SEIZURES, EPILEPSY, AND INTERSTATE COMMERCIAL DRIVING

Current federal regulations prohibit commercial licensure of individuals with epilepsy. These regulations were written in 1971 and last revised in 1978. However, there have been major advances in neurology and epilepsy which warrant reconsideration of previously recommended restrictions. We also advise that all evaluations be individualized, considering nature of the seizures, risk of recurrence and specific job requirements, and appeal procedures provided. Future research into this matter is encouraged.

It is clear that individuals with a high risk for loss of consciousness should have restrictions from activities in which they may endanger themselves, or more importantly others, should they lose consciousness. Licensure for driving is an area where such restrictions have been imposed by society through government regulation. An alteration of consciousness while driving could lead to an accident and possible human injury as well as financial loss to the affected individual(s). Most states impose some restrictions for driving licensure on individuals who are at risk to suffer loss of consciousness, even for personal transportation, despite the fact that the amount of time spent driving by most individuals is minimal and the likelihood of an event occurring while driving is small. More stringent restrictions have appropriately been imposed upon individuals wishing to drive for hire in general and for individuals driving cross country vehicles specifically. In addition to spending considerably more time in the activity of driving than the average individual, professional drivers are required to maintain control of a vehicle at times weighing in excess of 50 tons and/or maintain control of a vehicle carrying passengers. They are frequently required to work long distances from home, and because of driving schedules, maintain irregular eating and sleeping habits which will alter circadian rhythms. An adverse event of any type including episodes of loss of consciousness may be more likely to occur in such situations. An episode of alteration of consciousness while driving in this situation could cause considerable harm to the driver as well as other individuals.

Safety is the major reason to restrict individuals with epilepsy or seizures from driving. However, the actual risk of traffic accidents or death due to traffic accidents related to seizures or epilepsy is not very well substantiated and probably fairly small. In fact, accidents caused by epilepsy more often than average involve only the driver's vehicle, result in less serious injury, and occur in less populated areas(9). There are, however; few studies of seizures or epilepsy as causes of accidents among commercial drivers, and the data on risks are derived principally from studies involving noncommercial drivers. One study performed on traffic records of the Netherlands indicated a rate of 1' traffic accident per 10,000 caused by a seizure at the wheel. This compares to 6 per 10,000 caused by natural death at the wheel and 5,000 per 10,000 caused by alcohol. Although the risk for accidents caused by seizures is small, it has been estimated that the accident rate of people with epilepsy is approximately twice that of the population at large. How many accidents in people with epilepsy occur in relation to a seizure versus other factors is difficult to establish.

It would be easy to say that anyone who will ever experience an episode Of loss of consciousness while driving should be excluded from driving. This in fact has been a stance taken for some occupations (as commercial driving) when the episode in question has been considered to have been related to the occurrence of a seizure or to a history of epilepsy. The end result of such regulation would be to limit the driving privileges Of three groups of people. The first group would be the 10 percent of the population who might be expected to experience an episode of loss of consciousness due to a seizure. The second group is the 30 percent of the population who will experience an episode Of loss Of Consciousness for

other reasons. The third group includes the large body of individuals who have some characteristic or "risk factor" which places them at increased risk to experience an alteration of consciousness. Some balance between individual rights and the general good must be attempted; unfortunately data to allow informed judgments regarding this balance are few.

The question of appropriate restrictions from licensure to drive commercial vehicles to be used in interstate commerce is addressed in this paper. Considerations apply only for individuals with a history of seizures or epilepsy and for individuals at high risk to have seizures or epilepsy in the future. Data will be presented in terms of risk for future seizure occurrence. The data to be presented are in our opinion the best available at the present time. It should be made clear that recommendations for licensure to operate commercial vehicles to be used in interstate commerce are not necessarily appropriate for licensure for other driving activities. Drivers involved in interstate driving activities are required to drive long hours, may have meals at irregular intervals, are frequently subjected to high levels of stress, and are frequently steep deprived. Even though these factors have as yet to be shown to aggravate seizure disorders in rigorous studies, all are factors suspected by both clinicians and patients alike to increase the risk for seizures. Should medical problems of any sort develop, these individuals are often far from their usual source of medical care. For these reasons, criteria for restrictions for licensure to operate commercial vehicles used in interstate commerce due to seizures (and other medical conditions) may be more stringent.

RATES AND RISK

Rates are the proportion of the population which may be expected to develop a seizure at any point in time. This will be presented as a number of events per 10,000 population. Risk will be presented as the ratio of the frequency (or rate) of an event (seizure) in a population exposed to a specific factor compared with the expected base tine rate in those unexposed. It should be pointed out that the risk for an event or an exposure may be very high, but if the base line rate is low, the impact at a population level will be minimal.

There are many reasons for loss of consciousness, but in the present review, only the risk for or rate of seizures is addressed. Our interest in past history (i.e., of epilepsy) is relevant to this discussion only to the extent that it can predict future probabilities of an event such as a seizure in general or, more specifically, a seizure while driving. There is a certain baseline rate at which new seizure disorders can be expected to develop in the general population. This is the rate at which a "normal" individual might be expected to experience a new event (such as a seizure). It is this rate against which the rate of seizures in any presumed "high risk" group must be compared. The rate of newly occurring unprovoked seizures in predominantly white middle class Americans between the ages of 20 and 50 is 5/10,000 per year(10,11). It is clear that those 5?10,000 individuals should not be driving a commercial (or other) vehicle at the time of their first episode. Since there is no good way to predict future events, and thus no way to identify those individuals who may have a seizure in the future, this must be considered to be the minimal level of risk which society must accept for the occurrence of seizures. Given the small proportion of time most individuals spend driving and the likelihood of episodes occurring de novo while driving, even if one considers first seizures to occur as random events, the rate Of potential occurrence while driving would be reduced by a factor of 10 to 20.

