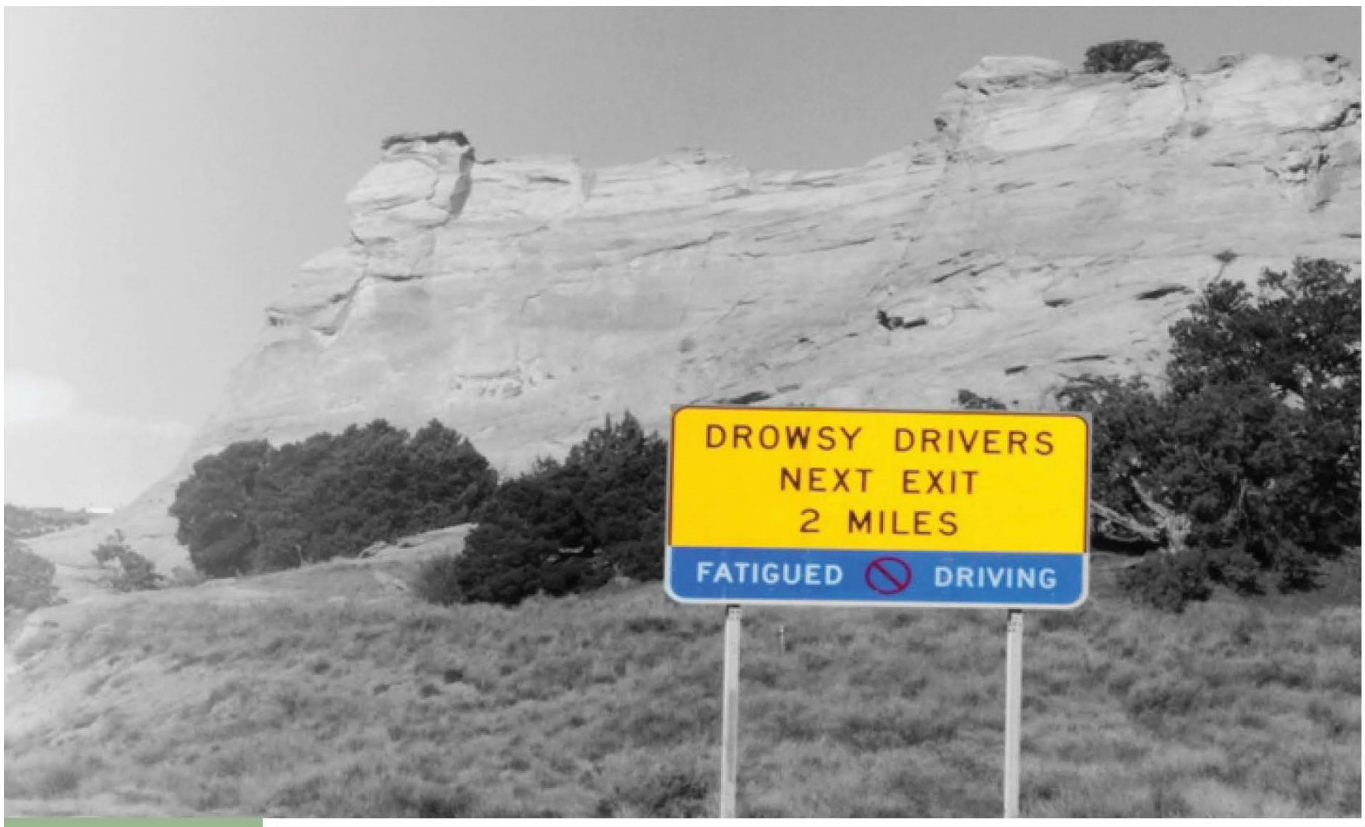

Guidelines and Materials to Enable Motor Carriers to Implement a Fatigue Management Program

IMPLEMENTATION MANUAL

Sponsored by the North American Fatigue Management Program

NAFMP
North American Fatigue Management Program

Guidelines and Materials to Enable Motor Carriers to Implement a Fatigue Management Program

IMPLEMENTATION MANUAL

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FOREWORD

The purpose of this fatigue management program (FMP) is to address the issue of driver fatigue through a comprehensive approach that includes: (i) information about developing a corporate culture that facilitates reduced driver fatigue; (ii) fatigue management education for drivers, drivers' families, carrier executives and managers, shippers/receivers, and dispatchers; (iii) information about screening for and treating sleep disorders; and (iv) driver and trip scheduling information.

For the past several years, Canadian and American regulators, carriers, and researchers have worked on the development of a comprehensive approach for managing fatigue. This work has been led by the steering committee of the North American Fatigue Management Program (NAFMP), a consortium of government and industry agencies with an interest in developing a more effective means of dealing with professional driver fatigue. The NAFMP Steering Committee comprises Transport Canada, the Federal Motor Carrier Safety Administration (FMCSA), Alberta Transportation, Alberta Workers Compensation Board, Alberta Employment and Immigration, Société de l'assurance automobile du Québec, and the Commission de la santé et de la sécurité du travail du Québec, Alberta Motor Transport Association, American Transportation Research Institute. The NAFMP Steering Committee agreed to develop a comprehensive FMP designed to enhance a carrier's ability to effectively deal with the challenges of fatigue in a highly competitive, widely dispersed, and rapidly changing industry.

Along with NAFMP, the Virginia Tech Transportation Institute (VTTI) was charged with developing the content included in the final FMP. Additionally, VTTI oversaw the development of the overall FMP structure and produced this implementation manual. The current implementation manual was developed for use by carrier management, including safety managers, fleet managers, logistics managers, transportation managers, and others responsible for designing and applying the motor carrier FMP of a company or an organization. This manual is a practical, easy-to-understand reference guide for implementing an FMP. It includes chapters about module content in the FMP, fatigue risk management systems, developing and implementing the FMP, train-the-trainer concepts, and a step-by-step guide for developing a sleep disorder screening and treatment program in commercial motor vehicle (CMV) operations.

EXECUTIVE SUMMARY

INTRODUCTION

Fatigue can best be defined as combinations of symptoms that include mental and physical elements, impaired performance, and subjective feelings of alertness.[1,2] Characteristics of fatigue include: loss of alertness, attention, and vigilance; increased wandering thoughts; decreased reaction time; distorted judgment; decreased motivation; impaired memory; reduced field of vision; and increased frequency of microsleeps.[3]

The symptoms associated with fatigue can lead to involvement in a vehicle crash. In 1990, for example, the National Transportation Safety Board (NTSB) studied 182 fatal-to-the-driver large-truck crashes.[4] The in-depth investigations conducted by NTSB revealed fatigue to be a principal cause in 31 percent of these crashes (fatigue was the largest single cause of truck crashes in the study). Additionally, Knipling and Wang[5] found that commercial motor vehicle (CMV) drivers were asleep at the wheel in 4 percent of all heavy-vehicle crashes, and the Federal Motor Carrier Safety Administration (FMCSA)[6] found that fatigue was a contributing factor in 13 percent of serious CMV crashes (i.e., crashes involving serious injuries and/or fatalities). Furthermore, FMCSA estimated that fatigue was a factor in 15 percent of all fatal large-truck-related crashes.[7] The agency estimated that fatigue was a direct factor in 4.5 percent of these crashes, and mental lapses and inattention associated with fatigue were a direct factor in an additional 10.5 percent of fatal large-truck related crashes. Regardless of the degree to which fatigue was an associated factor during these CMV crashes, it is apparent that fatigue-related crashes among CMV drivers are prevalent given drivers' extended work hours and shifts that can start at various times of the day and night.

FATIGUE MANAGEMENT PROGRAMS

CMV driver fatigue is a serious issue that affects all motorists on the roadway. One way to respond to driver fatigue is through prescriptive hours-of-service (HOS) rules. HOS compliance, for both daily and weekly requirements, is essential for rest/sleep. However, a more proactive and comprehensive approach will support drivers in further managing other risk factors that contribute to fatigue. Research has shown there are numerous factors that impact driver fatigue; no simple solution exists to reduce driver fatigue and improve safety performance.[3,8]

Fatigue management programs (FMPs) are designed to address and change driver and operational factors to reduce driver fatigue. Ultimately, the goal of an FMP is to reduce the frequency of fatigue-related crashes and costs to drivers, carrier management, workers' compensation agencies, insurance companies, and the general roadway

public.[3] To accomplish this goal, an FMP attempts to realign corporate culture to support fatigue management, address dispatching practices that hinder drivers from obtaining adequate sleep, provide training and education to drivers to improve sleep habits, and introduce drivers to a sleep disorder screening and treatment program.

FMP Purpose

The purpose of this FMP is to address the issue of driver fatigue through a comprehensive approach that includes:

- Information about developing a corporate culture that facilitates reduced driver fatigue;
- Fatigue management education for drivers, drivers' families, carrier executives and managers, shippers and receivers, and dispatchers;
- Information about screening for and treating sleep disorders; and
- Driver and trip scheduling information.

After reviewing this implementation manual and the FMP modules, carrier executives and managers will be able to:

- Better understand the importance of driver fatigue management;
- Provide fatigue management training and education to drivers, drivers' families, carrier management, dispatchers, and shippers and receivers;
- Understand the basic principles and concepts of fatigue risk management systems (FRMSs);
- Adapt fatigue risk management concepts to their organizations;
- Measure and monitor fatigue indicators in their drivers; and
- Ultimately manage and reduce driver fatigue.

FMP MODULES

There are 10 different training modules included in this FMP. Table 1 lists the instructional modules, the target audience, and the amount of instruction required.

Table 1. Instructional Modules in the FMP

Module	Target Audience	Amount of Instruction
Module 1: FMP Introduction and Overview	Carrier Executives and Other Managers	45 minutes
Module 2: Safety Culture and Management Practices	Carrier Executives and Other Managers	1.5 hours
Module 3: Driver Education	Drivers	3 hours
Module 4: Driver Family Education	Drivers' Spouses and Family	45 minutes
Module 5: Train-the-Trainer for Driver Education and Family Forum	Trainers and Managers	3.5 hours
Module 6: Shippers and Receivers	Shippers and Receivers	30 minutes
Module 7: Motor Carrier Sleep Disorders Management	Carrier Executives and Other Managers	1.5 hours
Module 8: Driver Sleep Disorders Management	Drivers	1.25 hours
Module 9: Driver Scheduling and Tools	Dispatchers and Managers*	1 hour
Module 10: Fatigue Monitoring and Management Technologies	Carrier Executives and Other Managers	1 hour
*Can also be considered an advanced module for drivers		

As shown in Table 1, some of the FMP modules require a greater amount of instruction time. It is anticipated that each FMP module will take longer than the amount of instruction time listed in Table 2 to allow for breaks, questions, and discussions. The ideal amount of instruction should be 30 to 45 minutes, after which time trainees should be allowed to break for 5 to 10 minutes. Moreover, a didactic discussion of the material should occur between trainers and trainees prior to any break. The FMP modules requiring more than 1.5 hours of instruction should be split across several days to increase retention of the information (see FMP Modules 3 and 5). However, this split should not involve an excessive period of time (e.g., several weeks). A review of information presented during the previous instructional session should precede any new information session. This will reinforce concepts introduced during prior instructional sessions and will provide a segue into new concepts that will be discussed.

Unless otherwise noted in Chapter 2, each instructional module includes three delivery options: an instructor-led PowerPoint (PPT) presentation, a web-based non-interactive

course, and a web-based interactive course. Additionally, each module (unless otherwise noted in Chapter 2) includes a full script, a voiceover for web-based instructional methods, instructor notes for PPTs, quizzes, and lesson tests.

STEP-BY-STEP GUIDE TO IMPLEMENTING THE FMP

Careful consideration is required when developing, implementing, and evaluating the FMP. Each step of the FMP is critical to success and includes the following (please refer to Chapter 3 for a description of this process):

1. Development of an FMP steering committee;
2. FMP policy development;
3. Development of a process for FMP documentation;
4. Definition of roles and responsibilities in the FMP;
5. Development of a timeline for FMP implementation;
6. FMP introduction and awareness;
7. FMP training;
8. Development of strategies for ongoing FMP communication; and
9. FMP monitoring and evaluation.

FATIGUE RISK MANAGEMENT SYSTEMS

FRMSs are comprehensive and provide an ongoing, data-driven process designed to monitor and manage fatigue-related factors. The goal of an FRMS is to reduce CMV driver fatigue so drivers are sufficiently alert and able to optimally operate their CMVs. To accomplish this, FRMSs are designed to:[9]

- Proactively identify operational processes and other risks that contribute to the development of fatigue,
- Retrospectively identify fatigue-related factors that may have contributed to incidents,
- Improve operational processes that reduce the development of fatigue, and
- Develop strategies for mitigating factors that contribute to driver fatigue.

The primary function of an FRMS is to provide fatigue risk management procedures. These procedures provide fleets with the tools and processes necessary to achieve the fatigue-related safety objectives stated in an FRMS policy. These procedures ensure fatigued-related risks are identified, assessed, managed, and evaluated[1] through a

series of steps that include the following (please refer to Chapter 4 for a description of each step):

1. Identify where FRMS processes may apply within the organization,
2. Collect and analyze fatigue-related data,
3. Identify fatigue risk,
4. Assess safety risk,
5. Set measures and countermeasures, and
6. Evaluate the effectiveness of the measures and countermeasures.

FRMSs are different than an FMP. An FMP is purely educational, while FRMSs use indicators to identify fatigue risk factors and to monitor efficiency of mitigation strategies. However, to better manage driver fatigue, it is important to use FRMS strategies to develop additional mitigation plans that address fatigue risk factors in each fleet.

TRAIN-THE-TRAINER

Trainers will often be the “face” of the FMP since they will typically be the first person discussing fatigue management with drivers and other relevant personnel. This means it is critical for management to carefully select who will administer any fatigue management training. With this in mind, there are several prerequisites recommended for the FMP trainer. An FMP trainer must possess the following:

- Knowledge of CMV driving and personal experience driving a CMV,
- Previous experience training CMV drivers,
- Ability to model appropriate fatigue management behaviors,
- Ability to relate well to other drivers and their families,
- Enthusiasm for CMV driver fatigue management,
- Loyalty to the company, and
- Ethics related to driver confidentiality.

FMP trainers must possess, or have the ability to develop, the following:

- Skills in effectively presenting materials to a group,
- Computer skills,
- An understanding of adult learning and motivation,
- Ability to create an environment conducive to learning,
- Active listening and positive reinforcement skills,
- Knowledge of company policies, and
- An understanding of the behavior change process.

In addition to these skills, there are a number of steps the trainer must achieve before being allowed to facilitate FMP training and education modules, including:

- Prior successful completion of Modules 1, 3, 4, and 8 with an 80 percent or higher average exam score;
- Prior successful completion of at least one FMP training module (preferably Module 3 in the web-based interactive mode); and
- Successful completion of Module 5 with an 80 percent or higher exam score.

IMPLEMENTING AN OBSTRUCTIVE SLEEP APNEA (OSA) SCREENING AND TREATMENT PROGRAM FOR CMV DRIVERS

The following information is reproduced with permission from Mabry, Baker, Hickman, and Hanowski (2012). This information is presented to provide guideance on how to implement an OSA screening, treatement, and compliance program in CMV operations.

Two leading U.S. carriers (Schneider National, Inc. [SNI], and J.B. Hunt Transport, Inc. [JBH]) respectively partnered with commercial sleep apnea providers (Precision Pulmonary Diagnostics [PPD] and SleepSafe Drivers, Inc. [SSD, who later partnered with FusionHealth]) to implement obstructive sleep apnea (OSA) programs designed to screen, diagnose, treat, and manage OSA-positive CMV drivers. This resulted in a project, Case Study on the Impact of Treating Sleep Apnea in Commercial Motor Vehicle Drivers, and included focus groups and phone interviews conducted with drivers and staff involved in each OSA program to assess drivers' and staff perceptions and opinions of their respective OSA programs.

Procedures

VTTI research personnel conducted the driver focus groups at fleet terminal locations. A total of 15 drivers participated in the focus groups. After discussing all components of the OSA programs, including screening, education, testing, treatment, and compliance,

SNI and JBH drivers were asked to list the benefits and drawbacks they experienced while participating in the OSA program. SNI, JBH, PPD, and FusionHealth staff members were interviewed over the phone and/or face-to-face at a central location. A total of 17 staff participated in the phone interviews and/or focus groups. These staff participants were asked to list procedures that assisted in the implementation of the OSA program for SNI and JBH drivers and any challenges they faced.

Program Outcomes

The following summary discusses program outcomes highlighted by SNI and JBH drivers and SNI, JBH, PPD, and FusionHealth staff involved in their respective OSA programs. Overall, the majority of drivers expressed satisfaction with participating in their carrier's OSA program. Drivers reported benefits of their respective OSA programs, including: better quality of sleep, more energy and feeling better rested, improved health, and feeling less worried they would fall asleep while driving. Drawbacks of the OSA programs as reported by drivers included discomfort while sleeping with the positive airway pressure (PAP) device, mask discomfort, and complaints about the PAP device (including using it at home and cleaning and maintaining it). Drivers also complained about being "tied to" the PAP device, having to use the device during their personal time, and feeling that treatment is a life-long adjustment.

Overall, OSA program personnel believed their OSA programs were successful, and they were eager to continue refining and improving the programs. OSA program personnel cited several key aids in implementing and maintaining the OSA programs, including a supportive team of carrier and OSA provider staff who made roadway safety and driver health a priority. Another significant support system noted by staff was an established, effective compliance monitoring protocol accompanied by consistent follow-up with drivers. Staff reported challenges they faced while implementing and maintaining their OSA programs, including gaining driver acceptance of the program. Staff also experienced significant time delays between screening and testing drivers for OSA due to the high volume of drivers at risk for OSA. Staff also noted logistical challenges inherent to the trucking industry and the mobile workforce of drivers, as well as collecting and organizing PAP compliance data due to the volume of data received.

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LIST OF ABBREVIATIONS AND ACRONYMS

Acronym	Definition
AASM	American Academy of Sleep Medicine
ALPA	Air Line Pilots' Association, International
APAP	Automatic positive airway pressure
BAC	Blood alcohol concentration
BMI	Body mass index
CCOHS	Canadian Centre for Occupational Health & Safety
CDL	Commercial drivers' license
CMV	Commercial motor vehicle
CPAP	Continuous positive airway pressure
CVO	Commercial vehicle operation
DBL	Driver Business Leader
DOT	Department of Transportation
EDR	Electronic data recorder
EKG	Electrocardiogram
EMR	Electronic medical records
ESC	Electronic stability control
ESCAP	Economic and Social Commission for Asia and the Pacific
ESS	Epworth Sleepiness Scale
FCW	Forward collision warning
FDA	Federal Drug Administration
FMCSA	Federal Motor Carrier Safety Administration
FMP	Fatigue management program
FMT	Fatigue management technology
FOSQ	Functional Outcomes of Sleep Questionnaire

Acronym	Definition
FRMS	Fatigue risk management system
HOS	Hours-of-service
ICAO	International Civil Aviation Organization
JBH	J.B. Hunt
KSA	Knowledge, skills, and abilities
LDW	Lane departure warning
LMS	Learning management system
MRB	Medical Review Board
NAFMP	North American Fatigue Management Program
NASA	National Aeronautics and Space Administration
NASA TLX	NASA Task Load Index
NHTSA	National Highway Traffic Safety Administration
NSW MSAC	North South Wales Mine Safety Advisory Council
NTSB	National Transportation Safety Board
OSA	Obstructive sleep apnea
OSM	Onboard safety monitoring
PAP	Positive airway pressure
PPD	Precision Pulmonary Diagnostics
PPT	PowerPoint
PSG	Polysomnogram/Polysomnography
PVT	Psychomotor Vigilance Test
RSC	Roll stability control
SCE	Safety critical event
SD	Specification document
SMART	Specific, motivational, attainable, relevant, and trackable
SME	Subject matter expert

Acronym	Definition
SMS	Safety management system
SNI	Schneider National, Inc.
SSD	SleepSafe™ Drivers, Inc.
SSS	Stanford Sleepiness Scale
VPAP	Bi-level PAP
VTTI	Virginia Tech Transportation Institute

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CHAPTER 1. INTRODUCTION TO FATIGUE

Fatigue can best be defined as combinations of symptoms that include mental and physical elements, impaired performance, and subjective feelings of alertness.[1,2] Characteristics of fatigue include: loss of alertness, attention, and vigilance; increased wandering thoughts; decreased reaction time; distorted judgment; decreased motivation; impaired memory; reduced field of vision; and increased frequency of microsleeps.[3]

There are two types of fatigue: 1) acute, or short-term, fatigue; and 2) chronic, or long-term, fatigue.[10] Acute fatigue is experienced daily by most people and is caused by normal activity. Acute fatigue can often be reduced or eliminated by one night of sleep or a mid-day nap. Acute fatigue may also be reduced with caffeine consumption and rest (i.e., without any sleep). On the other hand, chronic fatigue is due to inadequate sleep across longer periods of time, which is called sleep deprivation. To recover from chronic fatigue, a few nights of long, sound sleep is needed.

CAUSES OF FATIGUE

There are a number of factors that influence the onset of fatigue. The major factor is insufficient sleep and/or rest. Acute fatigue may develop through the accumulation of insufficient sleep and/or rest, with long periods of wakefulness or insufficient rest eventually developing into chronic fatigue. Ongoing insufficient sleep quality and/or duration will eventually accumulate into "sleep debt," or sleep deprivation.

One reason for the development of sleep deprivation may be a sleep disorder such as obstructive sleep apnea (OSA). OSA is when breathing stops during sleep due to an obstruction of the throat. OSA is characterized by repeated closures of the upper airway that last approximately 10 seconds or more each time. In addition to sleep disorders, factors that may influence the onset of fatigue include: shifts worked (e.g., day versus night shifts), increased stress (e.g., financial difficulties), the misuse of alcohol, use of prescription and over-the-counter medications, and illegal drug use.[1,11]

IMPLICATIONS OF FATIGUE

Fatigue can lead to a range of health and wellness complications for individuals and a number of problems that can contribute to crashes and near-crashes. The following health and wellness issues may result, at least in part, from fatigue:[12]

- Increased blood pressure
- Increased risk of heart disease
- Gastrointestinal problems
- Increased calorie consumption
- Weight gain
- Disruption of circadian rhythm
- Type II diabetes
- Poor immune system function
- Increased likelihood to smoke and use alcohol
- Increased irritability and depression
- Disruption in relationships
- Worsening of psychiatric conditions
- Decreased quality of life
- Increased number of sick days used

In addition to these health and wellness implications, fatigue can increase the risk of involvement in a crash and/or near-crash.[13,14] Fatigued drivers perform more inappropriate lane deviations and have slower steering responses,[15-19] experience reductions in responses to speed changes of a lead vehicle,[20] have increased speed variations,[21] exhibit slower reaction times,[18] experience impaired visual scanning or "tunnel vision,"[15] and are at risk of falling asleep at the wheel.[22,23] All of these factors increase the likelihood of crashes and near-crashes resulting from driver error.

FATIGUE AND COMMERCIAL MOTOR VEHICLE OPERATIONS

As mentioned above, the symptoms associated with fatigue can lead to involvement in a vehicle crash. In 1990, for example, the National Transportation Safety Board (NTSB) studied 182 fatal-to-the-driver large truck crashes.[4] The in-depth investigations conducted by NTSB revealed fatigue to be a principal cause in 31 percent of these crashes (fatigue was the largest single cause of truck crashes in the study). Additionally, Knipling and Wang[5] found that commercial motor vehicle (CMV) drivers were asleep at the wheel in 4 percent of all heavy-vehicle crashes, and the Federal Motor Carrier Safety Administration (FMCSA)[6] found that fatigue was a contributing factor in 13 percent of serious CMV crashes (i.e., crashes involving serious injuries and/or fatalities). Furthermore, FMCSA estimated that fatigue was a factor in 15 percent of all fatal large-truck-related crashes.[7] The agency estimated that fatigue was directly involved in 4.5 percent of these crashes, while mental lapses and inattention associated with fatigue were directly involved in 10.5 percent of fatal large-truck-related crashes. Regardless of the degree to which fatigue was an associated factor during these CMV crashes, it is apparent that fatigue-related crashes among CMV drivers are prevalent given drivers' extended work hours and shifts that can start at various times of the day and night.

Factors that Affect Fatigue in CMV Drivers

As previously mentioned, fatigue is associated with an increased risk of crashes and near-crashes. Research has shown that fatigue affects driving performance similar to alcohol consumption.[24-27] Simulator studies found that drivers who were awake for 18 hours had decreased driving performance comparable to their performance with a 0.05 blood alcohol concentration (BAC) level. This is noteworthy considering the legal BAC limit for CMV drivers in the United States is 0.04. When these drivers were awake for 24 hours, their driving performance was comparable to their performance with a 0.08 BAC, which is the limit for non-CMV drivers.

Issues associated with fatigue in CMV operations can be conceptualized into three areas: driver, environmental, and operational factors.[3] When addressing fatigue in CMV operations, it is important to identify how these three areas relate as each factor can influence the others. For example, operational and environmental factors may influence driver factors such as sleep deprivation or sleep hygiene practices. Solutions to manage CMV driver fatigue should consider the following driver, environmental, and operational factors:

Driver factors

- Circadian rhythm performance
- Sleep deprivation
- Sleep disorders
- Sleep hygiene practices
- General physical health
- Lifestyle factors
- Diet
- Emotional state
- Domestic factors

Environmental factors

- Weather
- Road conditions
- Seasonal variations
- Engineering/ergonomics

Operational factors

- Hours-of-service (HOS) regulations
- Owner/operator issues and contacting
- Loading/unloading practices
- Dispatching practices
- Rest areas
- Sleeper berth regulations
- Corporate culture

INTRODUCTION TO FATIGUE MANAGEMENT PROGRAMS

CMV driver fatigue is a serious issue that affects all motorists on the roadway. One way to respond to driver fatigue is through prescriptive HOS rules. . HOS compliance, for both daily and weekly requirements, is essential for rest/sleep. However, a more proactive and comprehensive approach will support drivers in further managing other risk factors that contribute to fatigue. Research has shown there are numerous factors that impact driver fatigue; no simple solution exists to reduce driver fatigue and improve safety performance.[3,8]

Fatigue management programs (FMPs) are designed to address and change driver and operational factors to reduce driver fatigue. Ultimately, the goal of an FMP is to reduce the frequency of fatigue-related crashes and costs to drivers, carrier management, workers' compensation agencies, insurance companies, and the general roadway public.[3] To accomplish this goal, an FMP attempts to realign corporate culture to support fatigue management, address dispatching practices that hinder drivers from obtaining adequate sleep, provide training and education to drivers to improve sleep habits, and introduce drivers to a sleep disorder screening and treatment program.

FMP Purpose

The purpose of an FMP is to address the issue of driver fatigue through a comprehensive approach that includes:

- Information about developing a corporate culture that facilitates reduced driver fatigue;
- Fatigue management education and training for drivers, drivers' families, carrier executives and managers, shippers/receivers, and dispatchers;
- Information about screening for and treating sleep disorders; and
- Driver and trip scheduling information.

Although training and education are critical factors in an FMP, these elements can only change behavior to a certain degree. Organizational changes and long-term programs are needed to sustain lasting behavioral change. Management practices should be developed to encourage lasting changes in fatigue management behaviors,[9,28] and screening and treatment programs should be developed to identify and treat sleep disorders.

