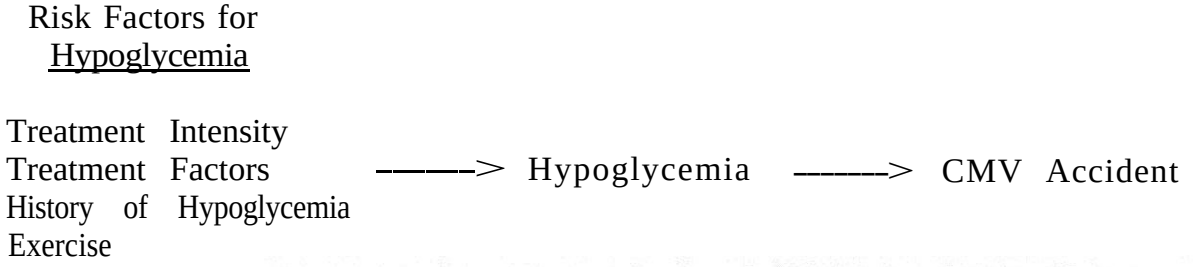
EFFECTIVENESS OF DIABETES TREATMENT

RISK FACTORS, BLOOD GLUCOSE CONTROL AND HYPOGLYCEMIA

In order to address the issue related to medical practices and technology for reducing the risk of accidents for insulin-using diabetic individuals, it is first important to describe the conceptualized model of the relationships of, and medical practice risk factors for hypoglycemia and risk of CMV accidents. Figure 1 presents the model that underlies the current discussions.

Figure 1

Relationship of Risk Factors for Hypoglycemia, Risk of Hypoglycemia, and CMV Accidents



It has been hypothesized that individuals taking insulin are at an increased risk for CMV accidents because of hypoglycemic reactions. These hypoglycemic reactions may be accompanied by a loss of consciousness which would increase the risk for motor vehicle accidents(l). The primary goal of medical practices/technology would be to reduce the occurrence of hypoglycemic reactions, in particular severe reactions.

As discussed in the first part of our review, there is clear evidence that hypoglycemic-related accidents can occur; however, what is not clear is the degree to which these do occur thus the risk of accidents per hypoglycemic reactions in not known. Since hypoglycemia! related accidents are of primary concern, we will first discuss the epidemiology of hypoglycemia as this forms the foundation of the model.

Of critical importance though is the role of risk factors in hypoglycemic-related accidents. These factors could be used for screening individuals who might be at risk for hypoglycemic reactions and thus at risk for hypoglycemic-related accidents. Therefore the second part of this review focuses upon the risk factors for hypoglycemia with partidular emphasis upon the relationship of blood sugar control and hypoglycemia. As part of this,

the current state-of-the-art of medical practice and technology of blood glucose control is overviewed. Finally, general conclusions are reached about risk factors for hypoglycemia, medical practices and therapy, and the relationship to the proposed federal guidelines.

THE DESCRIPTIVE EPIDEMIOLOGY OF HYPOGLYCEMIA

The central concern in licensing individuals who have insulin-dependent diabetes and insulin-acquiring diabetes is the risk of hypoglycemic reactions when driving(1). It is feared that these reactions will increase the likelihood of accidents, thus producing an overall increased risk of commercial motor vehicle accidents/injuries in drivers and the public.

Hypoglycemia can be defined both by symptoms and by blood sugar levels. In the simplest biochemical definition hypoglycemia can be defined as a blood sugar concentrations below 50 mg/dl. The symptomatic and behavioral consequences of hypoglycemia include seizure, coma, confusion, and other symptoms such as sweating, palpitations hunger and blurred vision. In the most severe form, the individuals can become unconscious and in rare events, die. The definition of hypoglycemia and hypoglycemic reaction varies across the literature(l-4). We will evaluate the epidemiology of hypoglycemic reaction at two levels. The first will be severe reactions using the definition of severe hypoglycemic reactions established for the Diabetes Control Complication Trail (DDCT)(2,3) of a coma, a seizure or a reaction requiring hospitalization or intervenous glucose or glucagon. It is likely that "severe" reactions would be predominant in the relationship to accidents(l). The second will be "mild" reactions where cognition and perception are modestly altered(1-4). The risk of accidents associated with these mild reactions is thought to be small.

Treatment in the very early stages of hypoglycemia requires some recognition by the individual that a hypoglycemic event is imminent; once a hypoglycemic event is identified a food that has a ready quantity of sugar can by consumed to raise the blood sugar level(4). For example, orange juice, candy bars, and candy are effective in the very early stages of a hypoglycemic reaction to raise blood sugar to prevent symptoms. The relationship between symptoms and blood sugar is not perfectly correlated. Individuals can have symptoms of hypoglycemia at blood sugars above 50mg/dl, and also individuals can react perfectly normally at levels below 50. However, this level of blood sugar is a reasonable indicator of risk(3) as well as early recognition of a potential reaction.

In the area of accidents, the recognition of early warning symptoms may be equally important as the "prevention" of events. For example, if early warning signs [illegible], then an individual can park the vehicle, and an accident can be avoided. The hypoglycemic reaction may still occur but the accident does not. We will come back to the issue of early warning signs later under the medical technology section.

There has been considerable metabolic and biochemical work investigating hypoglycemia(4). Most of this is not directly relevant to licensing and regulation for CMV drivers because of its biochemical nature. A primary concern for CMV licensing is the frequency with which hypoglycemia occurs. With increased frequency, one might expect an