There is, unfortunately, no standard rate for any adverse event which society has defined as acceptable to allow individuals to undertake activities which may be dangerous.

The data regarding the frequency of myocardial infarction was used to provide some estimates of the rate of potential occurrence of an adverse event which may be deemed acceptable without obvious restrictions. The rate of myocardial infarction in a white male middle class population between the ages of 45 and 54 is 5/1,000 a frequency 10 times the rate for newly developing seizures(12). Such individuals have an equal probability of losing control of a commercial vehicle if they are unfortunate enough to be operating one at the time of a newly occurring event. Since there is, at present, no policy to limit driving in this age group and no policy to revoke interstate commercial driving licenses for all males over age 45, we will assume this ten-fold increase above baseline rate of seizure to still represent an elevation in risk which should be acceptable to society (and regulatory agencies).

OTHER DEFINITIONS

* a--the clinical manifestation of an abnormal electrical discharge involving a set of cortical neurons.

* Acute Syptomatic Seizure--a seizure occurring at the time of an acute systemic metabolic insult or in association with an acute insult to the structural integrity of the brain.

* Unprovoked Seizure--a seizure occurring in the absence of an identifiable acute alteration of systemic metabolic function or acute insult to the structural integrity of the brain. There may be a known or distant cause of the seizure.

* Epilepsy--recurrent unprovoked seizures.

RECOMMENDATIONS FOR SITUATIONS IN WHICH SEIZURES OR EPILEPSY ARE KNOWN TO HAVE OCCURRED

Historv of Epilepsy

* Diagnosed Epilepsy Taking Anticonvulsant Medication With Uncontrolled Seizures--In this situation, individuals are at high risk for further episodes and should not be considered for licensure.

* Diagnosed Epilepsy Taking Anticonvulsant Medications With Seizures Controlled--The majority of individuals with a diagnosis of epilepsy, about 75 percent will become totally controlled. Risk for further seizures may be very low in such individuals, possibly at or even below baseline rates for newly developing seizures. Nonetheless, these individuals are exposed to conditions previously discussed which in and of themselves increase the risk for seizures in seizure-prone individuals. In addition, the inconsistent access to medical care may cause difficulty in the evaluation of acute problems, which may increase the risk for seizure occurrence, and the acquisition Of replacement anticonvulsant medication if drugs are lost or forgotten, place such individuals at some increase in risk. These individuals should not be authorized to drive commercial interstate vehicles. It is impossible to predict which of these individuals may have seizures should they inadvertently miss a dosage of medication. However, this issue requires further investigation and should be reassessed in the future when more data is collected.

* Diagnosed Epilepsy, Seizure-Free, and Off Medication--Once seizure-free for a period of 2 years or more, about 80 percent of individuals may be successfully withdrawn from anticonvulsant medication(13-16). In studies of planned withdrawal of medication, most relapses have occurred in the first six months with a recurrence rate for further seizures over the following two to three years of 3 to 5 percent per year. After successful withdrawal, these individuals are still at an increased risk for seizures well beyond this initial two or three year interval. Whether this seizure recurrence following a long interval of freedom from seizures, off medications represents relapse of the old condition or the development of a new condition in a susceptible individual is unclear. Recurrence risk is about 10/1,000 per year 5 to 9 years following withdrawal, and 5/1,000 per year from thereafter(10,17), It would seem that individuals with a history of epilepsy off anticonvulsant medication and seizure-free for 10 years should not be restricted from obtaining a license to operate a commercial vehicle.

  There are specific predictors which identify individuals for whom successful medication withdrawal can be achieved. Thus, at the time of medication withdrawal, both normalization of an abnormal electroencephalogram (EEG) or the absence of epileptiform activity after withdrawal of medications have been reported to identify those in whom medication can be withdrawn without further seizures(l3). These and other factors may allow future identification of individuals with acceptable risk for further seizures, permitting longer seizure-free intervals. Information allowing specific recommendations is not at present available and further dam collection is needed on this condition.

Single Unprovoked Seizures

While individuals who experience a single unprovoked seizure do not have epilepsy per se, they are clearly at a higher risk for having further seizures. While the overall rate occurrence is estimated to be 36 percent by 5 years following the seizure, this recurrence varies from 20 to 80 percent depending upon clinical characteristics(l8-20). After 5 years, the risk of recurrence is down to 2 to 3 percent per year for the total group. While more detailed analysis will identify individuals with differential risk, it would seem that individuals with a single unprovoked seizure, seizure-free for a S-year period or more, off medications, should not be restricted from obtaining a license to operate a commercial vehicle. A waiver may be considered for those individuals with a normal examination and an EEG with the absence of epileptiform activity, when examined by a neurologist specializing in epilepsy.

Acute Symotomatic Seizures

* Febrile Seizures--Febrile seizures occur in from 2 to 5 percent of the children in the United States before their fifth birthday(21). Since febrile seizures seldom occur after the age of 5, they should in and of themselves be of no specific concern for the current recommendations. It should be noted that as written, the current regulations exclude individuals with a history of febrile seizures from obtaining a license to operate a commercial vehicle. Individuals with febrile seizures are at a six-fold increase in risk to subsequently develop epilepsy. Most of this increase in risk is appreciated in the first 10 years of life, but the risk remains elevated by a factor of 3 at least through the third decade(22) This would convert to a rate of 15/10,000. From a practical standpoint, most individuals who have experienced a febrile seizure in infancy are unaware of the event and would not be readily identified through routine screening. The history of the occurrence of febrile seizures in childhood should not be

a restriction for licensing an individual to operate a commercial vehicle.