Benefits of an FMP

There are three major areas in which an FMP is beneficial to the organization if implemented successfully: safety, driver health and well-being, and finances.[11] Safety benefits of an FMP include reduced fatigue-related risks, reduced crashes and near-crashes, and improved alertness. The purpose of an FMP is to reduce or eliminate the risks associated with fatigue while increasing drivers' alertness levels. Successful fatigue measures and countermeasures will reduce these risks while decreasing the number of crashes and near-crashes associated with fatigue.

Health and wellness benefits of an FMP include increased job and life satisfaction, fewer health complications, and weight loss. Fatigue may contribute to drivers experiencing

less satisfaction with their jobs and lives. Therefore, an FMP may promote increased job and life satisfaction by helping drivers acquire adequate sleep. Furthermore, research has linked sleep deprivation with a variety of serious illnesses, including obesity and diabetes,[29] gastrointestinal problems,[30] and an increased risk of cancer.[31] Implementation of an FMP can help to offset these health complications through driver education.

Lastly, financial benefits of an FMP include reduced legal exposure and lower healthcare- and crash-related costs. FMPs help carriers proactively prevent fatigue-related crashes, thus limiting legal matters and associated costs. Furthermore, as FMPs result in health and wellness benefits to drivers, carriers may experience lower healthcare costs. For example, Schneider National, Inc. (SNI) implemented an FMP for 339 drivers with sleep apnea. The study evaluated the related safety performance and healthcare costs 12 months before drivers were treated for sleep apnea and 12 months after treatment. Results showed that in the months following treatment, preventable crashes were reduced by 30 percent, with the median cost of crashes reduced by 48 percent. The driver retention rate improved by 60 percent, and healthcare costs were reduced by more than 50 percent (a $539 per driver/per month savings). An expanded study in 2006 tracked 788 drivers and saw similar results.[32] A cost-benefit calculator is included in the FMP that allows carriersto calculate the potential savings resulting from FMP implementation.

THE NORTH AMERICAN FMP

For the past several years, Canadian and American regulators, carriers, and researchers have worked on the development of a comprehensive approach for managing fatigue. This work has been led by the steering committee of the North American Fatigue Management Program (NAFMP), a consortium of government and industry agencies with an interest in creating a more effective means of dealing with professional driver fatigue. The NAFMP Steering Committee comprises Transport Canada, FMCSA, Alberta Transportation, Alberta Workers Compensation Board, Alberta Employment and Immigration, Société de l'assurance automobile du Québec, Commission de la santé et de la sécurité du travail du Québec, Canadian Trucking Alliance, Alberta Motor Transport Association, American Transportation Research Institute, and the Quebec Trucking Association. The NAFMP Steering Committee agreed to develop a comprehensive FMP designed to enhance a carrier’s ability to effectively deal with the challenges of fatigue in a highly competitive, widely dispersed, and rapidly changing industry.

The initial phase of work began with the identification of elements to be included in a comprehensive FMP. This was followed by a series of focus groups held with motor carrier drivers, dispatchers, and managers to assist in the project design. A small beta test of the FMP was performed using six drivers. A second phase involved the development of educational and training materials and the development and assessment of procedures for field testing.[3] Field data collection was completed in Quebec, Alberta, and Texas. A third phase included full implementation of a comprehensive FMP in Quebec, Alberta, and California carrier operations to test program effectiveness in reducing driver fatigue and to better understand practical implications for carrier operations.[33] The results indicated significant safety benefits available to motor carriers that chose to implement a comprehensive approach to fatigue management. The fourth phase (the current output) involved the development of a final version of the FMP based on the recommendations and findings from the previous three phases.

Along with NAFMP, the Virginia Tech Transportation Institute (VTTI) was charged with developing the content included in the final FMP. Additionally, VTTI oversaw the development of the overall FMP structure and produced the current FMP Implementation Manual (which encompasses FMP procedures and materials).

SUMMARY OF THE IMPLEMENTATION MANUAL

To facilitate implementation of a comprehensive FMP, VTTI developed the current manual for use by carrier management, including safety managers, fleet managers, logistics managers, transportation managers, and others responsible for designing and applying the motor carrier FMP of a company or an organization. This manual is a practical, easy-to-understand reference guide for implementing an FMP. It includes chapters about module content, fatigue risk management systems (FRMSs), developing and implementing the FMP, train-the-trainer concepts, and a step-by-step guide for developing a sleep disorder screening and treatment program in CMV operations.This implementation manual includes the following:

- **Overview of the NAFMP**
    - Module format
    - Module content
- **FRMSs**
    - Definition of FRMSs
    - Factors that contribute to fatigue
    - Fatigue risk assessment and control
    - Evaluations
- **Safety Culture**
    - Definition and benefits of an FMP

    - Role of safety culture and chain of responsibility in an FMP
    - Roles and responsibilities in an FMP
    - Performance measures and rewards in an FMP
- **Train-the-trainer**
    - Introduction to learning
    - How to select a trainer
    - Trainer prerequisites, requirements, and responsibilities
    - Strategies for effective instruction
- **Sleep Disorder Screening and Treatment Programs**
    - Strategies for identifying at-risk drivers
    - Implementing sleep disorder screening and treatment programs

SUMMARY

Research has shown that fatigue can increase the risk of CMV crashes and near-crashes.[13,14] This may be the result of fatigue contributing to performance decrements in CMV drivers (e.g., inappropriate lane deviations, increased speed variations, "tunnel vision," slower reaction times, and falling asleep at the wheel). CMV drivers may be more susceptible to fatigue given their extended driving and work hours, their shifts, and their irregular work schedules. Although there have been a number of traditional regulatory methods (e.g., HOS regulations) developed to mitigate CMV driver fatigue, a more comprehensive approach (e.g., an FMP) will support CMV drivers in further managing other risk factors that contribute to fatigue. The FMP developed by NAFMP attempts to realign corporate culture to support fatigue management, address dispatching practices that hinder drivers from obtaining adequate sleep, provide training and education to drivers to improve sleep habits, and introduce drivers to sleep disorder screening and treatment programs.

CHAPTER 2. OVERVIEW OF THE NORTH AMERICAN FATIGUE MANAGEMENT PROGRAM

There is sufficient knowledge now to allow for the development of a “guide to motor carriers” that addresses the design and implementation of an FMP into ongoing carrier operations. This guide takes into account the best current research about corporate culture, education and training, sleep disorder screening and treatment, scheduling, and fatigue monitoring technologies. The purpose of this work was to design and develop an FMP for use by carriers (e.g., trucks and motorcoaches) of all sizes anywhere in North America. There are three primary features of the current FMP: training and education modules, an FMP website, and the implementation manual. These three features address the following:

- Key elements of a comprehensive FMP (including corporate culture, education and training, sleep disorder screening and treatment, scheduling and tools, and fatigue monitoring and management technologies);
- Challenges in reaching firms of all sizes dispersed throughout the continent;
- Challenges in reaching drivers who are often widely dispersed to provide training, medical screening, and support;
- The need to involve drivers, all levels of company management and staff, and family members;

- The need to involve shippers to sensitize them to driver fatigue considerations and to better manage their interactions with drivers in this regard;
- The need to integrate appropriate technologies associated with fatigue management;
- The need to monitor compliance using specific medical and technical interventions; and
- The need for performance measures and the infrastructure necessary to evaluate FMP efficacy and adjust as indicated.

The technical approach below provides an overview of the FMP training modules and website. There are 10 different training modules produced with a common architecture (though differing in specific components). Table 2 shows the instructional modules, the target audience, and the amount of instruction necessary. The FMP training modules and website are described below.

Table 2. Instructional Modules in the FMP

Module	Target Audience	Amount of Instruction
Module 1: FMP Introduction and Overview	Carrier Executives and Other Managers	45 minutes
Module 2: Safety Culture and Management Practices	Carrier Executives and Other Managers	1.5 hours
Module 3: Driver Education	Drivers	3 hours
Module 4: Driver Family Education	Drivers' Spouses and Family	45 minutes
Module 5: Train-the-Trainer for Driver Education and Family Forum	Trainer and Managers	3.5 hours
Module 6: Shippers and Receivers	Shippers and Receivers	30 minutes
Module 7: Motor Carrier Sleep Disorders Management	Carrier Executives and Other Managers	1.5 hours
Module 8: Driver Sleep Disorders Management	Drivers	1.25 hours
Module 9: Driver Scheduling and Tools	Dispatchers and Managers*	1 hour
Module 10: Fatigue Monitoring and Management Technologies	Carrier Executives and Other Managers	1 hour
*Can also be considered an advanced module for drivers		

HOW TO IMPLEMENT THE INSTRUCTIONAL MODULES

As shown in Table 2, some of the FMP modules require a greater amount of instruction time. It is anticipated that each FMP module will take longer than the amount of instruction time listed in the table to allow for breaks, questions, and discussions. The ideal amount of instruction should be 30 to 45 minutes, after which time trainees should be allowed to break for 5 to 10 minutes. Moreover, a didactic discussion of the material should occur between trainers and trainees prior to any break. The FMP modules requiring more than 1.5 hours of instruction should be split across several days to increase retention of the information (see FMP Modules 3 and 5). However, this split should not involve an excessive period of time (e.g., several weeks). A review of information presented during the previous instructional session should precede any new information session. This will reinforce concepts introduced during prior instructional sessions and will provide a segue into new concepts that will be discussed.

INSTRUCTIONAL METHODS, MEDIA, AND MATERIALS

VTTI assigned a lead subject matter expert (SME)/author to each of the FMP elements. Each SME/author developed content within the confines of the VTTI-approved

specification document (SD) to ensure consistency between modules. Unless otherwise stated, instructional methods, media, and materials used in each FMP module include: (i) instructor-led PowerPoint (PPT) presentations, (ii) a web-based non-interactive course, and (iii) a web-based interactive course (described below). Table 3 shows the 10 educational and training modules developed by the VTTI team and training deliverables of each module.

Table 3. Educational and Training Modules Developed by VTTI and Training Deliverables of each Module

Module	Training Delivery Modes		
	Instructor- led (PPT)	Web-based, Non-interactive	Web-based, Interactive
Module 1: FMP Introduction and Overview	X (no test)	X (no test)	X (no test)
Module 2: Safety Culture and Management Practices	X	X	X
Module 3: Driver Education	X	X	X
Module 4: Driver Family Education	X (optional test)	X (optional test)	X (optional test)
Module 5: Train-the-Trainer for Driver Education and Family Forum	X	X	X
Module 6: Shippers and Receivers	X (no test)	X (no test)	X (no test)
Module 7: Motor Carrier Management Sleep Disorders Screening and Treatment	X	X	X
Module 8: Driver Sleep Disorders Screening and Treatment	X	X	X
Module 9: Driver Scheduling and Tools	X	X	X
Module 10: Fatigue Monitoring and Management Technologies	X (no test)	X (no test)	X (no test)

Instructor-led PPT Presentations

For each of the 10 modules specified in Table 3, a PPT presentation (e.g., Figure 1) was created for use by an instructor. The instructor-led PPT presentations are targeted at carriers with existing instructor resources and will feature:

- Slides with bullet phrases,
- Slides with quiz questions,
- Instructor notes with a detailed explanation of each bullet phrase,
- Instructor notes with suggestions for class discussions or other interactions,
- Edited slide and instructor notes,
- Custom slide background,
- Slide and bullet transitions, and

- Still images (e.g., illustrations, schematics, photos; up to one per planned minute of instruction).

Figure 1. Example of PPT Slide from Module 1.

The PPT presentations may be distributed by posting to a website or saving to media (e.g., CD or removable USB flash drive).

Web-based Non-interactive Course without Test

For each of the 10 modules specified in Table 3, a self-paced PPT presentation was created for use when an instructor-led presentation was unavailable. The self-paced presentations are targeted at carriers without existing instructor resources and are the same as the instructor-led presentations except that:

- The self-paced presentations include a full script, with transitions, for each slide; and
- A voiceover was recorded in a studio with professional voice talent and inserted into the self-paced presentations.

The self-paced PPT presentations may be distributed by posting to a website or saving to media (e.g., CD or removable USB flash drive). These courses are non-interactive in that users are not presented with quizzes, tests, or exercises that require responses, thus no user scores are generated. Nevertheless, information is presented in an engaging, non-pedantic style in which questions are posed to the user and are answered during the course of the presentation. Users may stop, start, and rewind the presentation as needed to ensure comprehension. Each transcript used during the self-

paced PPT presentations was written by an SME and can be applied during the instructor-led PPTs to assist instructors and/or guide new instructors.

Web-based Interactive Course with Test

For each of the 10 modules specified in Table 3, a web-based interactive course was developed using a proprietary course authoring tool. The web-based include functionality and interactivity such as:

- Periodic quizzes,
- Interactive exercises,
- Complete voiceover,
- Still images (up to one per planned minute of instruction),
- Video, and
- Lesson tests (except for Modules 1 and 6).

The presentations appear similar to Figure 2 in that course chapters are listed along the top of the content area. Text is provided on the left side; images or videos are provided on the right side.

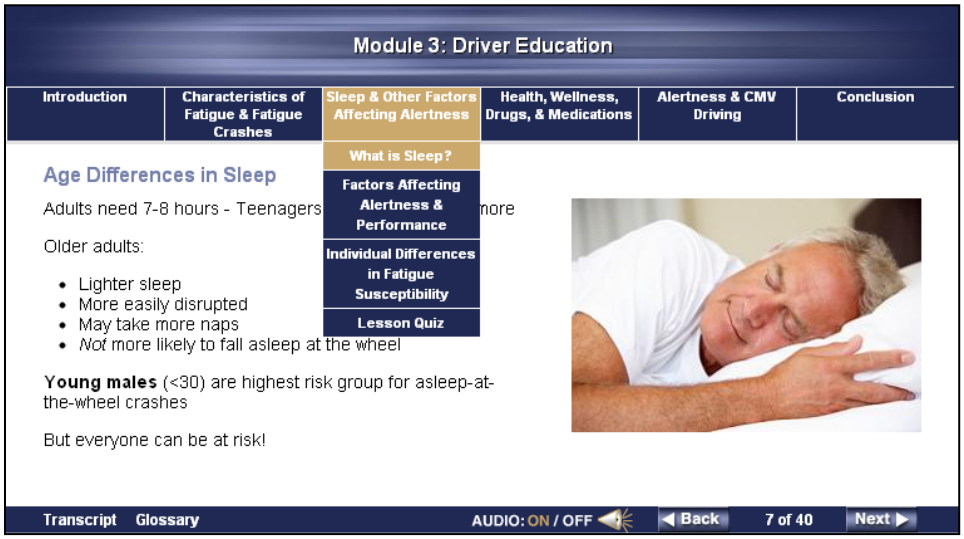


Figure 2. Example of the Web-based Interactive Course.

As shown in Figure 2, each module includes an outline with drop-down menus for sub-levels and navigational information. The bottom task bar in Figure 2 illustrates that learners are able to: return to a given topic at the end of each section, revisit any lesson upon completion of the final module exam, access the transcript text, access the resource button for links to external websites or PDF downloads, and disable the audio. Periodic questions or exercises (also called checks on learning) were also constructed to assess learners' comprehension of the materials. Checks on learning appear

throughout the course, occur during lesson tests (e.g., questions about a specific sub-module topic), and during course exams (e.g., questions about the entire module). Checks on learning questions will be used in the formats of multiple choice, multiple answer (Figure 3); multiple choice, single answer (see Figure 4); matching (see Figure 5); circle answer (see Figure 6); categorization (see Figure 7); and sequencing (see Figure 8).

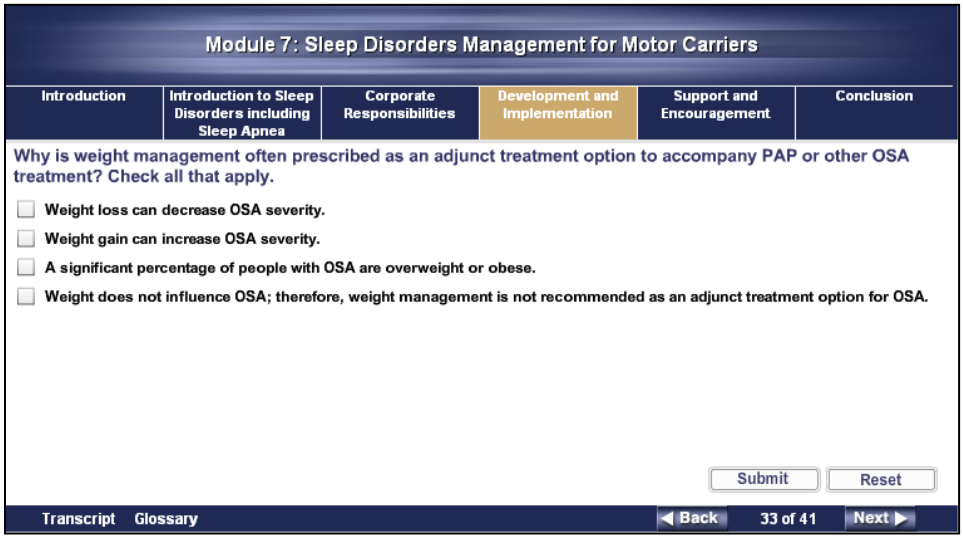


Figure 3. Example of Multiple Choice, Multiple Answer.

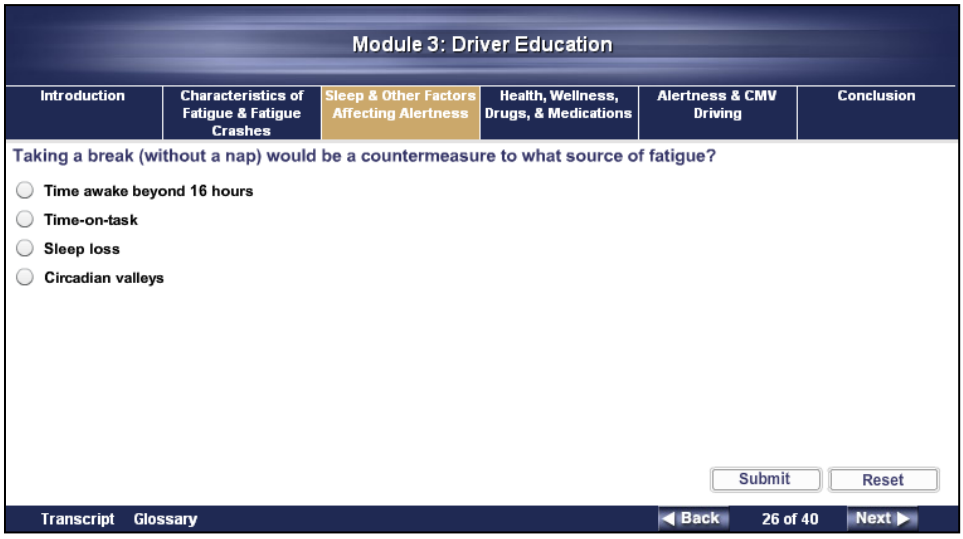


Figure 4. Example of Multiple Choice, Single Answer.

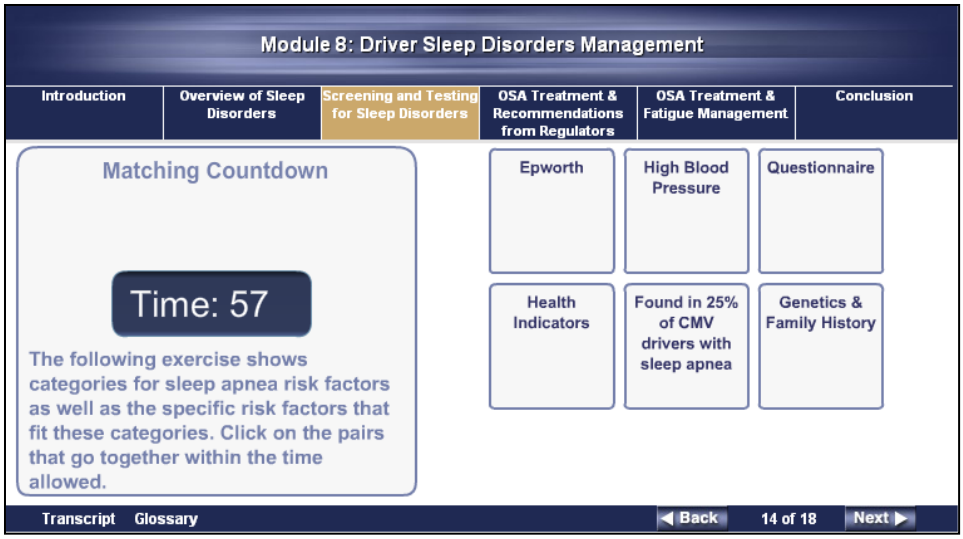


Figure 5. Example of Match Game.

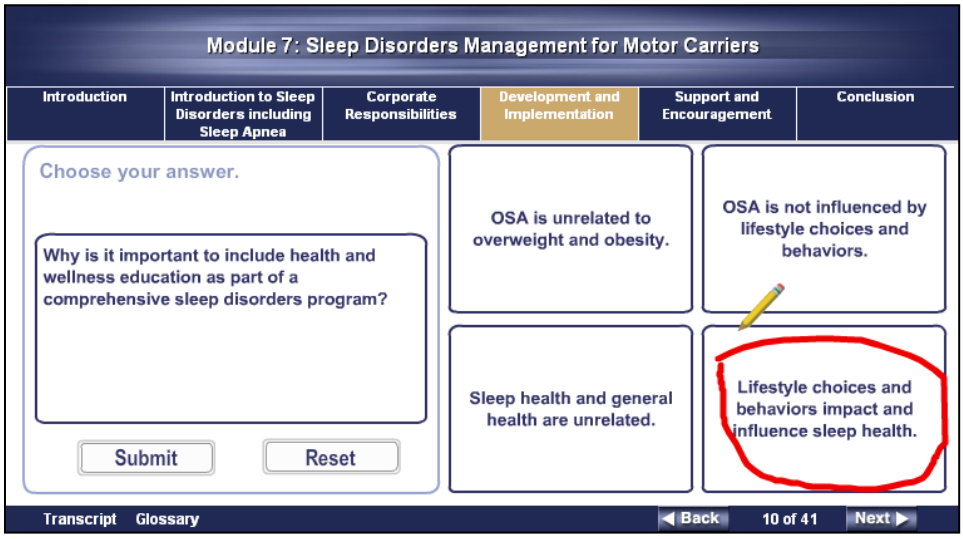


Figure 6. Example of Circle Answer.

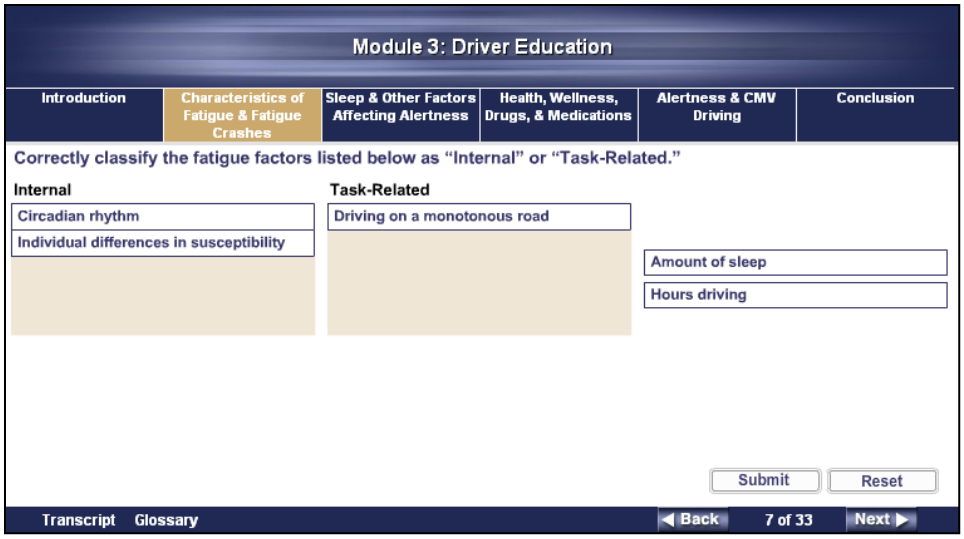


Figure 7. Example of Categorization.

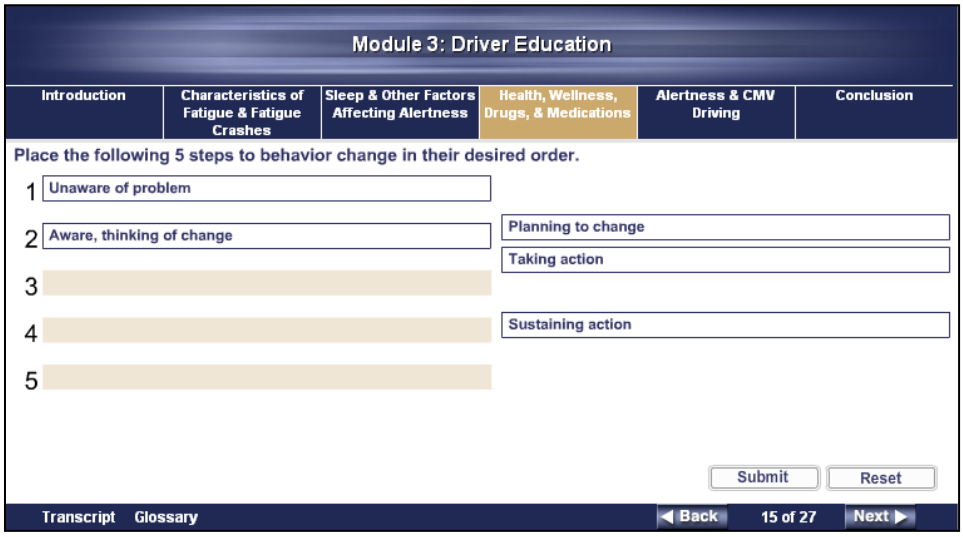


Figure 8. Example of Sequencing.

All FMP modules are available in the three delivery modes (i.e., instructor-led PPT presentations, web-based non-interactive course, and web-based interactive course) except for Modules 1, 4, 6, and 10. These latter modules provide an overview where fully interactive training with testing and score tracking would not be appropriate (although Module 4 has an optional testing component if desired). The other six modules have a testing/score-tracking option because of the desire to evaluate driver and carrier performance standards and to ensure accountability within the FMP structure.

OVERVIEW OF INSTRUCTIONAL MODULES

As indicated, there are 10 FMP educational and training modules that target various audiences (see Table 2). An overview of each module is provided below. Appendix A contains a list of useful references that are cited in each of the 10 FMP training and educational modules.

Module 1: FMP Introduction and Overview

The first FMP training and educational module is an introduction and overview of the FMP. This comprises three components:

1. Introduction to the FMP,
2. Concept and benefits of an FMP, and
3. Summary of modules in the FMP.

The goals of this training module are to educate and increase awareness of the various FMP processes and training components among motor carrier executives, transportation directors, and safety managers. Module 1 is targeted at decision makers within fleets to provide them with a thorough overview of the FMP.

Module 2: Safety Culture and Management Practices

Safety culture has remained a popular topic in safety literature since the Chernobyl disaster in 1986.[34] However, the exact definition of safety culture has been widely debated.[35] There are some common characteristics shared by safety culture definitions such as the incorporation of beliefs, values, and attitudes that are common to a group of workers.[36,37] Although an assortment of safety culture variables have been correlated with injury rates (e.g., management support/commitment to safety,[38] communication,[39] risk perception,[40] physical and psychological demands,[38] satisfaction with job,[40] employee participation in decision making[41]), an organization's safety culture is ultimately reflected in the way in which safety is managed in the workplace. A safety management system (SMS) is the manner in which safety is handled in the workplace and how those policies and procedures are implemented into the workplace.[42] Thus, it is evident that an SMS and the safety culture of an organization are closely related. Previous research has shown a relationship between organizational factors and crash injury rates.[43] Therefore, an enhanced safety culture is a necessary tool in an effective FMP. Figure 9 shows an example feedback loop to be used by carrier management in the successful application of health management systems and SMSs.

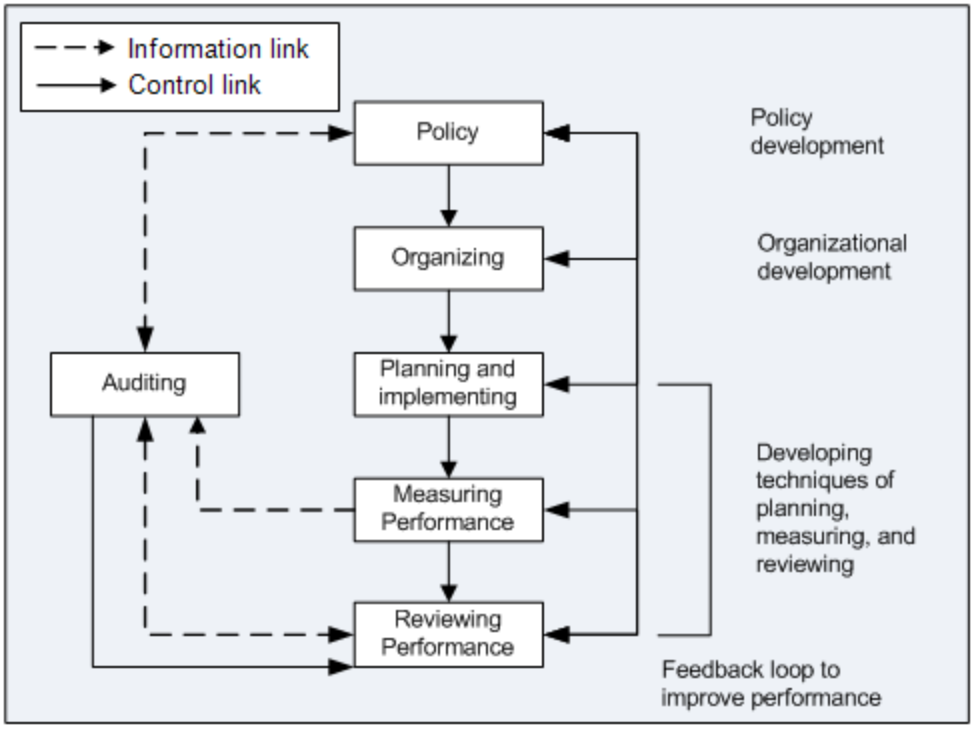


Figure 9. Key Elements of a Successful Health Management System and SMS (adapted from the Health and Safety Executive[44]).

Module 2 provides an introduction to safety culture and discusses management practices necessary to developing and implementing a successful FMP. This training and educational module comprises five components:

1. Introduction to safety culture,
2. Corporate responsibilities and roles in FMP implementation,
3. Strategies for engaging and empowering staff and generating commitment to the FMP,
4. A step-by-step guide to corporate culture change, and
5. Performance measures to gauge the efficacy of the FMP.

The goal of Module 2 is to increase awareness of the various safety culture components of implementing and maintaining a successful FMP within the community of motor carrier executives, transportation directors, and safety managers. Through this module, decision makers at fleets will be better prepared to make informed decisions and ask key questions concerning effective SMS techniques.

This module provides guidance for carriers of all sizes about implementing and maintaining a successful safety culture within an FMP. As an organization's safety culture influences multiple aspects of performance, Module 2 provides motor carrier executives, transportation directors, and safety managers with the necessary tools to

encourage their employees to: commit to personal responsibility for safety and act to preserve, enhance, and communicate safety concerns; actively listen, adapt, and modify behavior; and strive to be honored in association with these values. Although all organizations possess a safety culture to some degree, it is anticipated that those carriers successfully implementing and adhering to the techniques and methods of their corporate culture training module will have a high-quality FMP with employee follow-through. That is, a positive safety culture must be in place prior to implementing an FMP, otherwise the efforts of management to successfully execute an FMP will likely fail or desired success will not be achieved.

Module 3: Driver Education

Fatigue management ultimately focuses on the driver. Therefore, drivers are the most important people in the FMP. Furthermore, effective and rigorous driver fatigue education is necessary before carriers can truly be considered an FMP fleet. Module 3 focuses on providing CMV drivers with fatigue management education. This training and educational module comprises 11 components:

1. Introduction to the FMP;
2. Importance of sleep, alertness, and wellness;
3. Characteristics of fatigue and fatigue-related crashes;
4. Characteristics and structure of sleep;
5. Key factors affecting alertness and performance (i.e., causes of fatigue);
6. Individual differences in fatigue susceptibility;
7. Health and wellness;
8. Drugs and medications;
9. Improving sleep and alertness;
10. Scheduling and HOS; and
11. Team driving.

The goal of Module 3 is the transfer of critical driver fatigue management knowledge, skills, and abilities (KSAs) to CMV drivers so they can achieve FMP certification. This certification will help drivers self-identify as responsible managers of their fatigue/alertness and as cooperative participants in the FMP of their respective fleet. Through this education, drivers will be better prepared to perform effective fatigue management behaviors.

Module 4: Family Education

Drivers' families play an important role in supporting drivers' efforts to reduce fatigue. Therefore, it is important to provide drivers' families with fatigue management education. Module 4 provides a limited amount of the information available in Module 3 to drivers' families so they can better support their drivers' fatigue management efforts. This educational module comprises nine components:

1. Importance of sleep, alertness, and wellness;
2. Importance of home and family to CMV driver sleep, wellness, and alertness;
3. Characteristics of driver fatigue and fatigue-related crashes;
4. Characteristics and structure of sleep;
5. Key factors affecting alertness and performance (emphasis on those most relevant to the home environment);
6. Sleep disorders;
7. Health and wellness;
8. Drugs and medications; and
9. Improving sleep and alertness.

The goals of this training are to improve home support for driver sleep hygiene (e.g., sleep quantity and quality) and wellness and to impart the most important sleep/fatigue knowledge and attitudes to drivers' families.

Module 5: Train-the-Trainer

The FMP trainer is likely the face and principal conveyor of fatigue education and training for drivers and their family members who receive group instruction. Prior FMP phases II[3] and III[33] identified carrier trainers as a possible weak link in the FMP concept. Most carrier safety trainers are former drivers who have been promoted into management positions. They have varying academic skills and general book knowledge about human sleep, alertness, and performance. However, they are positioned to have credibility and the greatest possible influence on drivers (as most transport companies do not have the resources to hire fatigue/alertness SMEs as trainers). Therefore, there must be an effective and practical train-the-trainer element in

the FMP. Module 5 is designed for those individuals who will train drivers and drivers' families during Modules 3 and 4, respectively. Therefore, Module 5 will address the training topics and functions discussed during Modules 3 and 4. Unlike previous modules, there are several prerequisites for this module. The individual who will become the FMP trainer must complete Modules 3 and 4 before beginning Module 5. Additionally, previous experience as a driver trainer, carrier safety manager, or fatigue/alertness SME should be a preferred qualification (although not enforceable). This FMP educational and training module comprises eight components:

1. Trainer functions in the FMP,
2. FMP training overview,
3. Trainer requirements and responsibilities,
4. Web-based training,
5. Strategies for effective instruction,
6. Driver education training,
7. Family education training, and
8. Facilitating behavior change.

The goal of Module 5 is to prepare trainees to be effective trainers of the materials presented during Modules 3 and 4. To accomplish this goal, the following strategies will be used:

- Review the instructional methods and procedures in Modules 3 and 4 and the overall FMP,
- Review the content in Modules 3 and 4 to reinforce knowledge,
- Expand trainer fatigue/alertness knowledge with additional information about module topics, and
- Motivate trainers to teach the modules authoritatively and enthusiastically.

Module 6: Shipper and Receiver Education

Shipper and receiver practices have a major effect on driver alertness, fatigue, wellness, and HOS compliance. The active support of shippers and receivers for pro-driver-alertness practices (or at least passive acceptance of them) reinforces and facilitates a carrier's FMP. Therefore, it is important to provide shippers and receivers with pertinent information about the causes and effects of driver fatigue and strategies they can employ to reduce driver fatigue.

The first few years of a carrier-implemented FMP are not likely to include a requirement that shippers and receivers obtain any specified education or that they be certified as having received this education. Rather, this education is something that FMP carriers

will offer to shippers and receivers on a voluntary basis. This module has been made interesting and compelling for the trainees, with the goal of motivating shippers and receivers to adopt practices supportive of driver alertness (or at least acquire basic knowledge of how their practices affect driver alertness, fatigue, wellness, and HOS compliance). Furthermore, this module is not pedantic, technical, or rigorous. Module 6 includes nine separate components:

1. Importance of driver sleep, alertness, and wellness;
2. Severity and economic consequences of driver fatigue-related crashes;
3. Factors affecting alertness and fatigue;
4. Overview of driver HOS rules as a separate, legal requirement;
5. Driver fatigue management challenges;
6. Importance of all transport “partners” to driver sleep, wellness, and alertness. Shippers, receivers, and bus charter customers are part of drivers’ “work families” and are ideally members of the fatigue management prevention “team”;
7. “Chain-of-responsibility” concept;
8. Industry guidelines and standards; and
9. Critical shipper and receiver best practices.

The goals of Module 6 are to: (i) impart knowledge of the most important factors enabling sleep and the development of fatigue, (ii) improve shipper and receiver support for driver sleep hygiene (e.g., sleep quantity and quality) and wellness, and (iii) provide information about specific shipper and receiver practices that impact driver alertness and fatigue (so these practices can be eliminated or revised). A principal strategy is to make shippers and receivers feel they are “partners” in fatigue management and part of the drivers’ “work family.”

Modules 7 and 8: Motor Carrier and Driver Sleep Disorders Management

Medical screening, testing, and initiation and monitoring of treatment for OSA and other prevalent sleep disorders (e.g., restless leg syndrome, insomnias, hypersomnias, and parasomnias) are essential elements of an FMP. Challenges exist due to the nature of the motor carrier industry and include: unique logistical issues; engaging, screening, and testing often reluctant drivers for OSA and other sleep disorders; and providing long-term treatment and care for those with these disorders. The medical technologies applicable to sleep disorder screening, testing, treatment, and monitoring are progressing rapidly. This creates an excellent and timely opportunity to implement and demonstrate the outcomes of a sleep disorders screening and treatment program within an FMP that is tailored to fit the challenges of the motor carrier industry.

There are two modules within the FMP that focus on sleep disorders education, screening, and treatment: (i) Module 7, which is targeted at motor carrier executives, management, dispatchers, and other key administrative personnel in the motor carrier industry; and (ii) Module 8, which is targeted at CMV drivers. Figure 10 illustrates the two sleep disorders modules and how they interact. As shown in Figure 10, these modules can be adapted to trucking fleets of all sizes and to all types of drivers (e.g., independent operators or fleet drivers). The following topics are included within Modules 7 and 8:

- Strategies and processes for motor carrier personnel to identify drivers at risk for OSA and other prevalent sleep disorders and a clear and definitive way for drivers to self-assess their risk for developing these sleep disorders;
- Strategies for motor carriers to implement sleep disorder education, screening, and diagnostic testing programs into their fleets. Recommendations include strategies for accessing sleep specialists and sleep laboratories and using appropriate portable sleep testing (considering the logistical challenges in the industry). These strategies were developed with due consideration of current guidelines and recommendations outlined by the American Academy of Sleep Medicine (AASM) and the FMCSA Medical Review Board (MRB);
- Recommendations for effective sleep disorders treatment and compliance monitoring programs and ongoing support programs for drivers who require medical intervention and rehabilitation for sleep disorders; and
- Development of a sleep disorders program that effectively identifies drivers who do not comply with sleep disorders treatment(s) and recommendations for effective solutions that improve treatment compliance.

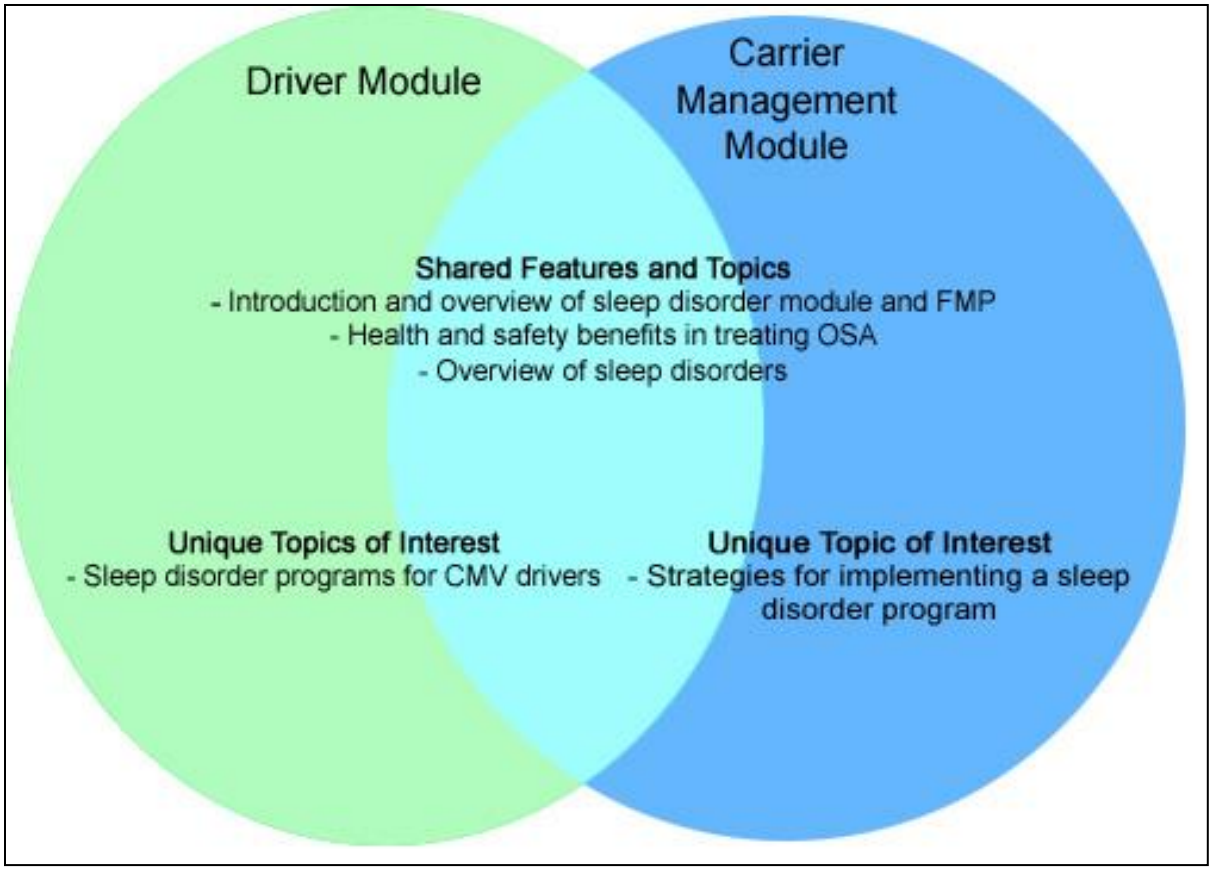


Figure 10. Representation of the Driver and Motor Carrier Management Sleep Disorders Management Modules.

Module 7: Motor Carrier Sleep Disorders Management

Carriers may use programs to educate, screen, test, treat, monitor, and support drivers with sleep disorders. However, challenges exist as motor carrier executives and management are often not equipped with the knowledge or resources to implement such programs. The dispersion of the industry and drivers across North America also introduces major logistical challenges to creating strategies designed to test drivers for sleep disorders and to providing long-term treatment and care that can be administered and monitored rapidly, efficiently, and economically. Therefore, a sleep disorders module was developed to target motor carrier executives and management personnel. Module 7 comprises four components:

1. Overview of sleep disorders and OSA,
2. Corporate responsibilities for managing sleep disorders,
3. Strategies for developing and implementing a sleep disorders management program in the motor carrier industry, and
4. Strategies for supporting and encouraging a sleep disorders management program.

The goals of this FMP module are to provide education, training, and materials for motor carrier executives, management, and other key personnel so that they may develop and implement a dynamic, innovative, and effective sleep disorders program for their fleets as part of an FMP. A step-by-step guide to implementing an OSA program in carrier operations is provided in Chapter 6.

Module 8: Driver Sleep Disorders Screening and Treatment

Driver acceptance of a carrier-implemented sleep disorders program is challenging as there are powerful disincentives for drivers to subject themselves to a diagnostic-treatment protocol. For example, drivers with a record of a diagnosed sleep disorder (e.g., OSA) generally are mandated to maintain documentation of compliance with treatment and/or face loss of their commercial driver's license (CDL) and employment in the CMV industry. Therefore, driver education regarding sleep disorders that includes an understanding of the impacts on health and safety is considered a critical element for improving driver acceptance of an OSA screening and treatment program. A sleep disorders module was developed that targets CMV drivers. Module 8 comprises four components:

1. Overview of sleep disorders,
2. Screening and medical testing for sleep disorders,
3. Treatment options for CMV drivers and recommendations from regulators, and
4. Compliance with OSA treatment and fatigue management on the job.

The goals of this FMP module are to provide educational information, materials, and tools to drivers regarding sleep disorders, sleep disorders programs in commercial vehicle operations (CVOs), and general information and recommendations for CMV drivers participating in a fleet-implemented sleep disorders program.

Module 9: Driver Scheduling and Tools

Fatigue is a complex state characterized by a lack of alertness and reduced mental and physical performance, often accompanied by drowsiness.[11] The event sequence that can lead to fatigue, loss of alertness, and human factors errors is diagramed in Figure 11. Figure 11 represents an incident event sequence illustrated through a tiered approach. Fatigue risk management includes understanding each tier in the processes that can lead to human error and crashes and introducing procedures at each level to minimize or eliminate those errors so the event sequence cannot proceed to the next tier. At the foundation of this sequence (i.e., the base of the pyramid) are Tier 1 controls applied by management to provide sufficient sleep opportunities so that drivers can

remain alert on the job. This is largely, but not exclusively, the result of work demands, scheduling, and available rest facilities.

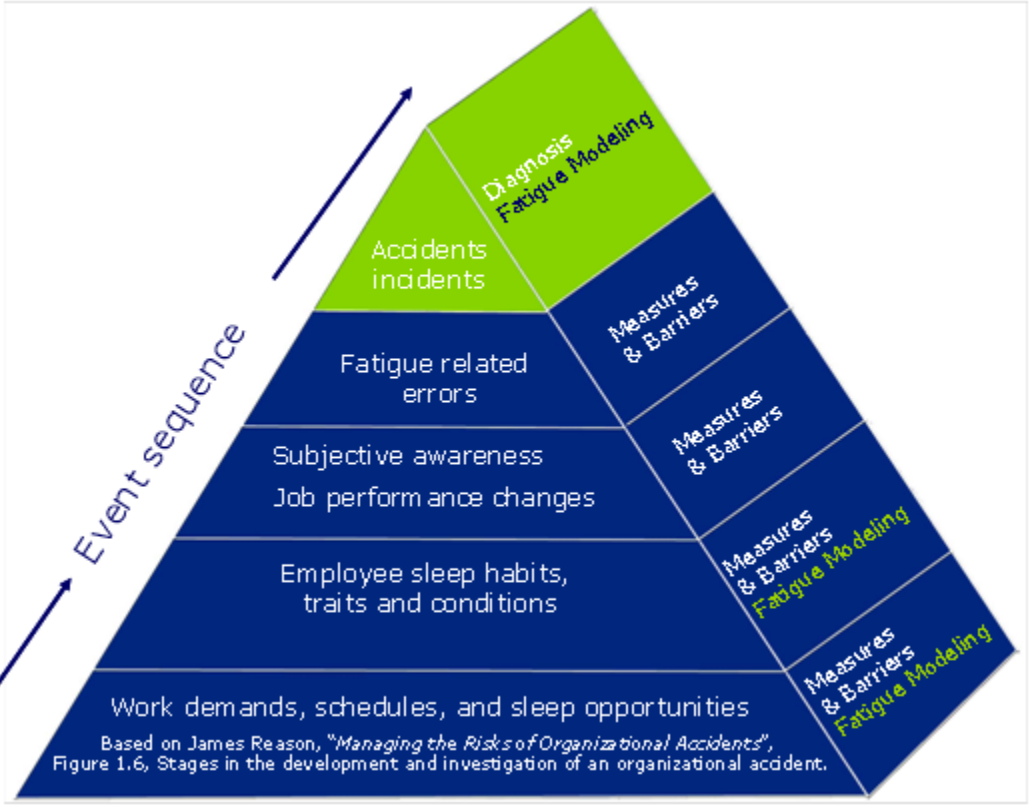


Figure 11. Fatigue Risk Pyramid (adapted from Reason, 1997[45]).

Federal regulations mandate a set of HOS rules that include limits on driver schedules. Those regulations provide a starting point for CVO driver scheduling. Therefore, scheduling and fatigue evaluation tools are essential elements in the FMP. Scheduling in the motor carrier industry must: balance a range of logistical considerations, comply with regulatory requirements, and meet the personal needs of the driver for restorative sleep at appropriate times of the day. This complex set of requirements can be aided by computer-based fatigue modeling tools for evaluating schedules, but the tools themselves must be fully understood in terms of their benefits and limitations. In addition, the tools must be coupled with an appreciation for the types of scheduling guidelines that are most likely to lead to improvements in performance and alertness while meeting the logistical demands in the company. Finally, all of these factors must be balanced with the individual sleep needs and preferences of the driver to be effective in maintaining a safe operating environment. Module 9 provides a familiarization with these tools and guidelines so that management can effectively apply them to provide driver schedules that support alert and safe driver performance. This FMP educational and training module comprises five components:

1. Fatigue and scheduling factors,

2. Limitations of current work rest regulations,
3. Shared responsibility in minimizing fatigue in schedules,
4. Scheduling and tools, and
5. Scheduling challenges and case studies.

The goals of this FMP module are to provide education, training, materials, and tools to motor carrier executives, management, and other key personnel in CVOs so they may develop and implement a practical, dynamic, and effective driver scheduling program for their fleets as part of the FMP.

Module 10: Fatigue Monitoring and Management Technologies

During the last decade fatigue management technologies (FMTs) have become increasingly available for motor carriers and CMV operators. As shown in Figure 12, these technologies have focused on both in-vehicle and out-of-vehicle countermeasures to driver fatigue. Technologies can occur at the management and supervisory levels (out-of-vehicle) and at the driver level (both in-vehicle and out-of-vehicle). Efficient route planning and driver scheduling along with fit-for-duty testing (e.g., driver fatigue risk profiling) are several of the approaches that safety managers and supervisors may use to prevent fatigued drivers from taking to the road. On the driver level, real-time monitoring technologies are of unique interest as they are considered the last stop-gap countermeasure to alert the CMV driver of fatigue and to reduce driver errors. These real-time monitoring technologies are based on driver input and vehicle kinematics, physiological factors, or a combination of both. Although there is no technology “silver bullet,” FMTs play an essential role in a carrier’s FMP. Previous research has shown these technologies have positive results on driver fatigue and can be an effective tool in an FMP.

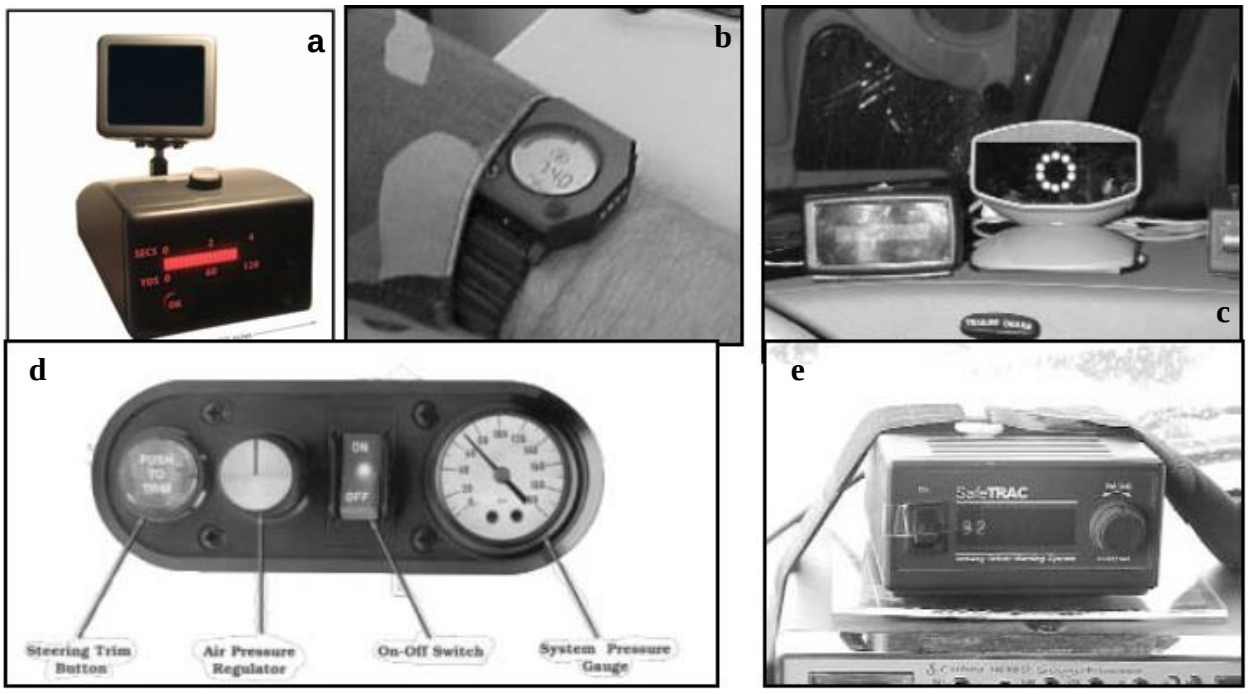


Figure 12. Samples of FMTs Evaluated in Federally Funded Research Projects; clockwise from top left: (a) The Co-Pilot Drowsy Driver Warning System, (b) SleepWatch® with Sleep Management Model Software, (c) Co-Pilot® System using PERCLOS[2], (d) SafeTRAC® Lane Tracking System[2], and (e) Howard Power Center Steering® System.[2]

Module 10 provides an introduction to FMTs; identifies the most promising FMTs available; and provides detailed content, comparisons, and more fundamental data for why they would be effective. This FMP educational and training module comprises five components:

1. Introduction to fatigue and FMTs,
2. Back-office versus driver-level FMTs,
3. Concepts behind FMTs,
4. Sample of current FMTs, and
5. Deployment strategies and operational guidelines.

The goals for Module 10 include: (i) providing education about, and increasing awareness of, the various FMTs currently available; and (ii) how these technologies can be effectively implemented into an FMP within the community of motor carrier executives, transportation directors, and safety managers. Through this education, decision makers at fleets will be better prepared to make informed decisions and ask key questions about specific FMTs.