- Acute Seizures in the Presence of Systemic Metabolic Illness--In this situation, the seizure is generally related to the consequences of a general systemic alteration of biochemical homeostasis. Seizures are in fact the normal reaction of a properly functioning nervous system to adverse events and are not known to be associated with any inherent tendency of the individual to have seizures, thus, the risk for recurrence of seizures is related to the likelihood of recurrence of the inciting condition. Seizures per se, in the context of a systemic metabolic dysfunction should not be a primary reason for restriction from obtaining a license to operate a commercial vehicle. Any restrictions should be based upon the risk of recurrence of the primary condition. Some of the metabolic or toxic disorders affecting the brain can present as dementia. These are discussed on pages 27-28 Task Force II Report: Progressive Neurological Conditions. All are considered to be initially disqualifying; however, appeal is possible.

- Acute Symptomatic Seizures in the Presence of Acute Structural Insults to the Central Nervous System--It is not surprising that individuals will have a seizure at the time of a brain insult. In many situations, the occurrence of seizures is a reflection of the site of injury but may also be a surrogate for severity. Nonetheless, most neurologic conditions in which acme or "early" seizures may occur, are also risk factors for later unprovoked seizures. In fact, the occurrence of early seizures adds a significant increment of risk for later epilepsy to that associated with the primary condition. While this issue will be further addressed in the section considering risk factors for epilepsy, in general the risk for subsequent unprovoked seizures is maximal in the first two years following the acute insult. Unless otherwise discussed below, such individuals should not be restricted from obtaining a license to operate a commercial vehicle after they have been seizure-free two years or more and off anticonvulsant medication, if other restrictions are not applicable.

Risk Factors for Unprovoked Seizures

There are several conditions, listed below, in which the risk for unprovoked seizures is sufficiently high, even in the absence of the occurrence of acute seizures, such that licensure should be restricted for variable periods following the insults Because of the high risk to develop unprovoked seizures in the future, there has been a tendency to use prophylactic medication for many of these conditions. Since anticonvulsant medications may suppress the manifestation of seizures in those destined to develop such episodes, this further complicates the issue of restrictions from obtaining a license to operate a commercial vehicle. Thus, not only does the risk for unprovoked seizures following brain insults have to be considered, but in addition, provisos regarding the use of anticonvulsant medications seem appropriate as well. The risk for epilepsy after severe head trauma is similar to the risk after elective surgery and therefore should also be considered in licensure of commercial drivers.

- Head Injury--Head injury is a definite risk factor for unprovoked seizures. In general, individuals with a history of head injury have a three- to four-fold increase in risk for subsequent unprovoked seizures over baseline rates(23). This risk varies depending on age at the time of injury, severity of injury, and whether early seizures have occurred.

  -'-Severe head injury--defined as injuries involving penetration. of the dura, such as military injuries due to missiles, and injuries associated with loss of consciousness of more than 24 hours. The majority of such individuals die from this injury. In military

series less than 5 percent of individuals survive such injuries. Data from civilian series, is little better. Only 25 to 45 percent will survive. In individuals with injuries of this severity, upwards of 50 percent can be expected to develop unprovoked seizures. The rate of newly developing seizures is about 10/1,000 per year even 15 years after the injury(24). Based upon the risk for unprovoked seizures alone, it would seem that such individuals should not be considered qualified to obtain a license to operate a commercial vehicle at any time.

NOTE: Surgical procedures involving dural penetration have a risk for subsequent epilepsy similar to that of severe head trauma. Individuals who have undergone such procedures, including those who have had surgery for epilepsy, should not be considered eligible for licensure.

--Moderate head injury--defined as an injury associated with loss of consciousness for greater than 30 minutes but less than 24 hours and without dural penetration. For such individuals, the risk is increased by a factor of 3 through the first 5 years following injury(23) Risk is highest in the first year following injury and decreases thereafter. Risk is substantially higher for those with early seizures, possibly as high as 40 over the first 5 years following injury. The risk seems not to be elevated significantly beyond this 5 year interval. With head trauma of this severity and early seizures, a seizure-free period of 5 years off anticonvulsant medication should be required prior to an individual being considered qualified to obtain a license to operate a commercial vehicle. Without early seizures, the risk is elevated in the first two years after injury by a factor of 15 to 20. After 2 years, but before 5 years, the risk is only slightly elevated above baseline population rates. A two year. seizure-free period off anticonvulsant medications should be required for such individuals, after which time they should be considered qualified to obtain a license to operate a commercial vehicle.

--Mild head injury--defined as injuries with no dural penetration and with loss of consciousness less than 30 minutes. In the absence of an early seizure there is little identifiable increase in risk for unprovoked seizures. The overall increase, if any. is less than two-fold. There should therefore, be no restrictions to obtain a license to operate a commercial vehicle placed upon such individuals. Even in the presence of early seizures, the increase in risk is minimal. For this group with mild head injury and early seizures, the two-year, seizure-free, off medication rule should apply.

0 Cerebrovascular Disease--Approximately 12 percent of individuals suffering an occlusive cerebrovascular insult resulting in a fixed neurologic deficit will experience a seizure at the time of the insult. Unprovoked seizures will occur within the next 5 years in 16 percent of all individuals with an occlusive vascular insult(25) This rate seems not to be modified significantly by the occurrence of early seizures. This risk is increased primarily in individuals with lesions associated with cerebral cortical or subcortical deficits. Individuals with strokes resulting in vascular lesions involving the cerebellum and brain stem are not at increased risk for seizures. Individuals with occlusive cerebral vascular disease with fixed deficits involving areas other than the cerebellum and brain stem should not be considered qualified to obtain a license to **Operate** a commercial vehicle for a 5 year period following the episode. Evaluation by an appropriate specialist to confirm the area of involvement may be required for waiver of this restriction. There is no sound data regarding risks of seizure following intracerebral or subarachnoid hemorrhage, but it must be assumed that risks will be similar, and thus similar recommendations would apply. Further studies are needed to clarify other groups at low risk. Limitations following cerebrovascular insult other than seizure also will impact licensure for commercial driving. Patients with embolic

or thrombic cerebral infarction and/or subarachnoid or intracerebral hemorrhage also will have residual intellectual or physical impairments severe enough to prevent a return to commercial driving. Commercial drivers who wish to return to full work status should undergo a careful neurological examination at one year following the incident. This examination should include assessment of cognitive abilities, judgment, attention, concentration, vision, physical strength, agility and reaction time. If the neurological residuals are sufficiently severe to interfere with any of the above, then the individual should not be allowed to return to commercial driving.