FMP TESTING

Certain modules within the FMP will incorporate periodic quizzes about course material, lesson tests, and final exams.

SUMMARY

The NAFMP is designed to provide a comprehensive approach to reducing fatigue among CMV drivers and is applicable to fleets of all sizes and any industry type. Three instructional methods have been incorporated into the NAFMP (i.e., instructor-led PPT presentations, web-based non-interactive courses, and web-based interactive courses) to reach the widest audience possible. All that is required is an Internet connection to download the FMP materials and/or complete the web-based interactive courses. The NAFMP comprises 10 training and educational modules that target carrier executives and management personnel, drivers, drivers' families, shippers and receivers, and dispatchers. These modules incorporate background information about fatigue, causes and characteristics of fatigue, and strategies for the various audiences to reduce CMV driver fatigue. Module exams are provided for six of the 10 modules and allow drivers to earn FMP certification. Finally, an FMP website provides a central access point for carriers and drivers to access FMP information such as registration information for the FMP training modules, fatigue information, and additional links.

CHAPTER 3. DEVELOPING, IMPLEMENTING, AND EVALUATING THE FMP

This chapter describes the processes for developing, implementing, and evaluating the FMP and includes the following topics: assembling an FMP steering committee, developing an FMP policy, developing a process for FMP documentation, defining roles and responsibilities in the FMP, constructing a timeline for FMP implementation, FMP introduction and awareness, providing FMP education and training, providing FMP communication, and evaluating and monitoring the FMP.

STEP 1: ASSEMBLE FMP STEERING COMMITTEE

The first step in developing an FMP is assembling a steering committee responsible for: the development of the FMP, oversight of the program once it is implemented, and providing any support necessary for employees. Although there is no standard size or structure for the FMP steering committee, it is recommended that all levels of the organization be represented, especially those employees most affected by the FMP (i.e., drivers). A driver advisory council on the FMP steering committee helps demonstrate the importance of driver input and carrier "buy-in." It is also important to include employees with varying levels of experience on the steering committee. The steering committee should represent the general population of the organization. In small fleets, one person may represent an entire group of employees (e.g., one driver to represent all drivers). In very small fleets, the FMP steering committee could be a function of the safety personnel. In this case, the safety personnel would be charged with all documentation, design, and implementation of the FMP. Appendix B shows an example document describing the terms and responsibilities of the FMP steering committee (adapted from the International Civil Aviation Organization [ICAO][9]). This document is intended only as a reference, and some of the terms and responsibilities may not apply to all organizations.

STEP 2: DEVELOP FMP POLICY

The FMP policy clearly defines all elements that support the program. The policy should be developed by the FMP steering committee with input from all levels of employees, especially those most affected by the policy (i.e., drivers). Developing the FMP policy with the help of drivers will show management's concern and support for fatigue management.

The FMP policy needs to include or address the following:[9]

- All elements in the FMP: The FMP policy should reflect all fatigue-related safety systems and plans.
- Scope of the FMP: The FMP policy should clearly identify those operations where the FMP procedures apply. As the fatigue hazard identification process is developed and implemented, it may be important to add or remove operations where the FMP applies. This should be considered the normal evolution of the FMP.
- Shared responsibility between management, drivers, dispatch, and other relevant personnel involved in the FMP: Drivers and management share a responsibility for fatigue management. Drivers are personally responsible for acquiring adequate rest when available and using appropriate fatigue management strategies (described in Module 3). Additionally, drivers are responsible for cooperating with any self-report or other data collection efforts. However, drivers' willingness to cooperate in the FMP is largely dependent upon management. Thus, management is responsible for supporting and participating in the FMP processes, providing support for: developing schedules that reduce driver fatigue, providing encouragement and acknowledgment of drivers' fatigue management efforts, providing feedback to drivers based on fatigue-related performance, and developing a positive safety culture to support a successful FMP (see Module 2).
- FMP safety objective definitions: Safety objectives state the purpose of the FMP and what the FMP is expected to achieve. The safety objectives need to be based on specific, motivational, attainable, relevant, and trackable (SMART) goals (see Figure 13). Examples of measures that may be useful for safety objectives can be found in Module 2 and Chapter 4.
- A clearly written policy signed by the executive accountable for the program.
- A policy clearly communicated to all relevant personnel in the organization.
- The commitment of management to effective fatigue reporting and continuous FMP improvement.
- Accountability of management, drivers, dispatch, and other relevant personnel involved in the FMP.
- Regular evaluation of the FMP to ensure continued effectiveness.

Appendix C provides an example of an FMP policy adapted from ICAO.[9]

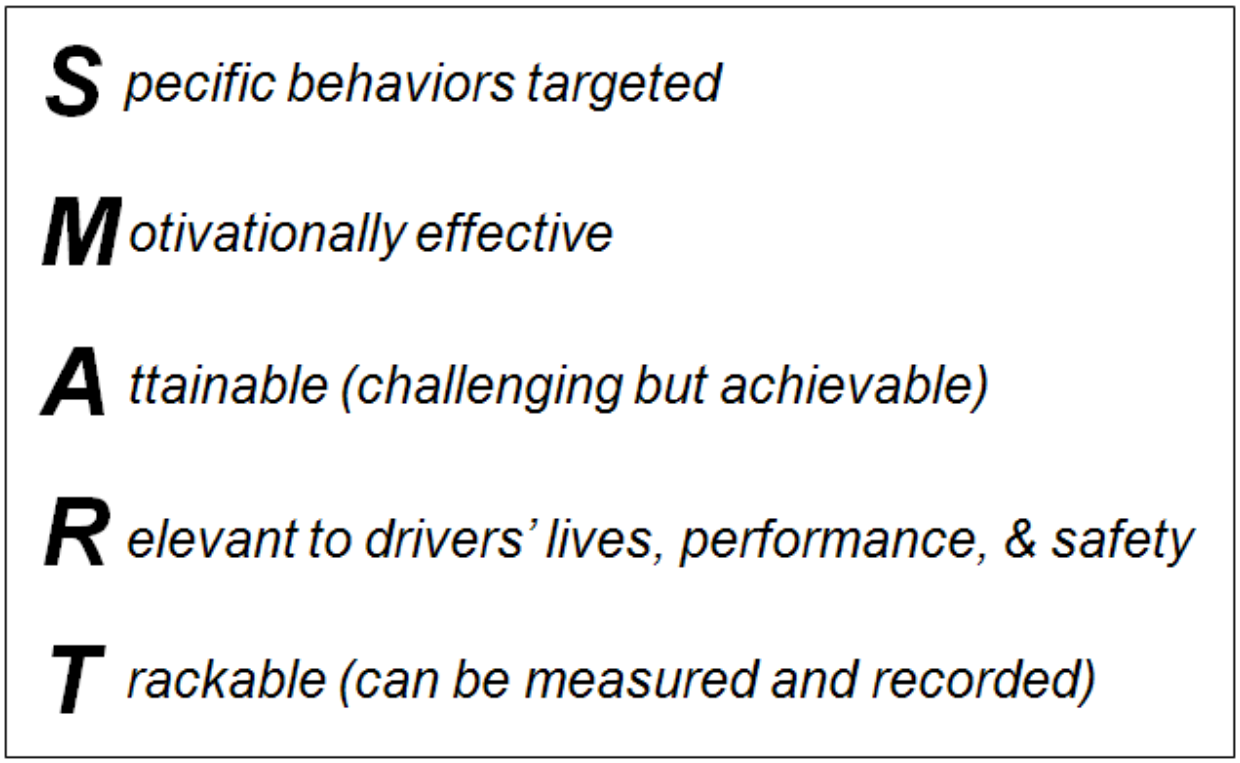


Figure 13. SMART Goals (adapted from Geller, 2001[28]).

STEP 3: DEVELOP FMP DOCUMENTATION PROCESS

Each carrier needs to develop an FMP documentation process that explains and records the following:

- FMP policies and objectives;
- FMP processes;
- Each party's accountability, responsibility, and authority for the FMP processes;
- A description of the FMP education and training programs, training requirements, and attendance records; and
- FMP data, findings, and recommendations.

STEP 4: DEFINE FMP ROLES AND RESPONSIBILITIES

An essential element of the FMP is shared responsibility for CMV driver fatigue management. To develop accountability in the FMP, management and driver responsibilities need to be clearly defined in the FMP policy statement (discussed above). Management is fundamentally responsible for controlling operational factors

associated with driver fatigue (e.g., driver schedules). Management responsibilities in the FMP include, but are not limited to:

- Ensuring the FMP is implemented,
- Ensuring adequate resources are available for the FMP,
- Ensuring there is an adequate staffing level to minimize fatigue,
- Providing drivers with adequate opportunities to recover from sleep debt,
- Creating a safety culture that supports honest reports of fatigue,
- Providing FMP education and training to all relevant employees,
- Ensuring known fatigue hazards are managed or monitored,
- Regularly communicating the effectiveness of the FMP with drivers, and
- Providing commitment to continuous improvement of the FMP.

Drivers have a personal responsibility to use fatigue management strategies that reduce the risk of fatigue they may experience on the job. Driver responsibilities in the FMP include:

- Choosing behaviors that do not create an excessive risk of fatigue,
- Appropriately using available opportunities for rest/sleep,
- Reporting instances of fatigue or when adequate rest could not be obtained,
- Attending and participating in FMP education and training, and
- Communicating with management if it is known or suspected they or another driver is suffering from dangerous levels of fatigue.

STEP 5: DEVELOP IMPLEMENTATION TIMELINE

Timely implementation is an important factor when creating driver “buy-in” to the FMP. A timeline should be developed (and adhered to) that ensures control measures and mitigation strategies are established as quickly as possible. Not only will this confirm actions are being promptly taken to mitigate fatigue hazards but it will also illustrate the commitment of management to the FMP. The FMP steering committee should closely monitor FMP activities to ensure the timeline is followed.

STEP 6: FMP INTRODUCTION AND AWARENESS

All employees need to be informed about the FMP. This communication should consider the various needs of employees in the fleet, including:

- Varied reading levels,
- Difficulty reading English,
- Differences between daytime and nighttime shift workers receiving communications, and
- Long-haul versus short-haul drivers receiving communications.

Based on the various needs in the fleet, different communication methods may be required. A number of communication types can be used, including, but not limited to:

- Electronic communications (e.g., email and websites);
- Companywide newsletters;
- Bulletins;
- Fliers;
- Fatigue seminars;
- One-on-one, face-to-face meetings; and
- Group meetings.

Appendix D includes four examples of fliers that provide drivers and other personnel with information about the FMP and fatigue management.

FMP Kickoff

A major responsibility of the steering committee is to ensure all employees know the principles, policies, and procedures of the FMP. Making employees aware of the reasons for developing and implementing the FMP should help reduce resistance because employees will learn why it is important to reduce fatigue and promote driver health and wellness. Once all employees understand the importance of the FMP, a kickoff celebration/meeting should be held at the onset of FMP implementation. This will develop trust in the program by showing support and participation of management personnel.

STEP 7: PROVIDE FMP EDUCATION AND TRAINING

Education and training are the core components of the FMP as many of the fatigue controls and mitigation strategies involve some type of education or training. Although education and training alone are not sufficient to mitigate fatigue, they provide a foundation of skills and knowledge that drivers, managers, dispatch, and other personnel can use to develop fatigue management strategies. For the FMP to be successful, it is critical that all relevant personnel know the fatigue basics, their roles and responsibilities in reducing driver fatigue, and effective strategies available to minimize fatigue.

Included in the education and training components of the FMP are the following topics:

- The basics of fatigue,
- Warning signs of the development of fatigue,
- Possible health and wellness effects of fatigue,
- Relationship between fatigue and CMV crashes,
- Factors that cause or contribute to the development of fatigue,
- Factors and strategies that can mitigate the development of fatigue, and
- Control measures to prevent the development of fatigue.

Please refer to Chapter 2 for education and training modules included in this FMP.

STEP 8: PROVIDE ONGOING FMP COMMUNICATION

The continued support of management personnel for the FMP helps sustain enthusiasm and participation in the program. To ensure employees know management will continuously support the FMP, carrier management should: maintain both formal and informal communication channels, remain active in fatigue-related discussions, and actively listen and address all FMP-related feedback.

The attendance of management personnel at fatigue-related meetings will demonstrate their commitment to the FMP. Such meetings provide management with opportunities to change or align policies and procedures to encourage the continued reduction of driver fatigue and fatigue-related incidents. These meetings allow management to recognize and acknowledge drivers' fatigue management efforts, provide feedback to drivers about their progress, encourage correct fatigue management behaviors, receive feedback from drivers about mitigation strategies that are not working as expected, gather data about factors that contribute to drivers' decisions to drive while fatigued, and hold face-to-face communications with drivers.

Face-to-face meetings with drivers in which fatigue is discussed provide a way for the organization to show their continued commitment to fatigue management. These meetings allow drivers to observe the enthusiasm of management personnel for reducing driver fatigue and reinforce the position that driver safety is valued in the fleet. These meetings can be informal or formal and can be held in an office, terminal location, driver lounge, or hallway. Face-to-face meetings provide an opportunity for management to praise and recognize drivers who are actively involved in reducing fatigue. The meetings also allow management to privately provide corrective fatigue-related feedback to drivers outside of a group setting. Furthermore, such meetings allow management to hear criticisms of the FMP directly from drivers and provide an opportunity to address drivers' concerns. Finally, these meetings are an ideal method to help drivers develop their fatigue-related goals. No matter the type of communication strategy used, the fatigue-related messages conveyed during these meetings need to be clearly stated, timely, and based on credible evidence (e.g., data gathered during the fatigue risk assessment process).

STEP 9: MONITOR AND EVALUATE FMP

Once the FMP has been fully implemented, it is critical to regularly review data to evaluate the continued effectiveness of the program to reduce or eliminate fatigue. For specific strategies about gathering fatigue-related data to monitor and evaluate the FMP, please refer to Chapter 4, which includes information about FRMSs and example strategies to collect fatigue-related data.

The FMP should be reviewed when:

- Operational changes are made;
- Staffing patterns or scheduling changes are made;
- Fatigue indicators suggest the fatigue hazards are not being reduced or eliminated; and
- New technologies, tasks, or equipment are added.

During a review of the FMP, the following questions should be asked:

- Are the fatigue controls and countermeasures working as intended?
- Was the FMP implemented as expected?
- Have new fatigue-related hazards developed?
- How do the number of fatigue-related crashes, near-crashes, injuries, violations, and other fatigue-related data (e.g., absenteeism) compare to occurrences before FMP implementation?

SUMMARY

Careful consideration is required when developing, implementing, and evaluating the FMP. This chapter focused on assembling an FMP steering committee, developing an FMP policy, developing a process for FMP documentation, defining roles and responsibilities in the FMP, constructing a timeline for FMP implementation, increasing FMP awareness, providing FMP education and training, providing FMP communication, and evaluating and monitoring the FMP. Each of these topics is critical to the ultimate success of the FMP. More detailed information about these topics can be found in the respective FMP education and training modules. For example, detailed information about communication and evaluation can be found in Module 2 in the FMP.

CHAPTER 4. FATIGUE RISK MANAGEMENT SYSTEMS

This chapter introduces FRMSs and describes the day-to-day processes involved in identifying, monitoring, and mitigating fatigue causes or hazards.

FRMSs are different than the NAFMP. This FMP is purely educational while FRMSs use indicators to identify fatigue risk factors and to monitor efficiency of mitigation strategies. To better manage driver fatigue, it is important to use the strategies described in this chapter to develop additional mitigation techniques aimed at reducing fatigue-related risk factors in an organization.

FRMS INTRODUCTION

FRMSs are comprehensive management systems that provide an ongoing, data-driven process to monitor and manage fatigue-related factors. An FRMS is defined as a scientifically based approach designed to manage employee fatigue in a flexible manner appropriate to the level of risk exposure and the nature of the operation.[46,47] The goal of the FRMS is to reduce CMV driver fatigue so drivers are sufficiently alert to optimally operate their CMVs. To accomplish this, FRMSs are designed to:[9]

- Proactively identify operational processes and other risks that contribute to the development of fatigue,
- Retrospectively identify fatigue-related factors that may have contributed to incidents,
- Improve operational processes that reduce the development of fatigue, and
- Develop strategies for mitigating factors that contribute to fatigue.

Specifically, an FRMS will allow carrier management to assess if interventions are working and to identify problem areas that may require additional intervention and/or monitoring.

Components of an FRMS

There are six core components of an FRMS.[11] These components are described in Table 4.

Table 4. Components of an FRMS (adapted from Fourie et al., 2010[11])

FRMS Component	Description
Fatigue management policy	Statement from top management reiterating the commitment of the organization to fatigue management; describes individual responsibilities
Fatigue risk management procedures	Specific procedures for identifying, managing, and evaluating driver fatigue
Fatigue training and education	Ensures all drivers and key personnel understand the importance of fatigue management and effective mitigation strategies
Fatigue reporting	Formal and informal processes for reporting driver fatigue and the use of correct fatigue management techniques
Fatigue incident investigations	Formal, documented process for investigating how (if applicable) driver fatigue contributed to crashes
Fatigue risk management evaluations	Processes for evaluating the effectiveness of the FRMS and, if necessary, revising the system to enhance effectiveness

Although there are six components of an FRMS, only fatigue risk management procedures, fatigue reporting, and fatigue incident investigations will be discussed in Chapter 4. The other FRMS components (e.g., fatigue management policy, training and education, and FRMS evaluations) were discussed in Chapter 3.

FATIGUE RISK MANAGEMENT PROCEDURES

The primary function of an FRMS is to provide fatigue risk management procedures. These procedures provide fleets with the tools and processes necessary to achieve the fatigue-related safety objectives stated in an FRMS policy. These procedures ensure fatigued-related risks are identified, assessed, managed, and evaluated[1] through a series of steps shown in Figure 14.

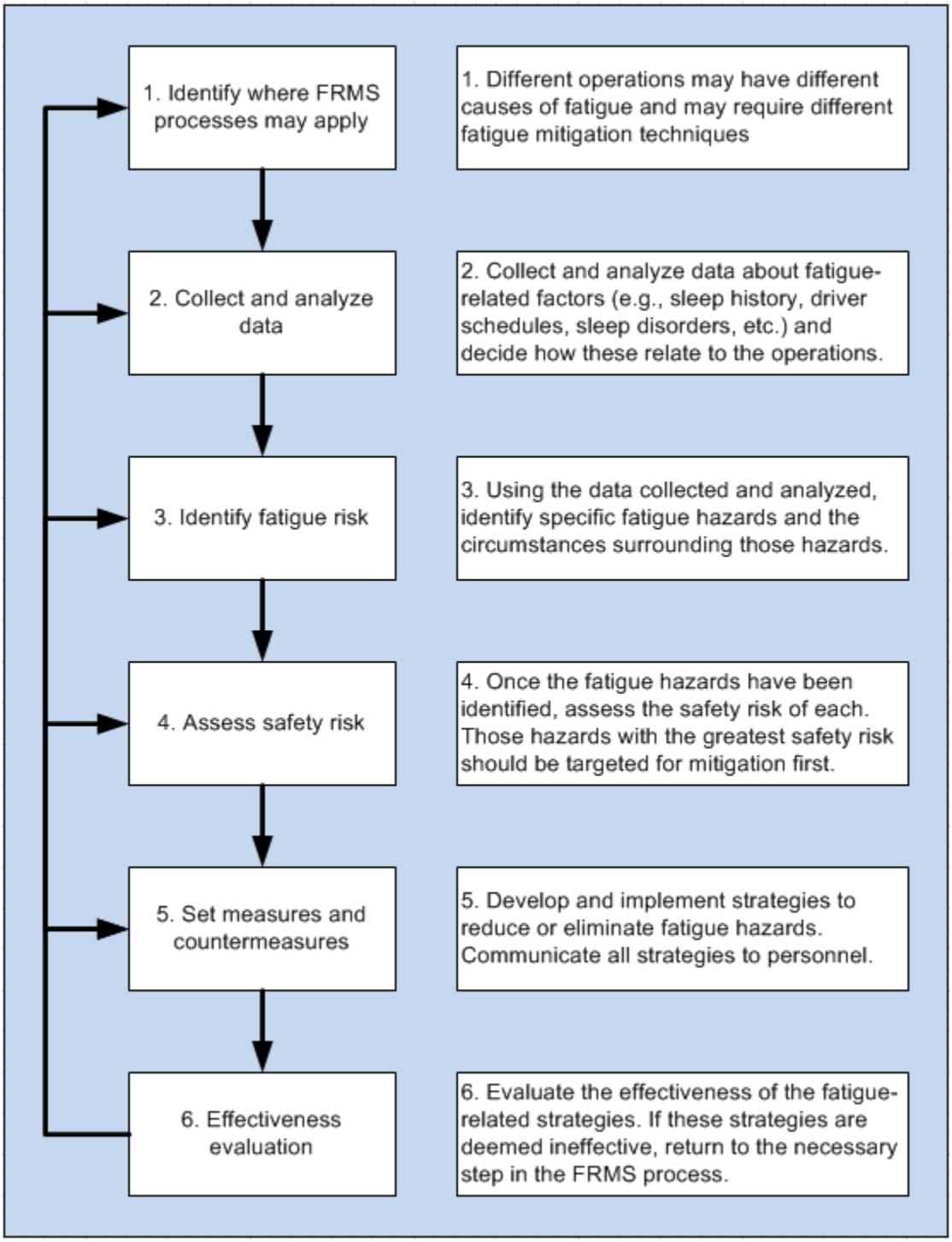


Figure 14. Fatigue Risk Management Procedures (adapted from ICAO[9]).

Discrete operations or fleets may experience driver fatigue differently and may have diverse causes of fatigue. The first step in the FRMS process involves identifying which operations experience problems with fatigue. During Step 2, fatigue-related data (e.g., drivers' sleep histories and hygiene, scheduling factors, sleep disorders, self-reports of fatigue, etc.) are collected and analyzed to identify where fatigue hazards exist and

what factors may contribute to the development of fatigue. Once these hazards have been identified during Step 3, the safety risk of each hazard should be assessed during Step 4. Because some hazards create a greater safety risk than others, those fatigue hazards with the greatest safety risk should be targeted for mitigation before other, less dangerous hazards. Once fatigue hazards have been deemed to be risky and/or severe, fatigue-related performance measures and countermeasures need to be developed during Step 5. During Step 6, the FRMS should be continuously evaluated for effectiveness and to identify any areas in need of improvement. If a measure or countermeasure has not reduced fatigue to an acceptable level, the previous steps in the FRMS should be repeated. Each FRMS step is discussed below.

Step 1: Identify Operations Where FRMS Processes May Apply

In many cases different operations within a fleet (e.g., long-haul, short-haul, routes, etc.) will experience varying risks to the development of driver fatigue. It should be the decision of the carrier whether the FRMS strategies are applied to the entire organization or only to specific operations within a fleet. It may not be cost-effective to target an entire fleet if only a few operations within a fleet experience significant driver fatigue. Furthermore, different operations within a fleet may experience diverse factors that contribute to the development of CMV driver fatigue. These operations will likely require a different combination of strategies to mitigate fatigue.

Step 2: Collect and Analyze Data

To make the FRMS credible, data should drive all decisions made. The FMP steering committee or action group (described in Chapter 3) should collect and analyze all necessary data available to identify where fatigue hazards or causes exist and what variables lead to the development of fatigue. Data may include, but are not limited to, any scheduling policies, incident analyses of past crashes/near-crashes, driver logs, and fatigue feedback.

When collecting fatigue-related data, the FMP steering committee should look for information about restricted opportunities for rest/sleep due to: short rest periods, early start times, late stop times, high workload, disrupted circadian rhythms, consecutive days with early/late start times, repeated short rest opportunities, and split-sleep patterns. Data gathered during this step may not necessarily derive from a new data collection effort. Analyzing existing data from past log books, published CMV fatigue studies, and incident analyses may provide useful information about identifying potential fatigue hazards. Specific techniques for collecting data related to different types of fatigue hazards are described in detail below.

After data collection and analysis processes have been developed and established in the fleet, these processes should become routine, day-to-day activities. Thus, fatigue-related data should be continuously monitored and tracked. However, the FMP steering committee may opt to perform non-routine data collection (e.g., analysis of current

driver schedules, review of recent fatigue literature, or a one-time driver sleep survey) to develop a better understanding of current experiences of specific fatigue-related factors.

Step 3: Identify Fatigue Hazards

The purpose of gathering data during Step 2 is to identify fatigue hazards or causes that may need to be targeted for improvement. There are a number of ways to identify these fatigue hazards, including, but not limited to, consulting with drivers, dispatchers, safety managers, transportation managers, and top management and analyzing past records of safety-related incidents. During these analyses, the FMP steering committee should look for factors that have been shown to contribute to the development of fatigue, including: mental and physical demands of CMV driving (e.g., concentrating for extended periods of time and the repetition of monotonous tasks), driver scheduling and planning (e.g., early start times, late stop times, night shifts, long hours of driving without a break, and a lack of other opportunities for sleep or rest), CMV driving work environment conditions (e.g., excessive truck vibrations may cause fatigue to develop more quickly), excessive commuting times (e.g., traveling long distances before or after work), and personal and non-work factors (e.g., diet; sleep disorders; alcohol, drug, or medication use; noisy neighborhood not conducive to daytime sleep; and level of fitness).[1]

Although each of these factors considered separately can contribute to the development of fatigue, it is important to consider how they interact and combine to contribute to the development of fatigue. For example, personal factors (e.g., sleep disorders) and driver scheduling can combine to increase the risk of fatigue more than either of these two factors alone.

There are three different processes for identifying fatigue hazards: predictive, proactive, and reactive.[9] For optimal success in identifying fatigue hazards, all three processes should be used. These processes are designed to continuously gather and analyze data about fatigue risk and allow the FMP steering committee to make informed decisions based on scientific principles and data. The predictive, proactive, and reactive processes for identifying fatigue hazards are described below.

Predictive Processes

Predictive fatigue hazard identification focuses on detecting factors (e.g., inadequate sleep opportunities) that negatively impact driver alertness. This information should be used to develop driver schedules and workplace conditions that minimize the future effects of driver fatigue. This can be accomplished in three different ways: previous experience, evidence-based scheduling, and bio-mathematical models.[9]

Previous experience: Management, dispatchers, and drivers have firsthand knowledge of the workplace and scheduling factors that contribute to the development of fatigue. These experiences are a critical resource in identifying the fatigue-related risks in a driver's proposed schedule. For example, specific routes or delivery locations may be known to cause increases in fatigue due to traffic conditions or lack of rest areas. Management or dispatch should consider these experiences to develop a new route.

Several sources of data should be used to identify fatigue-related factors based on previous experience. Driver, manager, and dispatcher knowledge of current or past schedules should be examined for any factors that have been shown to contribute to the development of fatigue. Some factors to examine include, but are not limited to: delivery, on-time performance, violation of HOS regulations, start/stop times, and reports of fatigue levels.

Although past experiences do provide useful information, predictive fatigue hazard identification should not be based solely on previous experience. Schedules based only on past experiences may not provide the most useful solutions to new situations (e.g., delivering to a new location). Additionally, fatigue levels or causes experienced previously may not apply to the current situation. For example, new rest stops may be available or a new road may have been constructed to relieve heavy traffic.

Evidence-based scheduling: Scheduling tools can add a valuable resource in combination with information from previous experiences. These tools use fatigue science to develop driver schedules and consider fatigue-related factors such as sleep opportunities, body clock, and other scheduling factors (e.g., start and stop times). Examples of fatigue science principles related to schedules are presented below.[9]

- The optimal schedule for drivers is a daytime shift with an opportunity for unrestricted sleep at night. All other schedules are a compromise of drivers' sleep.
- Humans' body clocks never fully adapt to altered sleep schedules (e.g., daytime sleep necessary for night shifts).
- Shifts that overlap a driver's normal sleep pattern are expected to restrict sleep. For example, drivers that normally do not have early start times or late stop times will experience restricted sleep if scheduled for an early start time or a late stop time.
- A greater overlap between a shift and the driver's normal sleep schedule will result in more restricted sleep.
- Nighttime shifts result in the highest self-reported ratings of driver fatigue, and additional strategies are required to help drivers maintain alertness.
- Sleep debt will accumulate across days or shifts when there is an overlap between the driver's shifts and his/her normal sleep pattern. The more consecutive days with an overlap, the greater the sleep debt.

- Recovering from a sleep debt requires a minimum of two consecutive nights of unrestricted sleep.

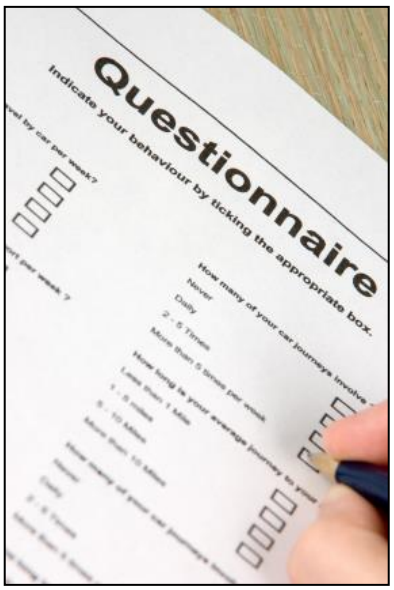
Bio-mathematical models: The process for predictive fatigue hazard identification involves developing programs or models that test how physiological and work-related fatigue factors (e.g., circadian rhythms, workload, and quantity/quality of sleep) interact to affect driver fatigue and alertness. This method often involves developing a program from data gathered during sleep-loss-induced laboratory studies. These studies are then replicated in new scenarios to determine if the same alertness and fatigue results are seen.

There are a number of bio-mathematical models commercially available that help explain how fatigue-related factors interact to contribute to the development of fatigue. However, these models must not be the sole focus of predictive fatigue hazard identification. As stated, the best predictive processes use previous experience, evidence-based scheduling, and bio-mathematical models to help predict when a driver may experience fatigue.

Proactive Processes

Proactive fatigue hazard identification focuses on monitoring and analyzing reports of fatigue in the fleet operation. Since fatigue can be caused by different factors, multiple data sources for fatigue identification should be used. Furthermore, using multiple data sources creates a more detailed and complete picture of fatigue in the operation. However, using multiple data sources can become time-consuming and expensive. Thus, the focus of this process should be on specific routes or operations where fatigue is known to be a problem.

Proactive processes for fatigue hazard identification are a shared responsibility between management, drivers, and dispatchers. It is critical to involve employees from all levels of the organization in the development of proactive processes (and all other procedures in the FMP). Thus, it is important for management to ensure drivers understand the importance of their data collection efforts and to acknowledge driver participation. (Creating driver buy-in is discussed in Chapter 3.)



There are five approaches to collecting proactive fatigue hazard identification, including:

- Self-reported fatigue risks (e.g., specific routes, start/stop times);
- Driver, dispatch, and manager fatigue questionnaires;
- Fatigue-related driver performance reviews;

- Review of fatigue-related CMV driving literature; and
- Analysis of planned schedules and time worked versus the actual schedules and time worked.

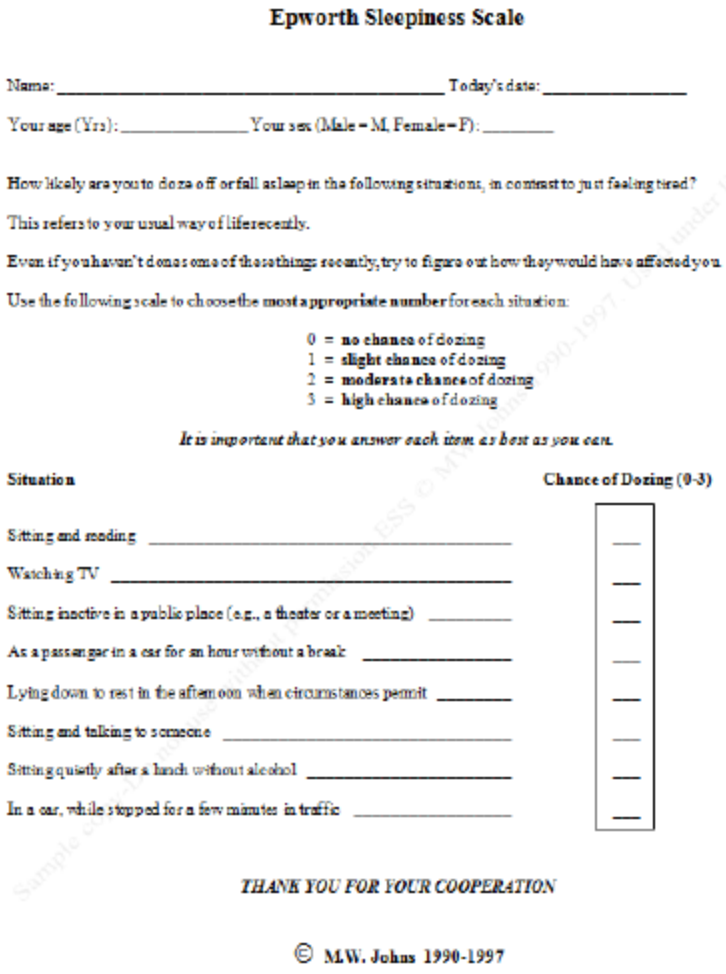
Self-reports of fatigue-related risks: Driver self-reports of fatigue risks are vital in developing an understanding of fatigue in a fleet's operation. Self-reports are drivers' firsthand knowledge of fatigue and offer an ideal method for drivers to provide feedback about the success of their fatigue management strategies. The driver self-reports can also lead to additional investigations that determine overarching themes contributing to the development of fatigue.

Although self-reports are an excellent method to gather firsthand data about driver fatigue, they do rely on a safety culture that supports and encourages accurate self-reports. Methods to create a supportive safety culture are described in Chapter 3 and in Module 2 of the FMP. Several strategies that encourage drivers to participate in the self-reporting process include:

- Use of simple and short forms;
- Clearly stating the FMP policy concerning confidentiality and driver protection;
- Including data about sleep quantity and quality;
- Regularly reviewing and analyzing driver self-reports; and
- Providing feedback to drivers based on their self-reports.

A sample self-report fatigue form is provided in Appendix E. This form is an adaptation of one routinely used in the aviation industry.[9] Refer to Chapter 3 and Module 2 in the FMP for more information about how to develop a safety culture that encourages accurate driver self-reports of fatigue.

Driver, dispatch, and management fatigue questionnaires: There are two basic types of questionnaires that can be used to gather fatigue-related data for proactive fatigue hazard identification. The first is a retrospective questionnaire that solicits information about sleep patterns and opportunities in the past and experiences of fatigue in the past. Usually this type of questionnaire is completed only once because self-reports can capture all current or new experiences of fatigue. An example of a retrospective questionnaire is the Epworth Sleepiness Scale (*ESS © MW Johns 1990-1997. Used under license*).[48] This tool is designed to measure how sleepiness impacts daily life.[49] Drivers are asked to respond to each scenario on a scale from 0 (would never doze) to 3 (high chance of dozing). Totaled scores above 10 typically indicate that excessive sleepiness impacts daily life.



Epworth Sleepiness Scale

Name: _____ Today's date: _____

Your age (Yrs): _____ Your sex (Male = M, Female = F): _____

How likely are you to doze off or fall asleep in the following situations, in contrast to just feeling tired?

This refers to your usual way of life recently.

Even if you haven't done one of these things recently, try to figure out how they would have affected you.

Use the following scale to choose the **most appropriate number** for each situation:

0 = **no chance** of dozing
1 = **slight chance** of dozing
2 = **moderate chance** of dozing
3 = **high chance** of dozing

It is important that you answer each item as best as you can.

Situation	Chance of Dozing (0-3)
Sitting and reading	
Watching TV	
Sitting inactive in a public place (e.g., a theater or a meeting)	
As a passenger in a car for an hour without a break	
Lying down to rest in the afternoon when circumstances permit	
Sitting and talking to someone	
Sitting quietly after a lunch without alcohol	
In a car, while stopped for a few minutes in traffic	

THANK YOU FOR YOUR COOPERATION

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ESS contact information and permission to use: MAPI Research Trust, Lyon, France. E-mail: PROinformation@mapi-trust.org – Internet: www.mapi-trust.org

Figure 15. The Epworth Sleepiness Scale (*ESS © MW Johns 1990-1997. Used under license*).

The second type of questionnaire is a prospective one that focuses on current sleep patterns and experiences of fatigue. These questionnaires can be administered repeatedly to gauge changes across trips or time. Prospective fatigue questionnaires were developed in the FMP.[3] The first questionnaire (see Appendix F) is a comprehensive one that gathers information about drivers' current experiences with fatigue and the strategies they use to minimize fatigue. This questionnaire is based on one developed in the aviation industry[50] and for CMV drivers.[51,52]

Another prospective questionnaire developed in the FMP[3] can be found in Appendix G. Drivers were asked to complete the same questionnaire three times during a shift: (i) at the start of the shift, (ii) in the middle of the shift, and (iii) when the shift was over (this

last questionnaire included additional questions). The questionnaire shown in Appendix G includes:

- Stanford Sleepiness Scale (SSS):[53] A simple and quick scale that assesses the effects of sleep.
- Somatic Symptom Checklist:[50] Aimed at assessing the effect of shift work on the somatic systems of operators.
- Current Mood Assessment: Based on a survey developed by Donderi et al.[54] and Colquhoun et al.[55,56] that gathers data about drivers' subjective ratings of alertness, happiness, calmness, patience, confidence, and their desire to interact with people.
- Fatigue and Alertness Assessment of Performance: Based on the Performance Assessment Questionnaire[57] designed to evaluate the impact of fatigue and alertness on drivers' performance. This questionnaire is also designed to assess early signs of the development of fatigue.
- Subjective Workload Assessment: Based on the NASA Task Load Index (NASA TLX)[58] and assesses the driver's level of workload during a shift.

Questionnaires can be as short or as long as desired. However, consideration needs to be given to the individual completing the questionnaire. The longer the survey, the more of an inconvenience it will be to complete (especially if it needs to be completed more than once). Additionally, questionnaires can focus on particular routes of interest or fatigue in general. For example, if several self-reports of fatigue were made during a particular route, the FMP steering committee can administer a quick questionnaire (retrospective or prospective) to all drivers who drive that route. These questionnaires can also be used to gather qualitative data about drivers' personal beliefs regarding fatigue indicators. This may be helpful in identifying times of day, schedules, or other factors that seem to increase the risk of fatigue.

Fatigue-related performance data: Performance data are critical and support the subjective data gathered through self-reports and questionnaires. Objective data provide insight into what drivers are actually doing. There are three approaches to gathering objective performance data: alertness tests developed in a laboratory (e.g., measures of reaction time, vigilance, short-term memory, etc.), driving performance data, and peer observation.

Tests or measures that have been developed in a laboratory are practical methods to gathering performance data during a shift. These tests measure different aspects of performance that have been shown to relate to fatigue or sleepiness. One commonly used performance test related to fatigue is the Psychomotor Vigilance Test (PVT).[59,60] Although these tests have been shown to be valid predictors of fatigue, they do not appear to be feasible in CMV operations. For example, the PVT requires 10 minutes of a driver's undivided attention. Thus, drivers could not perform this test while driving.

However, it is possible for drivers to complete this test as soon as a rest period starts or prior to starting their drives (i.e., fitness for duty test). This would provide a reasonable measure of fatigue at the end of a drive or prior to beginning a delivery.

The second approach to gathering objective performance data is to analyze driving performance data. The advantages of this method are that performance data can be routinely or automatically collected and are relevant to driving safety. There have been considerable efforts to determine driving performance decrements resulting from fatigue. For example, research has shown the following driving performance behaviors are associated with increases in fatigue: increases in inappropriate lane deviations and slower steering responses,[15-19] reductions in response to speed changes in a lead vehicle,[20] increased speed variations,[21] slower reaction time,[18] impaired visual scanning or "tunnel vision,"[15] and falling asleep at the wheel.[22,23]

Many of these objective performance behaviors can be tracked with driver behavior monitoring devices. For example, electronic data recorders (EDRs) can track lane position, hard braking events, and vehicle speed; eye-tracking technology can track drivers' visual scanning patterns and eye closures. Other technologies available that can track and mitigate unsafe driving behaviors include lane departure warning (LDW) systems, forward collision warning (FCW) systems, electronic stability control (ESC) systems, and roll stability control (RSC) systems. Once objective driving performance is recorded and tracked, these data can then be compared to other fatigue indicators such as: the time of day the incident occurred, circadian rhythms, self-reports of fatigue, driver sleep logs, etc.

The third approach to gathering objective performance data is to use peer observation, which provides a firsthand examination of fatigue-related behaviors. However, it is often difficult to observe CMV drivers due to the characteristics distributed operations and the fact that most CMV drivers are solitary workers with little accountability. One instance in which peer observation does work is team driving. In this case, a peer systematically records the occurrence of fatigue-related behaviors while the other individual is driving. These behaviors may include yawning, droopy eyelids, nodding off, etc. However, new technologies are available (e.g., onboard safety monitoring [OSM] devices) that provide objective measures of CMV drivers' behaviors. These in-vehicle technologies provide continuous measures of a variety of driving behaviors previously unavailable to fleet safety managers. Although most of these OSM

devices track vehicle speed and/or hard braking maneuvers, some are equipped with video cameras that can easily identify driver fatigue.

Review of fatigue-related scientific literature: Fatigue-related driving literature provides general guidance based on prior scientific studies. These studies may help explain fatigue-related crashes, known contributing factors, and countermeasures. As many of the aforementioned approaches used to gather fatigue-related data are expensive and time-consuming, scientific literature provides an inexpensive option to measure fatigue-related factors and complements the direct assessment of fatigue performed by a fleet.

There are several resources available when searching for fatigue-related literature, some of which are online. For example, fatigue-related research can be found at the following:

- FMCSA: http://www.fmcsa.dot.gov/;
- National Highway Traffic Safety Administration (NHTSA): http://www.nhtsa.gov/;
- Peer-reviewed scientific journals such as SLEEP, Accident Analysis and Prevention, Journal of Sleep Research;
- NASA Fatigue Countermeasures Program (although this information concerns aviation there are many instances in which information pertains to CVOs): http://humanfactors.arc.nasa.gov/zteam/; and
- The References section of this manual.

Planned versus actual time worked: Evidence-based scheduling practices (discussed above) assign drivers' schedules with consideration to known fatigue-related factors and CMV operational requirements. Although this is an ideal starting point, unforeseen circumstances can cause schedules to change (e.g., weather conditions, traffic conditions, technical problems, and illness). No matter how much planning occurs prior to starting a route, the actual time worked can differ from the scheduled time worked. As fatigue is related to actual time worked, it is important to analyze differences between actual times worked and scheduled times worked.

Reactive Processes

Reactive processes of fatigue hazard identification are designed to identify how (if at all) driver fatigue may have contributed to crashes, near-crashes, and violations. The goals of these reactive processes are to identify how fatigue may have been mitigated to prevent the crash, near-crash, or violation and how to prevent similar situations from occurring in the future. Reactive processes of fatigue hazard identification may be performed routinely or may be triggered by fatigue reports or crashes, near-crashes, and

violations. To determine if fatigue was a contributing factor in a crash, near-crash, or violation, the following should be shown:[9]

- The driver was likely in a fatigued state;
- The drivers' actions or decisions were a cause of the crash, near-crash, or violation; and
- The drivers' actions or decisions were comparable to that of a fatigued driver.

To determine if a driver was likely in a fatigued state, the following information is required:

- The amount of sleep usually needed for the driver to feel fully rested and alert,
- The amount of sleep experienced during the 24 hours prior to the incident,
- The amount of sleep experienced during the 72 hours prior to the incident,
- The amount of time awake immediately prior to the incident,
- Information about the driver's workload prior to the incident,
- The time of day the incident occurred and if the incident occurred during the driver's normal sleep or rest time, and
- If opportunities were present to fully recover from sleep debt.

Two examples of fatigue investigation checklists developed by the Transportation Safety Board of Canada[61] are provided in Appendix H and Appendix I. Appendix H contains a checklist that determines if the driver was in a fatigued state, and Appendix I contains a checklist that determines if the driver's actions or decisions were comparable to that of a fatigued driver.

Step 4: Assess Safety Risks

After the fatigue hazards or causes have been identified, the next step is to identify the level of risk for each hazard or cause. This step is one of the keys to effective fatigue risk management. Safety risk assessments involve careful review of the identified fatigue hazards to determine if they have been controlled or eliminated and, if not, which hazards should be addressed immediately.[1]

Each fatigue hazard identified during Step 3 should be analyzed to determine any impacts on: sleep quality and quantity, sleep or rest opportunities, hours worked during circadian lows, and the number of hours drivers are required to stay awake. To determine these impacts, it is important to consult with all employees affected by the development of fatigue. It is vital that drivers be involved in the process of assessing risk as their practical and firsthand knowledge provides insight into which fatigue hazards are most prominent, dangerous, and frequent.[1]

There are two aspects of risk assessments. The first aspect is measuring the likelihood the fatigue hazard will occur; the second aspect is evaluating the severity of possible outcomes from the fatigue hazard. A dual assessment facilitates prioritization of the measures taken to control or mitigate identified fatigue hazards.

The following four tables have been adapted from ICAO[9] and illustrate the fatigue risk indexes in the aviation industry. Although the tables are based on research conducted in an aviation setting, the rating scales should be appropriate for CVOs. Table 5 and Table 6 show the differences in fatigue risk probability and severity; Table 7 and Table 8 show the fatigue risk assessment matrixes.

To assess safety risks, the following four steps should be completed.

Step 1: Define Fatigue Risk Probability

For each fatigue hazard identified during Step 3, use Table 5 to determine the probability that the hazard will occur in the future. Categories range from extremely improbable that the fatigue hazard will occur in the future to frequently likely to occur in the future. Record the value found in Table 5 of the fatigue hazard.

Table 5. Defining Fatigue Risk Probability (adapted from ICAO[9])

Category	Meaning	Value
Frequent	Likely to occur many times (has occurred many times)	5
Occasional	Likely to occur sometimes (has occurred infrequently)	4
Remote	Unlikely to occur but possible (has occurred rarely)	3
Improbable	Very unlikely to occur (not known to have occurred)	2
Extremely Improbable	Almost inconceivable the event will occur	1

Step 2: Define Fatigue Risk Severity

For each fatigue hazard identified during Step 3, use Table 6 to determine the potential severity if the hazard results in fatigue. Categories range from negligible (i.e., no significant consequences will result from this fatigue hazard) to catastrophic (i.e., multiple deaths and equipment will be destroyed as a result of this fatigue hazard). Record the value found in Table 6.

Table 6. Defining Fatigue Risk Severity (adapted from ICAO[9])

Category	Meaning	Value
Catastrophic	• Multiple deaths • Equipment destroyed	A
Hazardous	• A large reduction in safety margins, physical distress, or a workload such that drivers cannot be relied upon to perform their tasks accurately or completely • Serious injury • Major equipment damage	B
Major	• A significant reduction in safety margins or a reduction in the ability of drivers to cope with adverse operating conditions as a result of increased workload or as a result of conditions impairing efficiency • Serious incident • Injury to persons	C
Minor	• Nuisance • Operating limitations • Use of emergency procedures • Minor incident	D
Negligible	• No significant consequences	E

Step 3: Determine the Fatigue Risk Assessment

Combine the values from Step 1 and Step 2 to assess the safety risk of each fatigue hazard. Use Table 7 and Table 8 as a reference guide to determine which hazards require immediate attention. As shown in Table 8, hazards highlighted in red may be considered to be intolerable and require immediate action to mitigate the fatigue risk. Hazards highlighted in yellow may be tolerable as currently experienced but may require management to make a decision regarding any fatigue measures and countermeasures. Hazards highlighted in green may be considered acceptable and will probably be considered acceptable at the current level.

Table 7. Fatigue Risk Assessment Matrix (adapted from ICAO[9])

Risk Probability		Risk Severity				
		Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent	5	5A	5B	5C	5D	5E
Occasional	4	4A	4B	4C	4D	4E
Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely Improbable	1	1A	1B	1C	1D	1E

Table 8. ICAO Risk Tolerability Matrix (adapted from ICAO[9])

Fatigue Risk	Assessment Risk Index	Suggested Criteria
Intolerable Region	5A, 5B, 5C, 4A, 4B, 3A	Unacceptable under the existing circumstances.
Tolerable Region	5D, 5E, 4C, 4D, 4E, 3B, 3C, 3D, 2A, 2B, 2C	Acceptable based on risk mitigation. May require management decision.
Acceptable Region	3E, 2D, 2E, 1A, 1B, 1C, 1D, 1E	Acceptable.

Although these tables provide an ideal example of risk probability and severity criteria, they are only suggestions. Each carrier should work with its FMP steering committee to develop definitions and criteria.

Step 5: Select and Implement Measures and Countermeasures

Once it has been determined that a fatigue hazard requires action, appropriate controls and mitigation strategies should be selected and implemented. It is critical to communicate these controls and mitigation strategies to relevant personnel to ensure they understand what each hazard is and how the strategies are designed to reduce fatigue hazards.

Specific controls and mitigation strategies are described in detail throughout the FMP modules. Several of these controls and mitigation strategies are: scheduling tools/changes (see Module 9); cooperation with receivers (see Module 6); protocols for napping/resting (see Module 3); sleep disorder prevention, screening, and treatment (see Modules 7 and 8); and FMTs (see Module 10). Please refer to these specific modules for descriptions of fatigue controls and mitigation strategies.

Step 6: Monitor Effectiveness of Fatigue Risk Measures and Countermeasures

The final step in the risk management process is regularly evaluating the effectiveness of the measures and countermeasures implemented during Step 5. The purpose of this step is to analyze the overall effectiveness of the FMP. To accomplish this task, data gathered during Step 2 should be compared to the safety performance objectives of the

FMP. Gradual decreases of fatigue should provide insight into the effectiveness of the FMP. However, dramatic decreases of fatigue should not be expected immediately. Behavioral change requires time, and patience is needed when determining the overall effectiveness of the FMP. Figure 16 is an example graph of the percentages of drivers who provided at least one self-report of fatigue per month across the course of the first year after implementation. As shown in Figure 16, there are months when fatigue data indicate decreases in effectiveness. This is a natural occurrence and should not raise concern as long as the measures indicate a trend that fatigue management is improving.

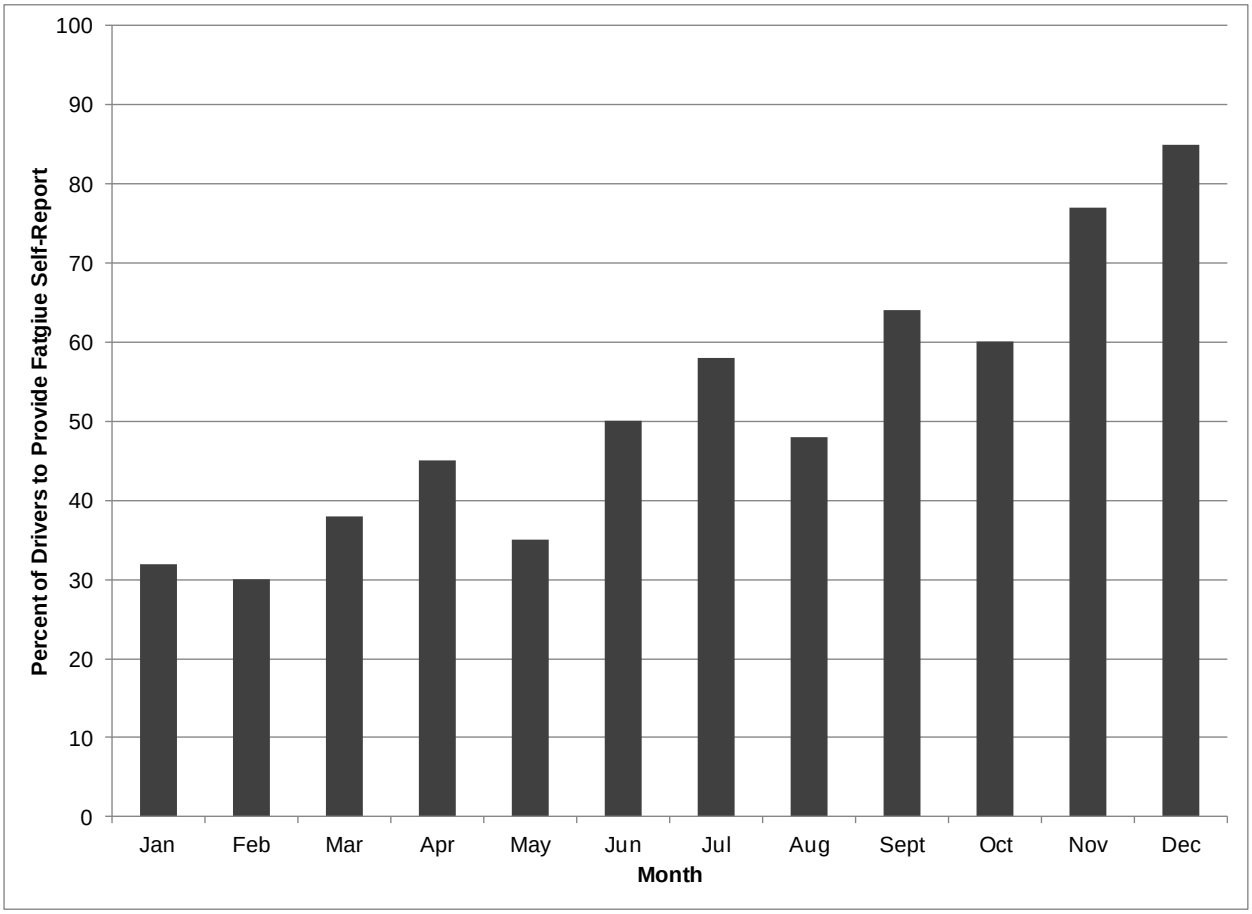

Figure 16. Percent of Drivers to Provide Fatigue Self-reports per Month.

If mitigation strategies perform to an acceptable standard, they should become part of the normal monitoring and evaluation of the FMP. However, if the selected mitigation strategies do not perform to an acceptable standard, FRMS processes should be reviewed and revised and/or new approaches should be considered starting at Step 1.