Infections of the Central Nervous System--Central nervous system infections have long been recognized as a risk factor for epilepsy. As with head injury, early seizures greatly modify the risk for subsequent epilepsy(26)

--Aseptic meningitis--is not associated with any increase in risk for subsequent unprovoked seizures. No restrictions should be considered for such individuals and they should be qualified to obtain a license to operate a commercial vehicle.

--Bacterial meningitis--is associated with a six-fold increase in risk for unprovoked seizures. This risk varies significantly according to the presence or absence of acute seizures. As with head trauma, the risk for unprovoked seizures is highest in the first four years after the infection and declines thereafter. For those with bacterial meningitis without early seizures, risk is increased about fifty-fold in the first year after infection, is increased ten-fold in the subsequent four years, and changes little thereafter. Individuals should be considered qualified to obtain a license to operate a commercial vehicle after a one year seizure-free period, off anticonvulsant medication,

For those with bacterial meningitis and early seizures, risk is elevated by a factor Of 35 through the first 5 years following infection and by a factor of about 7 or 8 through the next 15 years. Such individuals should be considered qualified to obtain a license to operate a commercial vehicle after a five year, seizure-free period off anticonvulsant medication.

--Viral encephalitis--is associated with a 20-fold increase in risk for subsequent unprovoked seizures. There are again major differences in risk depending upon the occurrence of early seizures. Without early seizures, risk is increased about 20-fold in the first year following infection and is associated with a 5 to IO-fold increase thereafter. Such individuals should be considered qualified to obtain a license to operate a commercial vehicle after a one year, seizure-free period off anticonvulsant medication.

In those with encephalitis and early seizures, more than 7 percent will have unprovoked seizures in the first year following infection, but the rate continues at almost one percent per year for the following 9 years. The risk between 10 and 20 years following the infection is elevated by a factor of 10. Such individuals should not be considered qualified to obtain a license to operate a commercial vehicle for the first 10 years following such an infection.

SLEEP DISORDERS

Regarding interstate commercial driving regulations, we are concerned mainly those sleep disturbances which cause excessive daytime somnolence (EDS) These disorders may be classified broadly into two categories(27)--transient disorders causing EDS and persistent or chronic sleep disorders causing EDS.

Transient Sleep Disorders Causing EDS

Many sleep disturbances are transient, lasting from a few days to a few weeks, and would not limit a drivers ability in the long run.

Persistent or Chronic Sleep Disorders Causing Excessive Daytime Somnolence (EDS)(27)

These disorders can be enumerated as follows:

- o Sleep apnea syndrome.
- o Narcolepsy syndrome.
- o Primary alveolar hypoventilation syndrome (idiopathic).
- o Central or secondary alveolar hypoventilation syndrome which is secondary to a variety of acute and progressive neurological diseases causing EDS.
- o Idiopathic CNS hypersomnolence.
- o Hypersomnolence (EDS) secondary to medical or non-neurological causes (metabolic, toxic, or systemic diseases).
- o Restless legs syndrome (RLS) associated with EDS or RLS-DOES (disorder of excessive somnolence) syndrome associated usually with periodic moments of sleep.
- o Disorders of sleep-wake cycles.
- o Hypersomnolence (EDS) secondary: to psychiatric disorders (major or minor depressive illness or schizophrenia).
- o Periodic hypersomnolence.

The two most common causes of EDS are the sleep apnea syndrome and the narcolepsy, and these two constitute about 70 percent of cases of EDS.

- o Sleep Apnea Syndrome(27-30)--This is probably the most common cause of EDS in the general population. Most of the time the cause is not known. Many patients are obese but the condition can also occur in nonobese individuals. This is more common in men than in women. The disorder affects commonly middle-aged and elderly people but many cases have been described in young adults. The sleep disorder is characterized by excessive daytime somnolence and the patient falls asleep at inappropriate times and particularly while sitting, and the patient may sleep for one-half to one to two hours. On awakening, the patient feels drowsy and not fresh, unlike that noted in narcolepsy. The patients do not have cataplexy, sleep paralysis hypnagogic hallucinations which form on important symptom-complex of narcolepsy. The night sleep of the patients is very disturbed and fragmented and they wake up frequently fighting for breath because they have upper airway obstructive, mixed Or central apneas throughout the night. Depending on the severity of the disturbance of night sleep and frequent awakenings due to sleep apneas the severity of EDS varies. After repeated attacks for many years, many of these patients may suffer from cognitive impairment which will interfere with the memory, concentration and

judgment. In longstanding cases, because of repeated hypoxemia, the patients also may have cardiopulmonary disturbances causing cardiac arrhythmia and cardiac failure, and sometimes even sudden death particularly in sleep. This condition, therefore, is conducive to hazardous driving during long driving hours as noted in interstate driving.

0 Narcolepsy(27,28,31)--Narcolepsy is a common cause of EDS in the general population. This syndrome is characterized by the following symptom complex:

--Sleep attacks are the first component of narcolepsy syndrome. They are characterized by irresistible desire to sleep at any time of the day; e.g., while driving, watching television, or sitting at the dining table. The subjects cannot control this sleep which lasts briefly for a few minutes to 15 to 30 minutes. On awakening the subjects often feel fresh. There may be numerous attacks throughout the day.

--The second component of narcolepsy syndrome consists of cataplexy which is characterized by a sudden loss of tone of the muscles of the limbs or the neck; the patient will fall suddenly to the ground without loss of consciousness or the head may drop forward momentarily. These attacks are often precipitated by some emotional outburst such as laughter or crying. The attacks are very short lasting for a few seconds, and there is never any loss of consciousness.