Chapter 4 in this manual and Module 2 in the FMP describe a number of measures that may be used to evaluate the effectiveness of the fatigue risk measures and countermeasures. Several of these measures focus on: sleep quality and quantity, fatigue-related crashes and near-crashes, driver alertness, fatigue-related violations,

FMP policies and procedures implemented correctly, and subjective opinions and perceptions of the FMP. For detailed descriptions of specific measures, please refer to Module 2 in the FMP and Chapter 3 of this manual.

SUMMARY

A FRMS approach provides an ongoing, data-driven process to identify, monitor, and manage fatigue-related factors. There are six core components of an FRMS: fatigue management policy, fatigue risk management procedures, fatigue management training and education, fatigue reporting, fatigue incident investigations, and FRMS evaluations. This chapter focused on the FRMS procedures, including: identifying operations where FRMSs may apply, collecting and analyzing fatigue-related data, identifying fatigue causes and hazards, assessing the safety risks of these fatigue hazards, selecting and implementing fatigue-related measures and countermeasures, and evaluating the effectiveness of these measures and countermeasures.

CHAPTER 5. TRAIN-THE-TRAINER

This chapter is designed to provide information about the important characteristics to consider when choosing trainers to lead the FMP instruction. The first section in this chapter provides a brief introduction to learning and characteristics of adult learners. The second section in this chapter focuses on how to select trainers and various trainer prerequisites. The third section in this chapter provides suggestions and strategies for trainers to enhance the learning experience of FMP trainees. Although this chapter reviews important information concerning trainer requirements, additional information can be found in Module 5 in the FMP.

INTRODUCTION TO LEARNING

The ultimate goal of any education or training program is the transfer of KSAs to trainees. To accomplish this, trainers not only have to be SMEs, they also have to understand how individuals learn. This involves trainers knowing the various principles and factors that influence learning.

What is Learning?

An individual learns when he/she has acquired relatively permanent KSAs from previous experiences that may impact his/her ability or method of accomplishing a goal, activity, etc.[62,63] There are three processes individuals use to learn new KSAs.[62] The first way is by acquiring and memorizing new knowledge. The second process is understanding this newly acquired knowledge, how the knowledge can be used, and how it relates to other information already memorized. In other words, individuals have to critically think about the new knowledge and how that knowledge can be applied in real-world situations. Finally, individuals need to repeatedly apply the knowledge in useful and meaningful situations.

When planning instruction, trainers should try to incorporate all three of these processes. For example, FMP trainers should provide trainees with new fatigue-related knowledge, facilitate discussions for trainees to think about and make sense of the new knowledge, and test trainees' knowledge and encourage them to practice new fatigue management strategies.

Generational Effects on Learning Styles

Research has shown there are specific learning characteristics of people based on the generation in which they were born and raised.[64-66] There are four generations currently in the workforce, and each generation has experienced different societal changes and technological developments that affect their learning experiences and preferences.

These generations are shown in Table 9 with their birth years and commonly used labels.[67]

Table 9. Generations Currently in the Workplace (adapted from Brock et al.[67])

Veterans (Traditionalists, Silent Generation)	Baby Boomers	Generation X	Generation Y
Born prior to 1946	1947 – 1964	1965 – 1979	1980 – 2000

Recognizing the various learning characteristics in each generation allows trainers to incorporate different learning styles into training. Brief descriptions of the learning characteristics of each generation are described below, as reported by Brock et al.[67]

Veterans, commonly referred to as Traditionalists or the Silent Generation, often share workplace values of conformity to others, dedication to hard work, discipline, logic, and conservative spending patterns. Veterans often expect a learning environment in which each person's background and experiences are respected, real-world examples and/or demonstrations are provided to support training concepts, and classroom instruction includes a review of all information expected to be learned (i.e., any information included in tests should be covered in class, not solely away from class).

Baby Boomers are often optimistic and strive for personal gratification from their work. They often place importance on team-oriented corporate cultures, value each individual's experiences, and have a strong drive to succeed. Baby Boomers typically flourish in a learning environment that includes logical, structured content; real-world opportunities to practice newly acquired KSAs; and positive feedback.

Generation Xers grew up in a technology-driven economy with the rise of the Internet, and their workplace values mirror this period. Their workplace values often include a sense of entitlement, high expectations for personal growth and career paths, a nurturing work environment, and a need to multitask. Learning styles preferred by Generation Xers include: environments that are flexible to their personal preferences, the opportunity to acquire KSAs through simulations and remote learning, and engagement and interaction in classroom settings.

Generation Yers, commonly referred to as the Millennials, share values with each of the generations discussed above. Similar to the Veterans, Generation Yers often believe in the importance of civic duties; like the Baby Boomers, they are often optimistic. Since Generation Yers grew up with the Internet, they possess superior technological skills similar to Generations Xers. Learning environments favored by Generation Yers typically are collaborative and integrate their personal lives with work. Unlike previous generations, this generation favors learning environments that allow personal navigation through learning material.

When instructing, trainers need to be aware of the preferred learning styles of each generation. Trainers should work with trainees to customize their instruction styles to provide the most rewarding learning environment possible.

Overarching Characteristics of Adult Learners

Although the four generations discussed have different preferred learning styles, there are overarching characteristics of adult learners that differ from children and young adults. Listed below are six characteristics common to adult learners.[68]

- Adult learners are self-directed in their learning. In other words, they learn new KSAs because they want to learn.
- Adult learners like to know *why* they need to learn. In other words, they need to be educated as to how the new KSAs are relevant to their lives.
- Adults prefer to learn in an environment that is characterized by mutual trust and respect. They prefer learning environments that are designed to encourage others to respect individual differences in experience.
- Adults learn best from personal experiences and the experiences of others. They learn the most information from real-world applications of the KSAs. In other words, "book knowledge" is not as meaningful to adult learners as it is for children or young adults. Thus, it is important to relate all "book knowledge" to real-world experiences.

- Adult learners prefer knowledge that can be immediately applied to their work and to their lives.
- Adults learn better when they are actively involved in the learning process and not simply receiving information. In other words, they like to be involved in discussions and prefer the opportunity to express their opinions on the subject matter.

SELECTING TRAINERS

Trainers are often the face of the FMP since they will typically be the first person discussing fatigue management with drivers and other relevant personnel. This means it is critical for management to carefully select who will administer any training. This selection process involves determining answers to a number of questions. These questions can be categorized as follows: educational requirements, required experience, job knowledge, interpersonal or people skills, and training knowledge and skills.[69] Example questions for each category are listed below.

Educational requirement questions to be answered when selecting a trainer for the FMP include:

- Is formal education required of FMP trainers? If so, how much?
- Are formal degrees a requirement? If so, which degrees are acceptable? How recently should the potential trainer have received the degree(s)?
- What knowledge is required of FMP trainers? Should this knowledge have been gained through on-the-job experience or solely through traditional education?
- Will the potential FMP trainer require additional education?

Experience requirement questions to be answered include:

- Does the potential FMP trainer know about specific organizational policies, the corporate culture, and/or other values that influence fatigue management?
- Has the potential FMP trainer exhibited excellent fatigue management behavior in the past?
- Is it required that the potential FMP trainer have previous training experience?
- Is driving experience a requirement for the potential FMP trainer?

Job knowledge questions to be answered include:

- What is the required amount of CMV driving and fatigue management knowledge?
- Should this knowledge have been gained through direct experience or through other means?
- Is previous fatigue management knowledge (other than what is presented in this FMP) a requirement?

Interpersonal or people skill questions to be answered include:

- Does the potential trainer have skills in: empathy (e.g., the ability to “stand in” others’ shoes), listening to concerns and questions, effectively communicating messages, group facilitation, addressing needs of trainees, and leadership?
- Does the trainer relate well to others?

Training knowledge and skill questions to be answered include:

- Does the potential trainer have knowledge of adult learning principles?
- Does the potential trainer have skills in counseling or advising trainees?

- Does the potential trainer have skills in following up with trainees and administering trainee evaluations?
- Does the potential trainer have knowledge of different learning styles?
- Does the potential trainer have public speaking skills?
- Does the potential trainer have skills in group facilitation?
- Can the potential trainer critique, evaluate, and be objective?
- Can the potential trainer be ethical and keep information confidential?

FMP Trainer Prerequisites, Requirements, and Responsibilities

Although the previous questions are critical to ask before selecting a trainer in any program, there are a number of prerequisites recommended for the FMP trainer.

An FMP trainer must possess the following:

- Knowledge of CMV driving and personal experience driving a CMV;
- Previous experience training CMV drivers;
- Ability to model appropriate fatigue management behaviors;
- Ability to relate well with other drivers and their families;
- Enthusiasm for CMV driver fatigue management;
- Loyalty to the company; and
- Ethics related to driver confidentiality.

FMP trainers must possess, or have the ability to develop, the following:

- Skills in effectively presenting materials to a group;
- Computer skills;
- An understanding of adult learning and motivation;
- Ability to create an environment conducive to learning;
- Active listening and positive reinforcement skills;
- Knowledge of company policies; and
- An understanding of the behavior change process.

There are additional skills required of the trainer before he/she is allowed to facilitate the FMP training and educational modules. These requirements include:

- Prior successful completion of the following modules with an 80 percent or higher average exam score:
    - Module 1: FMP Introduction and Overview (no exam but completion required);
    - Module 3: Driver Education;
    - Module 4: Family Education; and
    - Module 8: Driver Sleep Disorders Screening and Treatment
- Prior successful completion of at least one FMP training module (preferably Module 3) in the web-based interactive mode; and
- The successful completion of Module 5 with an 80 percent or higher exam score.

To increase the success of the FMP training, the trainer has a number of responsibilities. His/her principal responsibility is to conduct classroom training of Modules 3 and 4. To accomplish this task, the trainer should seek additional information about driver fatigue management to expand his/her knowledge base and to help answer any questions that trainees may have.

Another responsibility of the trainer is to supervise and assist trainees taking the web-based interactive instruction. The trainer should orient trainees to module content and requirements and ensure that trainees have adequate computer access and log-in information. The trainer should also be responsible for assisting students, whether in-person or remotely via computer or telephone.

A third responsibility of the FMP trainer is maintaining testing and record-keeping processes. All exam scores are recorded and should be tracked to ensure that all drivers and other relevant personnel have successfully completed the FMP training. Three attempts for each exam are permitted, but only the highest score is retained in the system. If a carrier has a learning management system (LMS), it will track online exam scores and student completion of modules. For those carriers without an LMS, the FMP trainer is responsible for providing the FMP steering committee with the training attendance and evaluation records.

Lastly, FMP trainers should be partially responsible for the support of trainees following completion of the FMP training and educational modules. Trainers should be open to any questions or concerns from trainees about the entire FMP. Since the trainers are likely the face of the program, trainers may be the person drivers go to with questions about fatigue management strategies. Trainers need to consider this role as important as the actual instruction and should take time to answer all questions and provide feedback as soon as possible.

STRATEGIES FOR EFFECTIVE INSTRUCTION

As mentioned, trainers are often the face of the FMP. This is because the trainers offer the first or only source of fatigue-related information to CMV drivers and their families. Thus, it is important for trainers to be effective in delivering instruction. Effective trainers possess several common characteristics and behaviors.[70] Although some of these characteristics and behaviors may come naturally to the instructor, it may be necessary to provide the instructor with training to improve some behaviors or to develop some characteristics. The common characteristics and behaviors of effective instructors are as follows:

- Trainers have respectful, personal relationships with the trainees.
- Trainers have high but realistic expectations of the trainees.
- Trainers are actively engaged in the training process and ensure that trainees are also actively engaged.
- Trainers recognize and reinforce successful learning.
- Trainers see themselves as change agents for the development of fatigue management.

To supplement the efforts of successful instructors, effective learning environments must be established. The following sections describe strategies for creating a positive classroom experience, providing and receiving feedback, and delivering instruction.

Strategies for Creating a Positive Classroom Environment

There are many ways to create a positive classroom experience for students. First, the classroom physical setting and equipment are important;[62] the best facilities and equipment available to the company should be used. This includes setting up the room so that trainees do not feel crowded. If possible, chairs/tables should be arranged such that trainees have an unobstructed view of the projector screen and can easily discuss training topics with each other.

The training should also take a learner-centered approach. In other words, instruction should be designed around the needs of the trainee. Instructional methods should be tailored to the trainees' specific learning styles. This includes facilitating discussion about fatigue management topics and using the learning principles incorporated in the FMP training and educational modules. Learning principles are used to enhance the amount of information trainees are able to retain.[71] These learning principles include: clear learning objectives stated for each FMP training and educational module, the context and relevance of each topic, overviews or "pre-organizers" so that students know what topics will be covered, information broken out and delivered in section,

information spaced to allow for breaks, illustrations provided, frequent opportunities for practice and feedback, and FMP module reviews designed to improve knowledge retention. Finally, it is important for trainers to project enthusiasm about fatigue management. This enthusiasm will transfer to trainees. Trainer enthusiasm will also help show trainees that the organization values fatigue management and the safety of its drivers.

Providing and Receiving Feedback

Feedback, or knowledge of results, is essential for effective learning. Feedback facilitates performance and behavior changes, identifies the present state of learning, highlights what needs to be learned, monitors progress, diagnoses problems, and provides positive reinforcement for success. Tips for providing learner feedback are as follows:[28,71,72]

- Feedback should be provided as close to the behavior or content as possible;
- Feedback should emphasize positive behaviors or what the trainee did correctly, not what the trainee did wrong;
- Feedback should be considered a two-way process in which trainees learn from the trainer's feedback and the trainer learns from trainees' feedback;
- Feedback needs to be credible (e.g., based on facts or data);
- Frequently providing feedback may cause the trainee to perceive a loss of personal control and may inhibit the trainee from developing skills in judging his/her personal behavior. Thus, frequency of feedback should be carefully examined; and
- The type of feedback should be chosen carefully. Higher performing trainees prefer feedback focused on competency that does not detract from their personal initiatives for learning. Lower performing trainees may need specific feedback with both positive and constructive aspects.

Delivering Instruction

Delivering the FMP instructional materials is the largest responsibility of the trainer. The following techniques or strategies should be used when delivering the FMP training and educational modules:[62]

- While the trainer needs to have mastered the material delivered during training, it is important that he/she thoroughly re-review all topics covered during the training session before beginning instruction.
- The trainer should bring additional reference resources to class to help answer any questions that may arise.

- If a trainee asks a question to which the answer is unknown, the trainer should tell the trainee such. The trainer should also tell the trainee the question will be researched after class and answered as soon as possible.
- The trainer should record any questions that were unforeseen or difficult to answer for future class offerings.

Additionally, the trainer should incorporate as many company examples and/or personal experiences as possible into the FMP instruction. Incorporating company information is consistent with learning principles as it provides context and relevance (i.e., learning is more likely to be applied if learners see the relevance to their work). It also helps reinforce company policies and practices. There are two approaches to using company examples: (1) Company examples could be shared throughout instruction or (2) A lesson focusing on company examples could be added to the instruction. However, caution should be exercised when providing examples. First, there are time constraints to the FMP. If the trainer adds a substantial amount of material, the training should be expected to take more time. Secondly, the company examples should reinforce the main content in the module, not contradict it. Finally, when citing company examples the individual confidentiality of those involved must be respected.

SUMMARY

The success of the FMP depends on trainers to effectively provide trainees with fatigue management KSAs. Thus, it is critical for these instructors to be carefully selected and trained in strategies designed to provide the most effective instruction possible. The topics covered in this chapter provided the basics for understanding how adults learn new material; questions to ask before selecting the FMP trainer(s); recommended prerequisites, requirements, and responsibilities of the FMP trainer(s); and strategies designed to provide effective instruction. For more information about train-the-trainer, please refer to Module 5 in the FMP.

CHAPTER 6. IMPLEMENTING AN OSA SCREENING AND TREATMENT PROGRAM FOR CMV DRIVERS

Parts of the following chapter are from Mabry, Baker, Hickman, and Hanowski.[73] This information is presented to provide guidance on how to implement an OSA screening, testing, and compliance program in CMV operations. This information was collected in 2010; thus, some of the technologies and procedures described below may have changed.

INTRODUCTION

OSA, the most common sleep disorder, is caused by repetitive collapse of the upper airway during sleep. These interruptions in breathing deprive the body of oxygen and induce numerous stressful arousals throughout the night, thus resulting in fragmented and insufficient restorative sleep. Young and colleagues estimated that between 2% and 4% of the U.S. population have mild OSA.[74] This estimate is likely to be higher given the strong relationship between obesity and OSA and the increased prevalence of obesity since the Young study, which included data collected in the Wisconsin Sleep Cohort Study, initiated in 1988.[74]

When considering CMV drivers as a population, there are few published reports of their status for body mass index (BMI). A study of 4,286 randomly sampled CDL holders in the Philadelphia area revealed that approximately half were obese, with a BMI of 30 kg/m^2 or more, and another 38% were overweight with a BMI of 25 to29.9 kg/m^2.[75] A more recent study by Wiegand et al.[76] found the prevalence of obesity among CMV drivers to be higher (53.4% of the sample). Given the distributed operations in long-haul trucking, limited access to healthy food options, and the sedentary lifestyle, it is not surprising that the prevalence of obesity among CMV drivers far outpaces the U.S. adult population. Furthermore, given the higher rates of obesity in CMV drivers, approximately one in four CMV drivers in the United States are estimated to possess mild or higher levels of OSA, with moderate and severe OSA found in 5.8% and 4.7% of this population, respectively.[77,78]

Individuals with OSA are at a greater risk for developing diabetes, hypertension, coronary artery disease, myocardial infarction, congestive heart failure, and stroke.[79] After following 1,522 people over the course of 13 years, Young et al.[80] found that individuals with severe sleep-disordered breathing were three times more likely to die during the study than those without breathing problems during sleep. Beyond health-related complications, OSA can be especially dangerous in CMV drivers since a major symptom of OSA is excessive daytime sleepiness. Excessive daytime sleepiness may negatively influence behavior, and can result in poor judgment and impairments in concentration, memory, and cognitive function.[81] These decrements may explain why passenger car drivers with mild, moderate, and severe OSA were 2.6, 1.9, and 2.0

times more likely, respectively, to be involved in a vehicle crash than were controls.[82] CMV drivers with OSA are likely to be at greater risk for involvement in a vehicle crash given their significant road exposure. In fact, Pack et al. found that CMV drivers with severe OSA were 4.6 times more likely to be involved in a severe crash during a 7-year period than were CMV drivers without OSA.[77]

OSA Screening and Testing

Because of these safety concerns, the FMCSA Medical Review Board[83], the NTSB[84], and a Joint Task Force comprising the American College of Occupational and Environmental Medicine, the American College of Chest Physicians, and the National Sleep Foundation[85] have strongly supported the implementation of federal mandates to screen and test all CMV drivers with Class-A and Class-B CDLs for OSA. FMCSA currently has a regulation that states that a CMV driver is physically qualified to drive if that driver has no established medical history or clinical diagnosis of a respiratory dysfunction likely to interfere with his/her ability to control and safely drive a CMV (49 CFR 391.41[b] subpart 5); however, there are no current regulations on mandatory screening and testing of CMV drivers. Thus, drivers may be unwilling to voluntarily consult their physician about OSA as it may disqualify them from driving if they are diagnosed with OSA and do not seek treatment (the current FMCSA regulation does not disqualify drivers who are treating their OSA with positive airway pressure [PAP]).

OSA Treatment

OSA treatment methods, including weight reduction and upper airway surgery, have proven successful in maintaining an open upper airway during sleep by preventing the posterior backward movement of tongue and soft palate from narrowing the airway.[86] However, the most prescribed and cost-effective first-line treatment for OSA is nasal continuous positive airway pressure (CPAP).[87] CPAP establishes a pneumatic splint in the nasopharyngeal airway to prevent upper airway collapse during sleep.[88] Studies have consistently shown that CPAP therapy reduces overall airway resistance, thereby decreasing OSA severity, improving sleep quality and reducing daytime sleepiness and fatigue.[89]

However, automatic PAP (APAP), which adjusts to changes in airway pressures during inspiratory/expiratory effort, has also been shown as an effective treatment for OSA.[90-92] In 2008, the American Academy of Sleep Medicine stated that APAP is an appropriate choice of therapy for moderate to severe sleep apnea in those without significant co-morbidities.[93] APAP has also been shown to result in an overall reduction in delivery pressure and potentially improves adherence to therapy.[94,95] Although fixed CPAP requires in-laboratory polysomnography, APAP can be “self-titrated” outside of the sleep laboratory.

OSA Case Study

The high costs associated with screening and testing drivers for OSA, as well as treatment via PAP, may dissuade carriers from investing in an OSA program with their drivers without data showing a positive return-on-investment (in terms of reduced health costs, lower crash rates, and improved driver retention). Additionally, many carriers are unlikely to possess the resources or knowledge necessary to implement an effective OSA program with their drivers. Fortunately, two leading U.S. carriers, Schneider National, Inc. (SNI) and J.B. Hunt Transport, Inc. (JBH) have partnered with commercial sleep apnea providers, Precision Pulmonary Diagnostics (PPD) and SleepSafe™ Drivers, Inc. (SSD) and their partner FusionHealth, respectively, to implement OSA programs to screen, diagnose, treat, and manage their OSA-positive CMV drivers. SNI initiated a pilot OSA program in 2003 with PPD and has since expanded it to mandatory fleet-wide screening, testing, and treatment. JBH initiated a voluntary pilot program in 2008 with SSD, who later included FusionHealth in the trial program. JBH has since expanded the sleep program nationally with SSD.

The "Case Study"[73] provides an overview of these two OSA programs; outlines each carrier's screening, testing, and compliance protocol; and compares and contrasts the two carriers' approaches. Focus group research was also conducted with drivers and staff involved in each OSA program to assess drivers' and staff perceptions and opinions of their respective OSA programs. A set of best practices will be developed which will provide recommendations and guidance for implementing and maintaining a successful OSA program for the trucking industry. However, the business case (i.e., return-on-investment) for implementing an OSA program has not been completed and is not included in the current report. The research team believed that carriers deliberating on implementing an OSA program with their drivers, or in the early stages of implementing an OSA program, would benefit from an overview of two successfully implemented OSA programs in CMV operations. The current report will be updated to include the business case for implementing an OSA program when data collection and analyses have been completed.

OSA CASE STUDY METHODS

To provide an overview of each carrier's OSA program, the VTTI team worked with executives and staff at SNI, JBH, PPD, and FusionHealth to accurately detail and describe their OSA program protocols. Each program is described in terms of OSA screening, testing, treatment, compliance monitoring, and follow-up.

Focus groups were conducted with drivers and staff involved in each OSA program to assess their perceptions and opinions of their carrier's OSA program. Four focus group meetings (one each with drivers and staff participating in SNI or JBH's OSA programs), each lasting approximately 120 minutes, were conducted. Between 5 and 10 participants were recruited in each focus group. Phone interviews, each lasting

approximately 90 minutes, were also conducted with staff participants that were unable to attend the focus group meetings. There was no exclusion criteria based on sex, health, status, or ethnicity; however, all participants were required to be eligible for employment in the United States, possess a valid Class-A CDL (if a driver), and be currently involved in their carrier's OSA program. Upon arrival to the focus group meeting, all participants consented to participate and completed a brief survey which collected demographic information and inquired about the participant's experience with the respective carrier's OSA program. The driver and staff interview guides were structured similarly; however, each was geared for the population of interest. Each focus group and phone meeting consisted of six parts:

I) **OSA Program Participation:** Drivers were asked about their likes and dislikes about participating in the OSA Program. Staff participants were asked about their position at the company and their roles and responsibilities within the OSA program.

II) **Screening, Testing, and Education:** Participants were asked to review and discuss the steps in this process, how they would revise this process, and about their opinions regarding each step and suggestions for improvement.

III) **Recommended Treatments:** Drivers were asked to list each treatment recommended to them in their OSA program. Drivers were also asked to discuss their experiences with each treatment and describe the education and training they received. Staff participants were asked to list each OSA treatment recommended to drivers, to discuss their experiences with each treatment, and to describe what (if any) education and training they provide drivers.

IV) **Treatment Compliance:** Drivers were asked to sort each treatment into categories to rate ease of compliance and discuss barriers and supports regarding PAP compliance. Staff participants were asked to sort each treatment into categories to rate the ease of compliance monitoring and to discuss barriers and supports in compliance monitoring.

V) **Program Outcomes:** Drivers were asked to list and discuss benefits and drawbacks in participating in the OSA program. Staff participants were asked to discuss supports and challenges in implementing an OSA program for carriers.

VI) **Closing Thoughts:** Participants were asked to express any important issues and ideas that were not brought up during the meeting.

All focus group meetings were audio-recorded for later transcription and analysis. Participant responses were analyzed via content analysis (adapted from a framework analysis methodology).[96]

RESULTS

OSA Program Protocols

Precision Pulmonary Diagnostics Protocol

PPD, founded in 2005, is committed to diagnosing and treating OSA in commercial drivers/operators to improve driver health and safety and provide a significant return-on-investment for employers. Several leaders in the trucking industry have chosen PPD as their sleep apnea provider, including SNI, H.O. Wolding, and Swift Transportation. PPD's integrated, patented program includes web-based screening tools, diagnosis, treatment, and monitoring of OSA in commercial drivers. Since 2006, PPD has served as SNI's sleep apnea provider to screen all of their CMV drivers for OSA, test those at high risk for the disorder, and treat and monitor those drivers diagnosed with OSA.

Screening

Sleep-related questionnaires and objective sleep tests are the most common and cost-effective methods to use for screening for OSA. Sleep questionnaires, including the Epworth Sleepiness Scale (*ESS © MW Johns 1990-1997. Used under license*; see Appendix J), the Functional Outcomes of Sleep Questionnaire (FOSQ; see Appendix K), and the Berlin Questionnaire (See Appendix L) , are all validated OSA screening tools in general adult populations where there is no pre-existing resistance to diagnosis.[47,97,98] Unfortunately, as a group, truck drivers are different in this regard.[99,100] Sleep tests, including the Multiple Sleep Latency Test and the Maintenance of Wakefulness Test, evaluate daytime sleepiness and fatigue; however, these laboratory-based tests have limited utility in some populations, including the case of shift workers.[101-103]

PPD has developed a proprietary web-based screening tool, the Somni-Sage® Screening Questionnaire (SSSQ), to identify drivers at risk for OSA (see Appendix M for the SSSQ). This self-report questionnaire includes items that can divulge information regarding OSA symptoms and coexisting conditions predictive for OSA. The questionnaire takes about 5 to 10 minutes to complete and includes approximately 30 subjective and objective items, including demographic and medical questions. As drivers may try to conceal OSA symptoms for fear it may jeopardize employment and/or require them to receive OSA treatment in order to drive, the SSSQ was designed to classify individuals based on the likelihood of OSA while minimizing drivers' ability to "trick" the system by providing false answers. The questionnaires are scored and ranked to determine the likelihood a driver may have OSA (with Class 4 representing the lowest probability and Class 1 the highest probability). The results are then posted

to a secure website that can be accessed by SNI for review and scheduling of laboratory polysomnograms (PSG), with preference given to Class 1 drivers.

PPD uses the SSSQ to screen all existing SNI drivers during spring and winter training and new hires during their entrance paperwork. PPD and SNI are currently working toward fleet-wide screening, as well as re-screening drivers, as they continue to refine and expand the OSA program. In addition to the SSSQ, SNI drivers may also be referred to undergo an overnight laboratory PSG through several other modes, including: (i) a DOT certifying physician may refer a driver for a PSG based on information from the certification exam, (ii) an SNI safety manager or occupational health nurse who believes a driver may be have a high likelihood of OSA (based on conversations with the driver, such as frequent sleepiness, etc.) can refer a driver, and (iii) self-report from the driver or a report from another driver (i.e., a team driver). These additional modes of screening identify SNI drivers that likely have OSA who may have "slipped through the cracks" (i.e., have not taken the SSSQ or concealed responses on the SSSQ).