--The third component of narcolepsy is hypnagogic hallucination which is characterized by vivid dreams as the patient is falling asleep or just awakening.

--The fourth component is sleep paralysis which is characterized by sudden feelings Of inability to move the limbs, either the upper or lower limbs, one side or both sides as the patient is going to sleep or awakening. This sometimes could be physiological without any other associated features.

--The fifth component of narcolepsy is sleep fragmentation and sleep disturbance at night which causes EDS.

--Miscellaneous symptoms of narcoleptic sleep attacks include blurring Of vision or double vision and may have automatic behavior.

Any and all of these symptom complexes of narcolepsy will be an added risk while driving, and particularly during interstate driving, and this risk might contribute to hazardous driving therefore causing accidents.

The incidence and natural history of sleep apnea and narcolepsy--The incidence and prevalence of EDS is difficult to determine but probably is up to 4 percent of the adult population. Sleep apnea and narcolepsy constitute the majority of such cases(29-31). The natural history of sleep apnea is variable. In the majority of cases, the condition is usually mild. Narcolepsy is a life-long condition, although the incidence and severity of sleep attacks tend to decrease as one gets older.

The incidence of road traffic accidents in narcolepsy and sleep apnea--Excessive daytime somnolence associated with narcolepsy or sleep apnea is a common cause Of road traffic accidents. There are many reports(31-33) of increased incidents of road traffic accidents due to EDS and sleep attacks associated with narcolepsy and sleep apnea syndromes. There are several reports in the literature of narcoleptic drivers having sleep attacks while at the wheel of the vehicle, causing a high incidence of

road accidents. In one reprt(32) there was a 40 percent incidence of narcoleptics as compared to 7 percent of controls falling asleep while driving on the New England Turnpike, giving rise to an increased number of road accidents on the Eastern U.S. highways. If a narcoleptic driver has all three features, namely sleep attacks, cataplexy and sleep paralysis occurring simultaneously, then he/she is faced with a dangerous situation while driving and is liable to be involved in serious accidents. Other factors which contribute to increasing the incidence of road accidents in narcoleptics includes automatic behavior, visual disturbances (blurring of vision and double vision), subwakefulness, and sleep drunkenness.

* Primary Alveolar Hypoventilation Syndrome(27,28)--This condition is characterized by EDS and impaired ventilation during sleep without significant apneas. The hallmark of this condition is impaired hypercapnic and hypoxic ventilatory responses during wakefulness.

* Central or Secondary Alveolar Hypoventilation Syndrome(27,28)--This condition is caused by acute and progressive neurological disorders. These conditions should be ruled out by appropriate laboratory and neurological tests.

* Idiopathic CNS Hpersomnolence(27)--This condition is characterized by isolated sleep attacks resembling narcolepsy but does not have the ancillary or the associated features of narcolepsy as described above. Polysomnographic study lacks sleep apneas or sleep-onset REM as noted in narcolepsy.

* Hypersomnolence Secondary to Medical Causes(27)--EDS in these patients is related to a variety of toxic, metabolic or systemic diseases which should be diagnosed by appropriate clinical features and laboratory findings.

* RLS-DOES Syndrome(27)--This is another condition causing EDS and is characterized by uncontrollable feelings of restlessness and uncomfortable sensations in legs, and the subjects have to move about to get relief from these painful sensations in the legs. They have difficulty going to sleep and therefore their night sleep is disturbed and shortened giving rise to EDS. Most of the patients with RLS also have periodic movements of sleep where the legs jerk periodically during sleep. Therefore. this condition is also hazardous for drivers taking part in interstate driving.

* Disorders of Sleep-Wake Cycles(27)--This could be divided into transient (described above), and persistent disorders. Persistent sleep-wake cycle disorders could cause the following main two disturbances:

  --Frequently changing sleep-wake schedule--The characteristic disturbance in this condition consists of a mixed pattern of hypersomnolence alternating with periods of arousal. Subjects may suffer from performance decrement and cognitive difficulties.

  --Irregular sleep-wake pattern--The hallmark of this condition is loss Of a clear sleep wake rhythm.

* EDS Due to Psychiatric Disorders(27)--The diagnosis should be made by psychiatric interview.

* Periodic Hypersomnolence(27) e.g., Kleine-Levin syndrome--This is an extremely rare sleep disorder occurring in adolescents and young adults and is characterized by

episodic hypersomnolence lasting for days to weeks and excessive appetite.

Diagnosis of Sleep Disturbances

The varieties of sleep disturbances described above must be diagnosed accurately for the purpose of recommendations for interstate commercial driving. The diagnosis is based on the characteristic clinical features and laboratory evidence of excessive daytime somnolence and other sleep-wake disorders(28-31). The two important laboratory tests for diagnosis of EDS, such as sleep apnea syndrome and narcolepsy, are multiple sleep latency tests and polysomnographic studies performed in sleep laboratories equipped to conduct such tests. Recurrent episodes of sleep-related upper airway obstructive, mixed or central apneas accompanied by oxygen desaturation and shortened sleep onset latency characterize the findings in sleep apnea syndrome. The diagnostic features in narcolepsy consist of sleep onset, rapid eye movement sleep and shortened sleep latency.

RECOMMENDATIONS

What should be the guidelines regarding driving ability in an individual subjected to excessive daytime somnolence and sleep attacks? Before developing the guidelines there are many variables which must be considered, including:

* Severity and frequency of sleep attacks.

* Presence or absence of warning of such attacks.

* Possibility of occurrence of such sleep attacks during driving.

* The degree of symptomatic relief by treatment.

Specific Guidelines for Patients with Narcolepsy Syndrome--Narcolepsy is generally a life-long condition, although the sleep attacks can be shortened or reduced in number by pharmacologic treatment in some patients. These drugs also have other side effects which generally do not control the sleep attacks completely. Patients with narcolepsy syndrome should not, therefore, be allowed to participate in interstate driving.

Guidelines for Patients With Sleep Apnea Syndrome--Patients with sleep apnea syndrome having symptoms of excessive daytime somnolence cannot take part in interstate driving, because they likely will be involved in hazardous driving and accidents resulting from sleepiness. Even if these patients do not have the sleep attacks, they suffer from daytime fatigue and tiredness. These symptoms will be compounded by the natural fatigue and monotony associated with the long hours of driving, thus causing increased vulnerability to accidents. Therefore, those patients who are not on any treatment and are suffering from symptoms related to EDS should not be allowed to participate in interstate driving.

Those patients with sleep apnea syndrome whose symptoms (e.g., EDS, fatigue etc.) can be controlled by surgical treatment, e.g., permanent tracheostomy, may be permitted to drive after 3 month period free of symptoms, provided there is constant medical supervision. Laboratory studies (e.g.. polysomnographic and multiple sleep latency tests) must be performed to document absence of EDS and sleep apnea.

Guidelines for Idiopathic CNS Hvoersomnolence and Primary (Idiopathic) Alveolar Hypoventilation syndrome--These patients should not be allowed to drive commercial vehicles.

Guidelines for the Patients With RLS-DOES Syndrome--These patients also should not participate in driving. This is generally a life-long condition and sometimes it is familial. The dangers in this condition are not only the excessive daytime somnolence but also the constant movements of the legs for relief of their symptoms which will be hazardous while driving. There is generally no satisfactory treatment: some pharmacologic treatment sometimes partially modifies the symptoms but cannot completely eliminate the symptoms.

Guidelines for Patients With Hypersomnolence due to Acute and Progressive Neurological or Systematic Medical Conditions and Psychiatric Disturbance%--Recommendations for these individuals should be determined by the underlying primary conditions causing EDS. In general these patients should not be allowed to drive commercial vehicles.

APPENDIX A

A Guide for the Functional Assessment of Commercial Drivers

I. PHYSICAL

A. Manual Muscle Test of Muscle Groups

1. Strength

- Ask driver to imitate the motion pattern necessary to turn a 24-inch steering wheel; offer resistance throughout this pattern.

2. Mobility

- Give resistance while driver simulates **patterns** described in this category (i.e., push, pull, twist at shoulder level, at each side, downward, bend, kneel, crawl, etc.)

3. Stability

- Offer resistance to trunk, forward, backward, sides while driver is seated; driver is instructed to maintain position.
- Ask driver to simulate shifting, i.e., reciprocal movement of both lowers and right hand--offer resistance.
- Have driver step up and down on a foot stool several times (this brings in an endurance component as well as an aerobic component to evaluate climbing).

B. Steering Wheel--Calibrated in pounds and actuated **by** mechanical means to offer resistance which can be measured.

1. Power Grip

Use dynamometer--Minimum grasp of 58 pounds (taken from Sister Kenny norms for males in 10th percentile. 76 pounds for age category 45 to 49, and 40 pounds for females in this category).

II. SENSATION--Especially the feet and hands. Assess the following sensory modalities.

A. Touch.

B. Positions sense.

C. Vibration.

III. VISION

A. Distance visual acuity..

B. Scanning the environment--saccadic movements.

C. Depth perception

D. Peripheral vision.

1. Reaction time.

2. Depth perception.

3. Visual acuity.

4. Peripheral vision.

IV. GENERAL PERCEPTUAL-COGNITIVE ABILITIES

A. Attentiveness, concentration, vigilance.

B. Controlled behavior impulse control.

C. Ability to predict/anticipate.

D. Problem solving--Ability to respond to simultaneous stimuli in a changing environment (i.e., when potentially dangerous situations could exist).

Assessments which measure, in part, those areas listed above:

1. Attention, concentration, vigilance and visual scanning can be tested by: a) using scanning sheets; a pencil/paper test requiring cancellation of designated letters on a sheet containing several rows of single letters; b) Benton Visual Retention Test; c) WAIV--digit span test.

2. Impulsivity--observation of driver during testing session. Does he/she begin activity before hearing all instructions? Does he/she work rapidly, inattentive to details? Is he/she able to correct errors made?

3. Picture Interpretation--questions are asked of subject viewing drawings or photos requiring inductive thinking--"what do you see in the picture?." "Why do you think . . . . ?," "What would happen if . . . . . ?" Can subject integrate components into a whole?

4. Note subject's distractibility during testing session. Problem solving abilities can be assessed using picture interpretation test.

APPENDIX B

Conference Participants

Harold P. Adams, Jr.. M.D.
Professor
Department of Neurology
University of Iowa
Iowa City, IA

Michael P. Alexander, M.D.
Assistant Professor of Neurology
Director, Aphasia Program
Braintree Hospital
Braintree, MA

Harold E. Booker, M.D.** (Chairman)
Former Chief
Neurology Service
Veterans Administration Medical Center
Cincinnati, OH

Michael H. Brooke, M.D.
Professor
Department of Neurology
Washington University School of Medicine
St. Louis, MO

Sudhansu Chokroverty, M.D.
Chief
Neurology Service
Veterans Administration Medical Center
Lyons, NJ

Stuart D. Cook, M.D.**
Acting Dean
UMDNJ-New Jersey Medical School
Newark, NJ

Robert B. Daroff, M.D.**
Gilbert W. Humphrey Professor of Neurology
Director, Department of Neurology
University Hospitals of Cleveland
Cleveland, OH

Donald Dawson, M.D.**
Program Consultant
Chairman, Medical Advisory Board
International Brotherhood of Teamsters
Concord, MA

** Steering Committee Member

Conference Participants (cont.)