Scheduling and Outreach

Once an SNI driver has been identified as "Class 1" via his/her responses on the SSSQ, or has been referred for PSG testing by one of the methods described above, PPD works with SNI to schedule the driver for an overnight laboratory PSG at one of PPD's multiple partnering sleep laboratories around the country that is most convenient for the driver in question. SNI drivers are scheduled for a PSG based on their Class categorization, such as those with severe co-morbidities, and the date they completed the SSSQ (with those ranked in Class 1 given priority). Approximately 50 to 60 SNI drivers are scheduled to undergo a laboratory PSG each month. Prior to the driver being tested, PPD begins OSA outreach by educating the driver on OSA symptoms, adverse consequences, and treatment, as well as what they can expect in the overnight laboratory PSG test.

Laboratory Polysomnography

All Class 1 SNI drivers complete a full-night Type 1 PSG to properly diagnose OSA (see Figure 17 for a typical Type 1 PSG). This overnight sleep study provides a comprehensive recording of multiple physiologic parameters related to sleep and health and is considered the gold standard for OSA diagnosis and several other sleep disorders.[104] The driver arrives at the sleep laboratory in the early evening for an introduction to the sleep laboratory environment, which includes a private room, similar to a hotel room, where the driver will sleep that night. A sleep technician will attach multiple wires and electrodes to the driver so that several channels of data can be recorded when the driver falls asleep. Recorded data include brain activity, heart rate and rhythm, airflow, oxygen saturation, chin and eye movement, and chest, abdominal and leg movement. Wires for each channel of recorded data lead from the driver into a recording device placed near the driver, often on a nightstand. This recording device transmits all data to a computer system for recording, storing, and displaying the data. A video camera in the driver's sleeping chamber is also recording the driver throughout

the night. A sleep technician is monitoring all data and video in real time as the driver sleeps. The next morning, the driver will wake up or be awakened by a sleep technologist and all sensors and wires will be disconnected.

Figure 17. Patient Undergoing a Laboratory PSG

To ensure the PSG does not interfere with drivers' work schedules, sleep tests are scored and interpreted by the participating sleep physician the morning following the SNI driver's laboratory PSG (i.e., prior to the driver leaving the sleep clinic). The sleep test is scored by interpreting the following information: (i) sleep onset latency, or the onset of sleep from the time the lights were turned off, (ii) sleep efficiency, or time asleep divided by time in bed, (iii) sleep stages, (iv) apneas and hypopneas (complete and partial, respectively), which are cessations of airflow for at least 10 seconds followed by an arousal and/or 3% oxygen desaturation, (v) arousals, which are sudden shifts in brain wave activity which interrupt sleep, (vi) cardiac rhythm abnormalities, (vii) leg movements and body positions during sleep, and (viii) oxygen saturation during sleep. The sleep test is interpreted in conjunction with additional collected information, including medical history, medications taken, and any other relevant sleep and health information. The sleep test is scored using the Apnea-Hypopnea Index (AHI), which assesses the severity of OSA based on the number of apneas and hypopneas per hour. AHI is used to classify severity of OSA, including: (i) an AHI of 5 to 15 events/hour indicates mild OSA, (ii) an AHI greater than 15 to 30 events/hour indicates moderate OSA, and (iii) an AHI greater than 30 events/hour indicates severe OSA. The interpreted results from the sleep tests are then sent to PPD's Chief Medical Officer, Dr. Mark Berger, for review and to upload into the Somni-Sage® administrator Health Insurance Portability and Accountability Act (HIPAA)-compliant data base. SNI drivers that test negative for OSA (i.e., AHI ≤ 5 events/hour) are informed of their results and are free to leave the sleep lab. However, drivers that test positive for OSA (i.e., AHI ≥ 5 events/hour) are informed of their results and are immediately administered treatment for their OSA.

Training and Treatment

The most prescribed and cost-effective first-line treatment for OSA is nasal PAP.[87] This device establishes a pneumatic splint for the nasopharyngeal airway by delivering a

stream of pressurized air via a hose connected to a face mask, thereby preventing upper airway collapse during sleep to reduce or prevent apneas and hypopneas.[88] See Figure 18 for a PAP device. Studies have consistently shown that, when used properly and consistently, PAP therapy reduces overall airway resistance; thus, decreasing OSA severity.[89] The most commonly prescribed PAP therapy is CPAP, which delivers a fixed air pressure, prescribed by the physician, to splint the airway open continuously. APAP is becoming increasingly popular, as these machines adjust the delivery pressure throughout the sleep period based on changing optimal pressure requirements due to sleep stage and body position. APAP treatment may be better tolerated by patients, thus improving compliance – as compared to CPAP – due to the fluctuating delivery of air pressure and the overall reduction in delivery pressure.[94,95] Bi-level PAP (VPAP) delivers a high pressure on inhale and a lower pressure on exhale, to make exhaling against the PAP delivery pressure easier for the patient. Bi-level may be indicated for a patient with more complex apnea or for those requiring additional ventilatory support.

Figure 18. PAP Device (left) and Person Sleeping with PAP Device (right)

Immediately after being diagnosed with OSA, SNI drivers receive treatment, which typically includes APAP treatment; however, CPAP and Bi-level may be prescribed as well. APAP is the preferred OSA treatment option for this population because it does not require individual titration and requires less time in the sleep clinic. For example, a titration study is necessary to determine the required fixed pressure needed to alleviate apnea when prescribing CPAP treatment. Titration often requires an additional overnight stay at the sleep laboratory following the diagnostic PSG. This additional night in the sleep laboratory is considered a drawback for drivers as it takes them off the road for an additional night, costing the driver and SNI extra money. Another option is a split-night PSG, where a PSG is conducted during the first part of the night and the second part of the night is used for titration; however, a drawback to a split-night study is the reduced time for sleep analysis, OSA diagnosis, and CPAP titration. Therefore, APAP is preferred in cases where titration may not be needed. By measuring the resistance in the driver's breathing, the APAP device automatically adjusts the amount of pressure delivered to the driver to the minimum required to maintain an unobstructed airway. Therefore, the driver receives the precise pressure required at a given moment and

avoids the compromise of continuous fixed pressure. Special cases, including central sleep apnea and very severe apnea, may be recommended for titration studies and different types of treatment devices may be suggested (such as CPAP or VPAP).

SNI drivers are instructed on how to care for and maintain the PAP equipment as well as the components of the device and how to order replacement masks and other components. SNI drivers are fitted with a mask and are given the necessary PAP device and accessories, including a humidifier, hoses, filters, water reservoirs, etc., which are on-site and ready for distribution at the PPD partnering sleep laboratories. The drivers are also provided educational and training information to facilitate immediate treatment and limit extended out-of-service time. Drivers are also informed of SNI's OSA treatment compliance policy and procedures. SNI drivers are currently expected to use their PAP device for a minimum of 4 hours each night. This is currently the accepted clinical threshold for adequate PAP compliance.[105] Drivers who do not meet this usage criteria are prohibited from driving for at least two weeks until adequate compliance can be demonstrated. Long-term driving suspension and termination may be indicated for chronically non-compliant drivers.

Once a driver is diagnosed with OSA, SNI is notified and the company sends these drivers a letter of support from SNI that discusses the expectations of the driver. These include the driver taking responsibility for managing and treating their OSA. Once SNI has been notified of the driver's OSA diagnosis, the driver works with his Driver Business Leader (DBL) to be routed to the nearest SNI operating center where a power inverter will be installed in his/her truck cab. The power inverter enables in-cab use of the PAP device and humidifier while on the road. It also enables PPD to access daily wireless downloads of treatment usage and efficacy from the PAP machine. The PAP device cannot function in the truck without the power inverter; therefore, the timeliness of the power inverter install is crucial so that the driver may begin treatment and return to driving. Upon leaving the operating center, the SNI driver is equipped with all the necessary equipment and accessories to begin using his/her prescribed PAP treatment.

Compliance Monitoring

Several positive outcomes are associated with PAP treatment for OSA, including improved attitude and daytime functioning, reduced fatigue, and reduced blood pressure and cardiovascular complications; despite these positive outcomes, treatment compliance continues to be inadequate. Studies indicate that a significant proportion of adult patients, as many as 83%, may not meet the criteria for compliance due to removing the device early in the night or skipping PAP use completely.[106] However, many of the technical and behavioral issues that contribute to poor PAP compliance, including poor mask fit, incorrect PAP delivery pressure, and general problems adjusting to treatment, can be addressed soon after treatment is initiated. The earlier these problems are identified and addressed, the sooner patients can begin establishing positive patterns of compliance which will help them with long-term adherence.

PPD uses the ResTraxx® web-based compliance monitoring device to monitor each driver's PAP usage and compliance (Figure 19). The ResTraxx® device has a wireless

transmitter which links to the PAP treatment device to automatically upload usage information to a secure server that is monitored by PPD personnel. OSA patients usually establish patterns of compliance within the first week following treatment initiation; thus, daily PAP usage and efficacy uploads are scheduled during the SNI driver's first 30 to 90 days with the PAP device. SNI drivers are carefully monitored during this early period to allow timely identification of problems and effective troubleshooting with the driver. Common complaints and problems following PAP initiation include mask discomfort and irritation, mask leaks, delivery pressure discomfort, claustrophobia, movement restrictions while sleeping, and morning congestion and dry mouth. Once a driver demonstrates a treatment compliance routine that meets the minimum usage requirements of 4 hours/night for 70% of the nights, the ResTraxx® wireless transmitter is no longer required. This usually occurs within the first month to allow drivers time to adjust to treatment and become comfortable with their PAP machines. Once the ResTraxx® is removed, SNI drivers are instructed to mail data cards from the PAP device to PPD every 90 days to assess ongoing PAP usage and compliance monitoring.

Figure 19. Restraxx® Compliance Monitoring Device

SNI has an OSA treatment compliance policy that outlines expectations and responsibilities for drivers regarding their PAP treatment, as well as consequences for non-compliant drivers. Consequences for these drivers may include verbal warnings, temporary driving restrictions, and termination. SNI drivers that do not attain the minimal threshold for adequate PAP usage (4 hours/night for 70% of the nights) are flagged as non-compliant and PPD alerts the driver's DBL. The DBL then contacts the driver to speak with him/her about their non-compliance. At this point, both PPD personnel and SNI personnel work together with the driver to address the problem(s). Initially, technical issues are examined; this may include poor mask fit or leaks, pressure discomfort, and humidification problems. If non-compliance persists after technical issues are addressed, the driver is suspended from driving for two weeks. During this time PPD and SNI personnel continue working with the driver in question to coach and support his/her use of PAP. SNI also uses "driver champions" which are SNI drivers that have been PAP-compliant and have a positive attitude regarding PAP treatment (non-

compliant drivers may be more responsive to these driver champions rather than to PPD and SNI personnel). The SNI driver must demonstrate satisfactory compliance during these two weeks before they are permitted to be in service again. If the driver continues to be non-compliant with PAP treatment, SNI may terminate the driver.

Long-Term Treatment

PPD monitors SNI drivers' quarterly compliance histories via the PAP data cards as long as they are driving for SNI. PPD also provides long-term care by supplying SNI drivers with PAP replacement supplies every 6 months. This includes a new mask, filter, water reservoir, and replacement hoses and tubing. PPD also provides ongoing support for SNI drivers via a toll-free number, including OSA and PAP support/questions, supplies, etc. If an SNI driver needs a new PAP and/or PAP supplies, PPD works with the driver's DBL to ensure that this equipment reaches the driver as soon as possible. Given the distributed operations of SNI, equipment will be sent to the nearest SNI operations center for pick-up or directly to the driver's home (whichever is most convenient and timely for the driver).

FusionHealth and SleepSafe™ Drivers, Inc. Protocol

FusionHealth has implemented a specialized medical program focused on restoring health and improving quality of life for people with sleep-related disorders. The FusionHealth company is based in Atlanta, Georgia and is focused on delivering sleep disorder management services to employers in risk-adverse industries, including trucking, aviation, public transportation, rail, and other occupations highly influenced by fatigue-related risk. SleepSafe™ Drivers (SSD) works to promote and deliver full sleep disordered breathing management services to a broad range of employers, although it specializes in industries with risk-sensitive job categories such as trucking, aviation, rail, maritime, and energy, where excessive daytime sleepiness caused by OSA can create significant safety challenges. FusionHealth and SSD partnered on a contract to run a clinical trial focused on testing and treating JBH drivers suffering with sleep apnea. The clinical trial is voluntary and will document cost savings associated with reduced medical expenses and accidents; however, the primary goal of the trial is to improve the health and safety of the JBH drivers. Together with the JBH Special Projects Manager, Debra Thomas, and the JBH Senior Vice President of Corporate Safety & Security, Greer Woodruff, the SSD President and Founder, Dana Voien, and the Chief Medical Officer and co-Founder of FusionHealth, Dr. Jeffrey Durmer, developed a protocol to detect and treat OSA in JBH drivers quickly and cost-effectively. The protocol delivers a low-cost, high-quality program designed to screen, test, and treat OSA in the workplace while minimizing drivers' downtime.

Recruitment and Screening

As the FusionHealth protocol is a clinical trial, JBH drivers must meet certain inclusion and exclusion criteria to participate in the JBH voluntary sleep apnea program. JBH drivers are eligible to participate in the clinical trial if they meet the following criteria:

voluntary JBH drivers under the age of 75 years must have been with JBH for at least one year, participate in the JBH insurance option, and have access to the JBH terminal site where the clinical trial is being conducted. While most JBH drivers are self-selected, some drivers are also screened to participate using available health records, anthropometric data, and symptoms of sleep-disordered breathing (e.g., snoring, witnessed apneas, and excessive daytime sleepiness). Voluntary participants may also be identified by the JBH managers and/or medical professionals who certify drivers for their DOT certification. Please note that JBH drivers may be referred to the OSA program; however, their participation, or lack thereof, is completely voluntary.

Education and Evaluation

JBH drivers that have been recruited and are eligible to participate in the study are scheduled to meet FusionHealth personnel at the participating JBH terminal. JBH drivers meet with FusionHealth personnel for an educational session where the health and safety complications of OSA are explained and drivers' questions regarding OSA are answered. Interested drivers consent to participate in the JBH clinical trial and complete detailed health and sleep questionnaires to identify and quantify their likelihood for sleep and medical disorders, including OSA and other sleep breathing disorders. JBH drivers also undergo a physical exam and are questioned about general medical information to assess pre-existing conditions. FusionHealth examiners assess each driver's resting heart rate and blood pressure, height and weight, and neck circumference, as well as Mallampati score and peripheral edema, both of which can be useful and non-invasive markers of OSA. A Mallampati score is determined by a physical examination of the oral cavity, specifically the uvula and the soft palate. A high Mallampati score is associated with a higher incidence of OSA.[107] Peripheral edema, or fluid accumulation and swelling of tissues in the limbs, is commonly caused by hypertension due to inadequate circulation of blood throughout the body.[108] Hypertension is strongly associated with OSA; therefore, peripheral edema may be a marker for untreated OSA.[109]

After the JBH driver completes the battery of questionnaires, including the ESS (*ESS © MW Johns 1990-1997. Used under license)* and the Berlin Questionnaire, and general health screens, he/she is fitted with an Embletta® device (i.e., a portable sleep testing device will be worn by the driver that night to determine the presence and severity of sleep-disordered breathing; Figure 20). The Embletta® is approved by the U.S. Food and Drug Administration (FDA) to measure nasal pressure, blood oxygenation via pulse-oximetry, lung volume via respiratory inductance plethysmography, snoring, and electrical activity of the heart via electrocardiogram (EKG). FusionHealth personnel instruct drivers on the proper set-up and use of the Embletta®. In some situations, the Embletta® is placed on the driver for immediate use that night; however, in other situations, the device is taken off and the driver is expected to replace the device him/herself that evening prior to going to bed that night. As the clinical trial is voluntary, there is no need to verify that the driver wore the Embletta®, as opposed to sabotaging the test by placing the device on another individual. It should be noted that

FusionHealth staff did verify each driver's' identity by checking their driver's license prior to setting them up on the Embletta®.

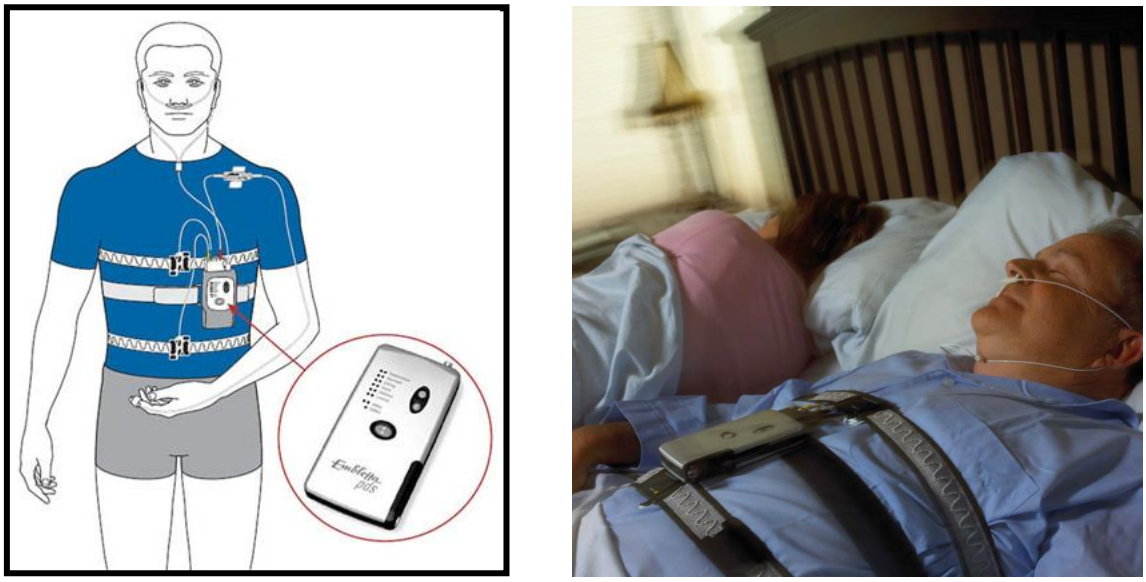

Figure 20. Embletta® Recording System

Once the JBH drivers have been instructed on the proper use of the Embletta® and all of their questions have been answered, drivers go to their sleeping chamber for the night (this may be the truck cab, bunk house, hotel, or home). The Embletta® is on and recording data throughout the night while they are sleeping. The next morning, the driver removes the Embletta® as instructed and returns the device to FusionHealth personnel waiting to meet them at the JBH terminal. Upon receiving the Embletta® from the JBH driver, the sleep technician inspects the device and downloads the data to a remote secure server via a wireless Internet connection. Once on the secure server, the FusionHealth technical team interprets and scores the data from the Embletta® (see Appendix N for an example of Embletta® scored apnea data). The final review of these data is performed by a board-certified sleep physician at FusionHealth and the principal investigator for the JBH clinical trial, Dr. Jeffrey Durmer. More specifically, Dr. Durmer reviews the overnight sleep test data, sleep and medical history, and physical examination data prior to making a formal diagnosis. While these data are being reviewed, the on-site FusionHealth team begins driver education regarding OSA treatment. This includes training the driver on how to use the PAP device and fitting the driver with the appropriate PAP mask. The turnaround time from when the sleep test data are downloaded to the secure server to when the driver receives a formal OSA diagnosis from the board-certified sleep physician at FusionHealth is 30 to 60 minutes.

Once a formal medical decision has been made by the FusionHealth sleep physician, a letter describing the results and a copy of the test report are generated and sent to the driver's DOT certifying physician. If the driver was diagnosed with moderate or severe OSA, according to the criteria in the clinical trial (AHI ≥ 15 events/hour), the DOT certifying physician is notified that the driver will receive immediate treatment with PAP

and a 90-day provisional certification is requested. In some situations, the request for a provisional certification may require an iterative process between FusionHealth and the DOT certifying physician (most notably that FusionHealth will be closely monitoring the JBH driver during his/her 3-month provisional certificate phase). If a driver was negative for OSA based on the clinical trial criteria (AHI <15 events/hour), it was documented and the DOT physician was notified. In some instances, a driver may score low on the overnight sleep testing device (i.e., (AHI < 15 events/hour) and found negative for OSA according to the criteria of the clinical trial; however, evidence from the test data may suggest another type of sleep-disordered breathing. In these cases, FusionHealth will contact the JBH driver for follow-up, including a consultation with a sleep medicine physician and/or a laboratory PSG test.

Other sleep disorders and/or sleep conditions suspected during these evaluations, including restless leg syndrome, hypersomnias, parasomnias, insomnias, and central sleep apnea may be identified by the FusionHealth program. If the driver is participating in the JBH program, FusionHealth personnel will follow up with a more thorough evaluation, which often includes a laboratory PSG to diagnose the specific sleep disorder. If the driver does not qualify to participate in the JBH program (i.e., AHI < 15 events/hour), then FusionHealth will recommend that the driver follow up with a sleep physician, either at FusionHealth or the driver's choice, to undergo a clinical evaluation to diagnose the suspected sleep disorder. The drivers with sleep disorders other than OSA will not be included in the clinical trial. Upon completing the evaluation phase, all voluntary JBH drivers completed screening and testing for the following sleep disorders: OSA and sleep-disordered breathing, restless leg syndrome, hypersomnia, insomnia, and parasomnias; however, only those JBH drivers that tested positive for OSA, according to the criteria of the clinical trial (AHI ≥ 15 events/hour), were included in the clinical trial.

Treatment

Upon receiving a positive OSA diagnosis, JBH drivers immediately begin treatment using an APAP device. As described above, APAP effectively treats most patients with OSA; however, unlike other PAP devices, APAP does not require an overnight in-laboratory titration study. The APAP device may not be appropriate for some drivers, such as drivers with more complex apneas. In these cases, CPAP or VPAP may be recommended following a laboratory PSG and titration study; however, APAP is the recommended device and is appropriate for the majority of JBH drivers. The drivers receive the PAP unit and all necessary equipment and accessories upon their formal OSA diagnosis. This includes two masks, tubing, filters, water reservoir, humidifier, compliance log book, pamphlets, and reading materials about OSA and PAP therapy, along with the contact information for FusionHealth. FusionHealth provides extensive training, fitting, and technical instruction to JBH drivers on the use and care of their PAP device. Attached to the PAP is a ResTraxx™ reporting device that wirelessly transmits daily usage and compliance data to the FusionHealth compliance team. The PAP device also records compliance and efficacy data, which is monitored by FusionHealth

personnel to ensure JBH drivers are using the PAP for the required amount of time and the machines are effectively controlling the driver's OSA. Note that when the JBH driver is undergoing the education and training with the FusionHealth team, the JBH mechanical shop is alerted and instructed to install a power inverter in the driver's truck cab. As indicated above, the power inverter is critical for in-cab PAP use as well as wireless compliance monitoring.

Compliance

As part of their compliance coaching program, FusionHealth uses the commercially available ResTraxx™ web-based compliance program to monitor each driver's PAP usage and compliance. The ResTraxx™ device has a wireless transmitter which links to the PAP treatment device to automatically upload usage information to a secure server that is monitored by the FusionHealth compliance team. The ResTraxx™ reporting device enables the FusionHealth compliance team to receive daily PAP compliance and efficacy data during the first month of PAP usage or until the driver is compliant with therapy. Daily transmission of these data are crucial during the initial stages of PAP usage as the driver is becoming accustomed to the device and new sleep habits are being developed. The FusionHealth team coaches the drivers to become 100-percent compliant with a minimum acceptable compliance of 4 hours use/night for 70% of the nights. Compliance coaches do this by stressing the specific health and safety implications of continued PAP use for each individual driver during the initial education and training sessions as well as with one-on-one coaching for all drivers in the program. If a driver demonstrates poor compliance or deviates from the minimal threshold for compliance (4 hours/night for 70% of the nights), FusionHealth coaches immediately contact the JBH driver to resolve the issue. FusionHealth personnel work with the driver to resolve behavioral barriers to adherence, medical problems that may limit therapy, and/or mechanical issues with the PAP device or accessories, including mask leaks, pressure deviations, or faulty inverters. If a solution cannot be identified within 24 to 48 hours, FusionHealth personnel contact the JBH coordinator who then decides how to handle the issue with the driver. Non-compliant drivers are typically restricted from driving for a week until they can demonstrate adequate compliance.

JBH drivers are removed from daily ResTraxx™ wireless monitoring once they have demonstrated 30 days of successful PAP treatment. After successfully demonstrating PAP compliance, JBH drivers are monitored monthly via data cards. Any deviation from adequate PAP compliance prompts FusionHealth personnel to immediately contact the driver to resolve the issue. JBH and the DOT certifying physician may be contacted as indicated.

Once successful PAP compliance has been attained in the initial 3 months, the FusionHealth sleep physician writes a letter to the DOT certifying physician indicating the driver's acceptable compliance with treatment and his/her eligibility for a 12-month certification exam. JBH drivers are required to continually demonstrate their PAP compliance by mailing their PAP data cards to FusionHealth every 3 months. Again, any

deviation from adequate compliance requires immediate contact with the JBH driver by FusionHealth personnel to resolve these issues. JBH and the DOT certifying physician may be contacted as necessary.

Medical Management

The FusionHealth team continues to monitor drivers' quarterly compliance histories via the PAP data cards and phone interview. The FusionHealth team also assures long-term support by providing JBH drivers with a toll-free telephone line for support, questions, device and supply requests, etc. JBH drivers are provided replacement PAP therapy supplies every 6 months using an automated supply replenishment program. Supplies may be shipped to the driver's home, JBH trucking terminal, or a pick-up may be arranged at the FusionHealth office (whichever is most convenient and timely for the driver). JBH drivers that are compliant with their PAP treatment are eligible for yearly DOT recertification letters (rather than 2-year certificates). Intervention with medications is sometimes required for PAP adherence, and/or the treatment of other sleep medicine conditions to help maintain compliance. FusionHealth sleep medicine physicians provide drivers with these treatments and coordinate any recertification activities with DOT certifying physicians. The FusionHealth medical team provides documentation and a full electronic medical records (EMR) system for drivers, JBH, and DOT certifying physicians. All medical management information regarding the drivers' care, including other sleep disorders under management, ongoing treatments, and specific compliance parameters, are maintained in the HIPAA-compliant FusionHealth EMR.

Focus Group Findings

Four focus group meetings and three phone interviews were conducted with 32 participating drivers and staff (15 drivers and 17 staff). Participant demographics are reported together to protect carrier anonymity and are included in Table 10. Focus groups and phone interviews were between 60 and 150 minutes long and all discussions were audio-recorded and later transcribed and evaluated. Although the description of the JBH and SNI OSA programs above provides detailed information on their respective procedures for screening, testing, and maintaining compliance, the focus group results below can be used to refine the OSA programs. The following are the results of the content analysis with supporting driver and staff quotes included in Appendix P.