Joel A. Delisa M.D.
Professor and Chair
Department of Rehabilitation Medicine
UMDNJ-New Jersey Medical School
Newark, NJ

Roger Duvoisin, M.D.
Professor and Chair
Department of Neurology
UMDNJ-Robert Wood Johnson Medical School
New Brunswick, NJ

Mark L. Dyken, M.D.**
Professor and Chair
Department of Neurology
Indiana University Medical Center
Indianapolis. IN

Gerald Friedman, M.D.**
Professor
Mt. Sinai School of Medicine
Medical Director
United Parcel Service
New York, NY

Joseph Frith
Director. Environmental Control
Overnite Transportation Company
Richmond, VA

Donald Hansen
Director of Safety
Preston Trucking Company, Inc.
Preston, MD

W. Allen Hauser, M.D.**
Professor of Neurology and Public Health
Gertrude H. Sergievsky Center
College of Physicians and Surgeons
Columbia University
New York, NY

Ronald Joseph
Interstate Driver
International Brotherhood of Teamsters
Washington, DC

** Steering Committee Member

Conference Participants (cont.)

Allan Krumholz, M.D.
Director
Division of Neurology
Sinai Hospital
Baltimore, MD

Jerry Mendell, M.D.
Professor of Neurology and Pathology
Ohio State University
Columbus, OH

Matthew Rizzo, M.D.
Assistant Professor
Division of Behavioral Neurology
and Cognitive Neuroscience
University of Iowa
Iowa City, IA

Eddie Roberts
Interstate Driver
Safeway Stores, Inc.
Washington, DC

William R. Shapiro, M.D.
Chair
Department of Neurology
Memorial Sloan-Kettering Cancer Center
New York, NY

Raymond Troiano, M.D.
Assistant Professor of Neurosciences
UMDNJ-New Jersey Medical School
Newark, NJ

B. Todd Troost, M.D.
Professor and Chair
Department of Neurology
Bowman Gray School of Medicine
Winston-Salem, NC

John Turner
Interstate Driver
Giant Food
Washingron, DC

Ken Utz
Director of Safety
Freymiller Trucking, Inc.
East Chicago, IN

Conference Participants (cont.)

Kenneth M. Welch, M.B.
Chair
Department of Neurology
Henry Ford Hospital
Detroit, MI

Zeke Wineglass
Interstate Driver
United Parcel Service
Washington, DC

Harold F. Young, M.D.
Professor and Chair
Division of Neurosurgery
Medical College of Virginia
Richmond, VA

APPENDIX C

Observers and Other Attendees

Neill Darmstadter
Senior Safety Engineer
American Trucking Associations
Alexandria, VA

John Eberhard, Ph.D.
Research Psychologist
Office of Driver and Pedestrian Research
National Highway Traffic Safety Administration
U.S. Department of Transportation
Washington, DC

Barbara Elkin
Director
Legal Advocacy
Epilepsy Foundation of America
Landover, MD

William Hark, M.D.
Certification Specialist
Office of Air Medical Standards
Federal Aviation Administration
US. Department of Transportation
Washington, DC

Pete Little
Highway Safety Specialist
Office of Motor Carrier Standards
Federal Highway Administration
U.S. Department of Transportation
Washington, DC

Richard Masland, M.D.
Epilepsy Foundation of America
Englewood, NJ

Michael Trentacoste
Director
Office of Motor Carrier Standards
Federal Highway Administration
U.S. Department of Transportation
Washington, DC

Eliane Viner
Medical Assistant
Office of Motor Carrier Standards
Federal Highway Administration
U.S. Department of Transportation
Washington, DC

APPENDIX D

Conference Speakers

Harold Booker, M.D., Former Chief, Neurology Service, Veterans Administration Medical Center, Cincinnati, Ohio.

Donald Dawson, M.D.. Program Consultant and Chairman, Medical Advisory Board, International Brotherhood of Teamsters, Concord, Massachusetts.

Pete Little,, Highway Safety Specialist, Office of Motor Carrier Standards, Federal Highway Administration, U.S. Department of Transportation, Washington, D.C.

Michael Trentacoste, Director, Office of Motor Carrier Standards, Federal Highway Administration, U.S. Department of Transportation, Washington, D.C.

Eliane Viner, Medical Assistant, Office of Motor Carrier Standards, Federal Highway Administration, U.S. Department of Transportation, Washington, D.C.

APPENDIX E

Conference Agenda

April 7

9:00 a.m.	REGISTRATION
9:30 a.m.	CALL TO ORDER AND INTRODUCTIONS --Harold Booker. M.D., Steering Committee Chairman
9:40 a.m.	SAFETY REGULATIONS AND THE MOTOR CARRIER INDUSTRY --Michael Trentacoste, Office of Motor Carrier Standards --Eliane Viner, Office of Motor Carrier Standards
lo:oo a.m.	INDIVIDUAL PHYSICIANS AND FEDERAL REGULATORY ACTIVITY --Harold Booker, M.D.
10:30 a.m.	DRIVER JOB TASKS AND DEMANDS --Pete Little, Office of Motor Carrier Standards
11:30 a.m.	MOTOR CARRIER INDUSTRY AND Medical Regulations: MANAGEMENT AND LABOR PERSPECTIVES --Donald Dawson, M.D., International Brotherhood of Teamsters
11:50 a.m.	CHARGE TO TASK FORCES --Harold Booker, M.D.
12:00 p.m.	BREAK
1:30 p.m.	TASK FORCE SESSIONS
evening	PREPARATION OF REVISED TASK FORCE REPORTS

April 8

8:30 a.m.	TASK FORCE SESSIONS
9:30 a.m.	PRESENTATION AND DISCUSSION OF TASK FORCE REPORTS
11:45 a.m.	CLOSING REMARKS --Harold Booker, M.D.
12:00 p.m.	STEERING COMMITTEE MEETING

REFERENCES

1. Waters W.E., "The Epidemiological Features of Migraine," International Journal of Epidemiology, 1973;2:189- 194.

2. Ziegler D.K,, et al.. "Character of Life Headache Histories *in* a Non-Clinic Population," Neurology, *1977;21:265-269.*

3. Jones A. and Harrop C., "Study of Migraine and the Treatment of Acute Attacks in Industry," Journal of International Medical Research, 1980:8:32l-325.

4. Childs A.J. and Sweetnam M.T., "A Study of 104 Cases of Migraine," British Journal of Industrial Medicine, 1961;18:234-236.

5. Troost B.T., "Dizziness and Vertigo in Vertebto-Basilar Disease. Part I: Peripheral and Systemic Causes of Dizziness," Stroke, 1980;11:301-303.

6. Troost B.T., "Dizziness and Vertigo in Vertebro-Basilar Disease. Part II: Central Causes," Stroke, 1980;11:413-415.

7. Baloh R.W., Honrubia V. and Jacobson K., "Benign Positional Vertigo: Clinical and Oculographic Features in 240 Cases," Neurology, 1987;37:371-378,

8. Baloh R.W., Dizziness. Hearing Loss, and Tinnitus: The Essentials of Neurotology (Philadelphia: F.A. Davis, 1984). 59-96.

9. Fisher R.S. and Krumholz A., "Driving and Epilepsy," Maryland State Medical Journal, 1988 (in press).

10. Hauser W.A. and Kurland L.T., "The Epidemiology af Epilepsy in Rochester Minnesota 1935 - 1967," Epilepsia, 1975;16:1-66.

11. Hauser W.A., Annegers J.F. and Kurland L.T., "The Incidence of Epilepsy in Rochester Minnesota 1935 - 1979," Epilepsia, 1984;25:666.

12. Elveback L.R., Connolly D. and Kurland L.T., "Coronary Heart Disease in Residents of Rochester Minnesota: II Mortality, Incidence and Survivors 1950 - 1975," Mayo Clinic Proceedings, 1981;56:665-672.

13. Shinnar J., Vining E.P.G. and Mellits E.D., et.al., "Discontinuing Antiepileptic Medication in Children and Epilepsy After Two Years Without Seizures: A Prospective Study," New England Journal of Medicine, 1985;313:976-980.

14. Overwig S., Withdrawal of Antiepileptic Drugs in Seizure-Free Adult Patients (Amsterdam: Rodopi Press, 1985).

15. Callaghan N., Garrett A. and Goggin T., "Withdrawal of Anticonvulsant Drugs in Patients Seizure-Free for Two Years: A Prospective Study," New England Journal of Medicine, 1988;318:942-946.

16. Shafer S.Q.. Hauser W.A., Annegers J.F. and Klass D., "The Electroencephalogram as a Predictor of Remission in Patients with Epilepsy," Epilepsia, 1988 (in press).

17. Annegers J.F., Hauser W.A. and Elveback L.R., "Remission of Seizures and Relapse in Patients with Epilepsy," Epilepsia, 1979;20:174-179.

18. Hauser W.A., Anderson V.E., Loewenson R.B. and McRoberts S.M., "Seizure Recurrence Following a First Unprovoked Seizure," New England Journal of Medicine, 1982;307:522-528.

19. Hauser W.A., Rich S. and Anderson V.E., "Seizure Recurrence After a First Unprovoked Seizure: An Extended Follow-up," Epilepsia, 1986;27:617.

20. Shinnar S., Berg A.T., Moshe S.L., Maytal J., Goldensohn E.S. and Hauser W.A., "The Risk of Recurrence Following a First Unprovoked Seizure in Childhood: A Prospective Study," New England Journal of Medicine (submitted 1988).

21. Hauser W.A., "Epidemiology of Febrile Seizures," in Febrile Convulsions, eds. J. Ellenberg and K. Nelson (New York: Raven Press, 1982), 5-17.

22. Annegers J.F., Hauser W.A., Shirts S.B. and Kurland L.T., "Factors Prognostic of Unprovoked Seizures After Febrile Convulsions," New England Journal of Medicine, 1987;316:493-498.

23. Annegers J.F., Grabow J.D., Groover R.V., Elveback L.R. and Kurland L.T., "Seizures After Head Tramma: A Population Study," Neurology, 1988;30:683-689.

24. Salazar A.M., Jabbari B., Vance J.C., Grafmon J., Amin D. and Dillon J.D., "Epilepsy After Penetrating Head Injury. I Clinical Correlates: A Report of the Vietnam Head Injury Study," Neurology, 1985;35:1406-1414.

25. Hauser W.A., Ramirez-Lassepas M. and Rosenstein R., "Risk for Seizures and Epilepsy Following Cerebrovascular Insults," Epilepsia, 1984;25:666.

26. Annegers, J.F., Nicolosi A., Beghi E., Hauser W.A. and Kurland L.T., "Unprovoked Seizures Following Central Nervous System Infections," Neurology, 1988 (in press).

27. Roffwarg H.P, et al., "Diagnostic Classification of Sleep and Arousal Disorders," Sleep, 1979;2(I):1-137

28. Chokroverty S., "Sleep and Breathing in Neurological Disorders," in Breathing Disorders of Sleep, eds. N.H. Edelman and T.V. Santiago (New York: Churchill Livingston, 1986). 225-264.

29. Guilleminault C., "Sleep and Breathing," in Sleeping and Waking Disorders: Indications and Techniques, ed. C. Guilleminault (Menlo Park, California Addison-Wesley Publishing Company, 1982), 155-182.

30. Parkes J.D., "Sleep Apnea and Other Respiratory Disorders During Sleep," Sleep and Its

32. Bartels E.C. and Kuskacioglu O., "Narcolepsy--A Possible Cause of Automobile Accidents," Lahey Clinical Foundation Bulletin. 1965;14:21-26.

33. Kennedy A.M., "A Note on Narcolepsy," British Medical Journal, 1929;1:1112.