Table 10. Focus Group Participant Demographic Information

Group	Gender M:F	Age (yrs) *n*:Range*	Experience Driving CMV (yrs)	Length of Participation in OSA Program *n*:Range	Original OSA Diagnosis *n*:Status	Overall satisfaction/rating of OSA Program *n*:Status
Drivers	15:0	2:25-34 5:35-44 7:45-54 1:55-64	5:1-4 2:5-9 8:10-24	2:<6 mo 7:6 mo-1 yr 4:1-2 yrs 1:2-3 yrs 1:>4 yrs	2:Mild 5:Moderate 7:Severe 1:Do Not Know	10:Satisfied 4:Very satisfied 1: Dissatisfied
Staff	N/A	N/A	N/A	2:<6 mo 2:6 mo-1 yr 4:1-2 yrs 2:2-3 yrs 2:3-4 yrs 5:>4 yrs	N/A	7:Good 10:Very good

Theme 1: Screening and Evaluation

During the focus groups, participants were asked to review and discuss the steps involved in their OSA program's screening process. They were asked their opinions of the process, if and how they would revise the screening process, and their suggestions for improving the screening process for identifying drivers who may be at risk for OSA.

Driver Feedback and Supporting Quotes:

A common opinion expressed by drivers was that the purpose of the screening questionnaires was not explained up front. Participants also thought that some questions were vague and the context of the questions was unclear. Participants reported they may have been better able to more accurately and honestly complete the questionnaires if told the purpose of the surveys. Drivers did not appreciate having to proceed with their participation in the OSA program after they volunteered to complete the screening questionnaire. After they were screened as at risk for OSA, the program was no longer voluntary, which some drivers reported not realizing up front. Drivers suspected that the OSA screening questionnaire was not the only way they were being screened for OSA; however, they indicated they were given this impression from program staff (carrier and/or OSA provider). Several drivers noted significant time gaps between the time that they completed the screening questionnaire and when they were scheduled for the laboratory PSG testing. Drivers reported experiencing up to a 2-year gap. Several of the participants stated they had not spoken to nor seen a sleep physician as part of the screening process and they recommended that this be available to drivers after completing the screening questionnaire (in case they had questions). Some drivers felt the screening process was too fast-paced and wondered how thorough it could be given the limited time they were evaluated.

Program Staff Feedback and Supporting Quotes:
OSA program staff highlighted the importance of establishing good rapport with drivers upon first meeting them or approaching them about the OSA program. Carrier and OSA provider staff named several ways that drivers were screened to undergo OSA testing (e.g., questionnaire(s), DOT long form, medical records, referral by safety managers, occupational health staff, fellow drivers, and self-referral). Program staff expressed they felt this was a thorough and accurate approach to identify those drivers at risk for OSA. Staff noted that BMI (see Appendix O for a BMI index) was used as an initial screener to identify drivers that may be at risk for OSA who should be solicited to participate in the OSA program. Exhibiting signs or symptoms of OSA, self-referrals from drivers, or referrals from DOT certifying physicians or safety managers may be additional ways that drivers are identified and solicited to participate in the OSA program. Program staff also indicated the sometimes long lag-time between screening and testing and believed this was a limitation in testing a large number of drivers within the logistical confines of the trucking industry. Program staff reported that the time lag between the OSA screening and the testing likely contributes to drivers' confusion regarding the OSA test. Staff noted that the program has improved since its inception and these time delays between screening and testing have been reduced and continue to improve. Program staff noted the program design works well in the current driver population. The screening tool is designed to *"work in an environment where the drivers are fearful of providing [you with] honest answers."* One reason for this fear is that *"their livelihood is attached to how they answer some of the questions."* Program staff recommends that all DOT examiners should be aware of the risks of OSA and know what to look for and how to identify those that should undergo OSA testing. PPD program staff suggested that biometric measures be added to the screening protocol and used in conjunction with the self-report PPD SSSQ, including height, weight, and circumference (including neck) measurements. These biometric measures are included in the screening protocol with JBH drivers and FusionHealth reports that they work well for identifying drivers at risk for OSA. OSA provider staff express that the physical exam drivers undergo is a positive part of the screening process for OSA.

Theme 2: Education and Outreach

Carrier and OSA provider participants were asked to describe the OSA education they provided to drivers. Program staff were also asked to describe what worked and what could be improved in the OSA education process. Carrier staff reported providing little education to drivers, as they preferred it come from other sources, including the carrier's occupational health team or the OSA provider. Both OSA providers and the occupational health staff reported educating drivers on the sleep apnea program, OSA, health, treatment and device, and compliance education.

Driver Feedback and Supporting Quotes:
Drivers receive information on their fleet's sleep apnea program in a variety of ways. Company newsletters, pamphlets, broadcasts, and portals let drivers know about the OSA program. Drivers also learn specifics about the program while talking to program

staff during PAP set-up; i.e., what is expected from them as a driver participant in a company-mandated OSA program. Many drivers reported receiving OSA education, including topics on what OSA is, associated health and medical conditions, myths and truths about sleep apnea, details on a driver's unique OSA condition, the risks and dangers of untreated OSA, and how OSA applies to the trucking industry. Drivers receive this information in a variety of ways, including reading materials, pamphlets, and public media (such as magazines and the Internet). Some drivers reported their families attending and participating in the educational session with them. Conversely, some drivers reported not receiving adequate information about OSA from the program staff. Drivers reported being provided health information to manage their OSA, including instructions to lose weight with lifestyle improvements. Drivers unanimously agreed that making healthy dietary choices and exercising while on the road are extremely difficult. Drivers recalled company-sponsored health initiatives, such as the million pound weight-loss challenge, to try and encourage drivers to make healthy lifestyle changes. Drivers also mentioned they have access to physical therapy services and health screenings, but were hesitant to disclose any health-sensitive information to carrier staff as they were distrustful of how their health information could be used against them. Drivers recommended that health education and outreach could be improved upon if they were given more reasonable advice for their over-the-road lifestyles. Drivers noted they were given common knowledge instructions, such as recommendations to eat fruits and vegetables and be more active, but would like to have received advice in consideration of their lifestyles, such as how to eat healthfully and economically over the road and how to fit in exercise over the road.

Drivers received information on their prescribed OSA treatment, PAP, and were educated on the PAP device and accessories, including use, care, and maintenance. Drivers reported the education they received regarding the PAP device and how to use it were adequate and simple to understand. Drivers also noted they were provided a phone number to call in case they had questions or problems. Some drivers reported they wished they were provided more education on other treatment options, in addition to PAP treatment, while others reported receiving information on alternative treatment options. Drivers noted the driving community needs to be more educated regarding considerations for CMV drivers with OSA.

Program Staff Feedback and Supporting Quotes:

OSA provider staff note that group training and OSA education can be effective with drivers and gives them a sense of camaraderie; however, private medical discussions and consults should be performed one-on-one with drivers. Staff noted the effectiveness of casual and open-ended group question and answer sessions for initiating conversations about OSA among drivers and educators. Staff also stressed the importance of tailoring the OSA education for truck drivers and their lifestyles, and the challenges they face. Program staff reported using many different outlets to provide drivers with OSA information, including monthly newsletters which include quarterly OSA-relevant articles, company-wide broadcasts, employee portals, and driver

testimonials. Drivers receive information on OSA during general driver orientation, as well as during education and training as part of the OSA program. Staff noted that for the drivers who have received this information, it is adequate; however, reaching more drivers and repeated exposure to materials could be improved upon. Health education and outreach is provided primarily by the OSA provider team and may be supplemented by the carrier's occupational health team. The OSA provider staff give drivers general health information to help them manage their OSA, including recommendations to lose weight. Carrier personnel reported that if drivers came to them with health concerns or questions, they usually direct them to the occupational health team or the OSA provider staff to ensure they are receiving accurate information. Some carrier staff also felt they needed more education about OSA to be better prepared for working with drivers with OSA; however, some staff felt the medical side of OSA should be handled primarily by medical professionals. OSA provider staff noted the importance of educating carrier staff on the OSA program and its importance for drivers. Drivers are also given information on the laboratory PSG and portable monitoring device if they have been screened as high-risk for OSA and require testing. Many drivers are fearful and do not know what to expect with these testing options. OSA provider staff try to ease their fears by describing what to expect with each testing modality. OSA treatment and PAP device information is provided by the OSA provider and is delivered to groups of drivers, rather than individually. Drivers learn how the PAP device works, how to maintain it, and about the accessories that accompany treatment; i.e., masks, humidifiers, hoses, etc. OSA providers may go over this information with drivers while their OSA tests are being scored, before they are ever diagnosed, to save the driver's time off the road. Drivers are given a phone number to contact the OSA provider support staff if they have questions or concerns. Staff did note that OSA treatment education could be improved by spending more time with drivers during this phase of the OSA program. They did note that this was a trade-off for getting drivers back on the road quickly, minimizing their time away from work. Repeated exposure to information on OSA treatment is another suggestion from OSA provider staff. Compliance education is provided by the OSA providers and includes an explanation on the importance of complying with each carrier's policy regarding PAP usage. Drivers are informed of the safety implications of not complying with PAP adherence, including the risk of falling asleep behind the wheel, as well as job termination. Drivers are not permitted to drive if they are non-compliant with PAP treatment. Repetitive non-compliance may lead to job termination. OSA provider staff noted that drivers newly diagnosed with OSA have the most trouble with compliance and many of them do not want to use the PAP. Program staff noted that it often takes time for drivers to become accustomed to the PAP masks. Carrier and OSA provider staff discussed the challenges in implementing a company-wide OSA program and are discussing process improvements such as continuously educating and re-educating the turnover of staff and maintaining communication between key players in the OSA program. OSA program personnel also noted the importance of educating the occupational medical community and physicians that perform DOT physicals on OSA, the signs and symptoms, how to screen for it, and when testing is indicated for further evaluation. Screening drivers for OSA during DOT physicals is a significant step in the

right direction, according to OSA provider personnel, because it can force drivers to be evaluated for OSA before they receive certification to operate a CMV. Program staff discussed the importance of driver support for newly diagnosed drivers with OSA. “Driver champions” who have had positive experiences with the OSA program and are willing to share their experiences with other drivers are effective. Staff also discussed other opportunities to encourage driver support, such as driver blogs, support groups, etc. One concern with these is that drivers may pass along tips that may be inappropriate (e.g., how to fake or bypass PAP compliance). One staff member suggested the use of a moderator to review inappropriate driver comments.

Theme 3: Testing and Diagnosis

Drivers were asked their opinions of the OSA testing process and how the testing process could be improved. Carrier and OSA provider staff were asked how the OSA testing process could be improved and what works well.

Driver Feedback and Supporting Quotes:
Drivers discussed their discomfort with the laboratory PSG. Drivers reported not being able to fall asleep because of the numerous wires attached to them during the night and having to sleep in an unfamiliar place. Drivers reported being disrupted during the night when clinical staff would enter their testing room to check wires or adjust monitors. Many drivers reported they did not sleep at all or slept very little during the PSG; thus, drivers did not understand how they could have received an OSA diagnosis after such a poor night’s sleep. Drivers reported they would have liked the option to have a second PSG if they felt they were misdiagnosed. When asked if they would prefer to undergo a portable/home diagnostic test rather than the laboratory PSG, drivers responded that a portable/home diagnostic test would help them feel more comfortable but they thought the sleep test was too complicated to take at home. Some drivers recognized that the PSG was a more thorough test than the portable monitor, which they liked. The drivers reported that the clinical staff at the labs and the sleep technicians on-site at the terminals to set up the portable tests were nice and accommodating. Some drivers that underwent the portable monitoring test for OSA reported not being satisfied with the procedures. Some lacked confidence in the test and preferred a more thorough exam; in some cases, they reported preferring a laboratory PSG over the portable testing. Some drivers lacked confidence in setting up the portable device and reported having to do so multiple times before they were correct. Other drivers preferred the portable testing and were satisfied with it. A few drivers had undergone both testing procedures and recognized that there were positive and negative aspects with both the PSG and the portable monitoring.

Drivers reported that the sleep technicians did go over their sleep test results with them the morning following their sleep assessments and some were satisfied with this process and the information they received while other drivers would have preferred receiving more information. Some drivers reported they never saw or spoke with a sleep physician and expressed they would have liked to speak to a physician about their PSG

results. Some drivers felt the testing and diagnostic approach was “sneaky” because they suspected the OSA provider and/or clinical team was making a profit from diagnosing drivers with OSA, prescribing PAP treatment, and then charging the carrier for these services. Drivers thought there should be a separation of OSA testing and prescription. Some drivers reported that they did not realize that once they tested positive for OSA, they were required to participate in the OSA program or risk losing their job – they felt they should have been told this up front; however, other drivers said that they were informed of these procedures and knew what to expect if they were diagnosed with OSA.

Program Staff Feedback and Supporting Quotes:
A challenge for testing drivers can be the lengthy wait time for OSA testing after the driver has been indicated as high-risk for OSA via the screening questionnaire. OSA program personnel are working to limit this lag time, but the volume of drivers and the challenges with scheduling and routing drivers to sleep laboratories for testing presents a challenge. As the OSA program has expanded, so have the number of clinical testing sites around the country. This has helped with scheduling and routing drivers for their OSA test, but there are still challenges. Carrier staff indicated they wanted more driver updates regarding where the driver was along the clinical pathway (as the carrier staff is ultimately responsible for scheduling and routing their driver for testing). Carrier staff reported that some drivers refused to undergo OSA testing or attempted to find alternative OSA treatments for fear that they would test positive for OSA. Program staff reported that a logistical challenge is getting a driver to testing for OSA.

Carrier staff recognized the drivers’ discomfort and dissatisfaction with the overnight PSG; however, they also recognize that Type 1 PSG is considered the gold standard for OSA testing. OSA provider staff also recognized the challenges in using portable monitoring in this population, including verifying driver identity and that the driver is asleep. Program staff reported that the testing and data review process with the drivers works well. The OSA provider clinical team explains the results of the sleep test to the driver, thereby limiting situations where a driver will try to argue his/her way out of a diagnosis by indicating he/she did not sleep during the test.

OSA provider staff recognized that while the portable monitor for OSA testing is convenient and cost-effective for the CMV driver population, it does have limitations, including capabilities to collect physiological data and chain of custody limitations. Staff demonstrate for the drivers how to put the device on and initiate recording and feel this is a fairly simple task that most drivers pick up quickly; however, staff note that some participants do have trouble and require more training and assistance than others. For drivers that do not want the responsibility of setting up the portable device themselves, staff may set them up on-site and the driver leaves with it on and ready to record. Drivers are also given a phone number to call in case they have questions or problems setting up the portable monitoring device. Staff recognize that it would be possible for a driver to put the portable testing device on another person rather than wearing it

themself, and this would be a concern for a mandatory, non-voluntary OSA program; however, for this voluntary OSA pilot program, staff were not concerned about drivers deceiving the system. Staff have identified portable monitoring devices that have chain-of-custody security checks in place, as well as additional channels for collection of physiological data, which they plan to move toward as they continue to revise and expand their OSA program. Staff also pointed out that while the portable monitoring device has software to automatically analyze and score a recorded sleep study, it is important and more accurate to have a trained technician review, analyze and score the study. OSA provider staff feel that the portable monitoring device is an accurate and cost-effective first-line testing protocol for the majority of drivers; however, if there are indications for further testing, drivers may follow up with a laboratory PSG for further evaluation.

Staff agreed that a significant challenge in diagnosing a driver with OSA was driver acceptance. CMV drivers represent a unique group where medical conditions, such as high blood pressure, cardiovascular disease, and OSA can disqualify a driver from his/her livelihood of driving a commercial truck. Drivers feel singled-out for their medical conditions. Having drivers understand the safety implications of being a professional driver with untreated OSA is critical in driver acceptance of their diagnosis. An OSA provider staff suggestion was to spend more time with the driver explaining their diagnosis if they are positive for OSA. Overall, staff reported being very satisfied with the partnering clinical labs and their work with the drivers. The clinical labs make the drivers feel comfortable before the test, provide education, and respond to driver questions.

Theme 4: Training and Treatment

Drivers diagnosed with OSA are prescribed PAP treatment. Company drivers are instructed on how to care for and maintain the PAP equipment. Drivers are fitted with a mask and are given the necessary PAP device and accessories for proper use. The drivers are also provided educational and training information to facilitate immediate treatment and limit extended out-of-service time. During the focus groups, drivers were asked to discuss the types of treatments recommended to them to improve or treat their OSA. Drivers were then asked to discuss their experience with each treatment. Program staff were asked to discuss the types of treatments recommended to their drivers to improve or treat their OSA.

Driver Feedback and Supporting Quotes: PAP treatment was prescribed to all drivers in the focus group, and most drivers reported being satisfied with their treatment.

Weight loss, along with PAP, was discussed with some drivers as an adjunct treatment to improve their OSA. Other drivers were not given additional treatment recommendations (other than PAP). Drivers stated they would have appreciated being informed about other treatment options or adjunct treatments that could be used in conjunction with PAP. Drivers wanted to know if there was a way to “get off” the PAP

machines at some point. Drivers unanimously agreed that their profession presents many barriers to living healthy, including the challenges of a healthy diet and exercise habits. It is difficult for drivers to make healthy choices in the terminal cafeteria and truck stops. They cited having difficulty parking at restaurants and grocery stores where they might find healthier choices. Drivers also cited fatigue and exhaustion after long hours on the road as reasons for not exercising. Drivers discussed how their driving altered their sleep and eating schedules, resulting in weight gain since they began driving a truck. Drivers who reported the motivation to exercise often found it difficult to find an appropriate area to exercise. Some drivers reported behaviors to overcome these barriers to healthy eating and exercise, such as preparing food in their cab and walking around the trucking terminal. Some drivers reported success with losing weight and several of them attributed their success to the OSA program and being on PAP. Drivers discussed their carrier's health and wellness initiatives which offer nutrition and exercise counseling; however, drivers reported this program was separate from the OSA program. Drivers suggested that the two programs be linked.

Program Staff Feedback and Supporting Quotes: OSA program staff discussed PAP treatment, primarily APAP, as being the most readily prescribed treatment for drivers with OSA. A secondary use of the PAP machines can be to recognize and diagnose other or additional sleep disorders which may not be identified during the sleep test.

Lifestyle changes, including weight loss, dietary changes, exercise habits, and sleep hygiene were noted as treatment options to accompany PAP that should be highlighted and emphasized more to drivers. Staff agreed that arming drivers with tools to be healthier on the road should be a priority for all company drivers, not just those participating in the OSA programs. Carrier staff noted that health and wellness coaching was a separate, voluntary service available to drivers, but that these services were not utilized often.

Along with the PAP machine, drivers are given all equipment and accessories needed to properly treat their OSA, including masks, hoses, filters, humidifiers, and compliance monitoring equipment. OSA provider staff feel that PAP compliance is largely influenced by the fit of the mask; therefore, they work to ensure drivers receive masks that fit comfortably and are effective. Drivers may be given two masks when they begin treatment, to offer them options and allow them to choose the mask type most comfortable for them. Some drivers must purchase the inverter required to use the PAP machines in some of the trucks; however, equipping the trucks with the inverter, and the labor required to do so, is provided by the carrier.

OSA program staff noted that an important feature of their OSA program is quick turnaround between testing, diagnosis, and treatment. Once they have been diagnosed with OSA, drivers are unable to drive until they receive treatment. Most drivers are not making money unless they are driving so, in order to keep them on the road and working while still maintaining safety, both OSA programs highlight the importance of no more than a 24-hour turnaround between when drivers are tested and when they return

to the roadways. Carrier staff reported delays in routing drivers to operating centers to install the power inverters in the trucks. The power inverter is often necessary to power the PAP device, especially for some PAP devices or older trucks. Thus, this can delay drivers from beginning PAP treatment until the power inverter is installed. The carriers are working to improve this process and are seeking PAP devices that do not require a power inverter (thereby the driver can begin PAP treatment immediately). OSA program staff noted that it can be challenging for drivers to properly clean and care for their PAP machines and accessories while on the road. It was suggested to set aside an area within the terminal facilities that would allow drivers a private and well-equipped area to clean and care for their machines. Another challenge voiced by program staff was routing and distributing PAP equipment and supplies to drivers as needed, especially when they are over the road.

Theme 5: Compliance Monitoring and Long-Term Management

During the focus group, drivers were asked to describe and give their opinions of their carrier's OSA compliance policy. Program personnel were asked if they monitor drivers' OSA compliance and, if so, how difficult (or easy) it was to monitor PAP compliance. Drivers and program staff were asked to discuss long-term care, follow-up, and medical management for drivers participating in the OSA program.

Driver Feedback and Supporting Quotes: Drivers discussed how their carrier was up front with their OSA compliance policy and how they were given a document explaining the company's OSA compliance policy. Drivers that do not adhere to the OSA policy are restricted from operating a CMV for their carrier until they demonstrate adequate PAP compliance (at least 4 hours/night for 70% of nights). Some drivers reported using the minimal level of acceptable PAP compliance, and other drivers reported using the PAP machine each time they slept and napped. Drivers did not appreciate that their carrier mandated their PAP use during their time away from work and at home; they felt that it should be their choice what they do in their personal time away from work. Drivers noted that the OSA provider personnel were understanding if they had valid reasons for non-compliance, such as equipment issues while on the road. Communicating with staff as issues or problems arise is important so everyone is on the same page and solutions can be found.

Drivers discussed equipment issues that would interfere with their PAP use, such as humidification problems, mask discomfort, sleep discomfort (due to not being able to sleep on their stomach), and power inverter issues that prohibited use of the humidifier in the truck cab. Drivers also complained that the inverter takes up a lot of their cab space, which is already limited.

Most drivers rated PAP use as "easy" or "very easy" as it only requires placing the mask over the face and turning on the PAP machine. Some drivers indicated it was more convenient to use PAP at home rather than while on the road, citing it being a hassle transporting the machine back and forth between home and their truck. Drivers had

different experiences with how long it took them to get comfortable with the PAP device. For some drivers, only one week was needed for them to become accustomed to the PAP device while they slept while others indicated they had been on PAP for several years and still cited discomfort. Drivers indicated the comfort of the mask played a significant role in their satisfaction and compliance with PAP. Some drivers indicated that access to PAP maintenance and replacement parts was “easy” while others indicated it could be inconvenient or delayed if they were over the road.

Drivers rated weight loss as something “very difficult” to achieve, citing their job and lifestyle as the main reason for this difficulty. Some drivers have taken initiatives to make lifestyle changes and have had success in doing so, although they also cite difficulties that they were able to overcome. Drivers noted that their carrier had health and wellness programs available to them, although it was not linked with the OSA program and some drivers were hesitant to utilize these services for fear that their carrier may use their health information against them and fire them.

Drivers indicated that the PAP compliance monitoring procedures work fairly well. They reported that the ResTraxx™ monitoring system was easy to use, as it was very hands-off for the driver and only required them to return the monitor to the OSA provider after they had demonstrated adequate compliance (on average, after one month of daily compliance downloads).

Drivers indicated the importance of carrier and OSA provider staff support as predictors for success in PAP compliance. Drivers reported the financial support received from their carrier as “very helpful.” Drivers appreciated the continued PAP support they received with the replacement of PAP supplies twice yearly. Some drivers indicated that their fleet managers were not very involved in the OSA program or helpful to participating drivers. Overall, drivers had positive opinions about the OSA providers, although some cited difficulty getting in touch with them when needed.

Drivers talked about their concerns regarding the data cards that monitored their PAP compliance. Drivers were responsible for sending these cards to the OSA provider staff and feared these cards would get lost in the mail or used by the authorities if they were pulled off the road. Drivers indicated this was a weakness in the program because they rely on the receipt and review of those cards to prove their compliance so that they may continue driving. Drivers in the OSA program should receive a limited DOT certification card because they have been diagnosed with OSA (and are currently on treatment). Some drivers were given a 1-year certificate, which they thought was the DOT regulation for drivers being treated for OSA. Some drivers received a 2-year DOT certificate even though their DOT physician was aware of their OSA diagnosis; and other drivers indicated that their DOT certifying physician did not even know of their OSA diagnosis. There was little consistency regarding the DOT certificates issued to the drivers.

Program Staff Feedback and Supporting Quotes: OSA program staff provide drivers with all PAP supplies and replacement parts needed to maintain their PAP machines and be compliant with treatment. The carriers cover these costs as they want to provide the driver with the tools and support to ensure their success with treatment.
OSA program staff reported that drivers acclimate to PAP treatment at different rates (some adapt very quickly and others take longer). Carrier staff noted that newly diagnosed drivers have the most problems adjusting to PAP therapy. Program staff also reported the need to remind drivers of the importance of using the PAP device when they are off duty. Program staff indicated that drivers frequently reported issues with the PAP equipment, including using the equipment in their truck, poor mask fit and mask discomfort, claustrophobia, and trouble sleeping with the machine. The staff also recognized that the inverter, which is required for PAP use in many of the trucks, takes up a lot of the already limited storage space in the cab of the truck. Since the inverter must be installed in trucks and be ready for PAP use that first night, before drivers can leave the terminal, this can cause delays and frustrate staff and drivers.

Carrier staff noted that OSA provider staff are an important support system for the drivers. The OSA provider staff is well trained in coaching drivers to become PAP-compliant and resolving any issues; however, in most circumstances, it is the responsibility of the driver to contact the OSA provider team if they need assistance. Carrier staff also indicated the importance of support from the OSA program staff (such as understanding that PAP use can be a difficult adjustment) and carrier staff – especially fleet managers who work closely with drivers – need to be supportive of the driver's needs.

Carrier staff indicated they do not monitor driver compliance with treatment. PAP compliance is monitored by the OSA provider and carrier staff are only notified if a driver is not complying with PAP treatment. Lifestyle modifications (nutrition and physical activity) and weight loss – other recommended treatments for OSA drivers – are not monitored by OSA program staff. Fleet staff reported they did not feel it was their place to tell a driver how to live his life, although it may be appropriate for the occupational health team to make health and lifestyle recommendations.

OSA program personnel believe the compliance monitoring protocol works well. The OSA provider does a good job with monitoring drivers' compliance and communicating issues with carrier staff. The wireless ResTraxx™ monitoring device used in both OSA programs allows drivers to be monitored daily for compliance, thereby enabling the OSA provider staff to identify and resolve problems immediately, ensuring the success of long-term compliance. There can be limitations with the ResTraxx™ monitoring system if drivers do not follow proper procedures so that staff can remotely and wirelessly pull compliance data from the PAP machines. After drivers are taken off ResTraxx™ monitoring (after adequate compliance has been demonstrated), they are instructed to mail compliance data cards from their PAP machines to OSA provider personnel for review and compliance checks. The data cards are utilized for long-term compliance management. OSA provider personnel explained that monitoring drivers' PAP history

provides them information on not only drivers' use, but also the efficacy of PAP treatment, and can alert them to more complicated sleep issues or disorders.

OSA program staff reported that drivers need to be monitored more closely at the beginning of PAP treatment, but as compliance requirements are met, they can monitor them less closely. At a minimum, staff would like to see PAP compliance reports from drivers every 3-6 months for long-term compliance management. OSA provider staff noted the importance of documenting and taking detailed notes on everything related to drivers' statuses in the OSA program; documentation can be important for supporting and advocating for drivers, as well as backing up OSA provider staff if issues arise. Staff reported that driver outreach regarding PAP monitoring can be problematic given the distributed nature of their work force. Carrier staff reported that same-day outreach with drivers having problems would improve the OSA program. OSA provider staff mentioned that the data cards were problematic at times (i.e., driver failed to send the data card or the data card was corrupted). A suggestion for improvement was to use a QualComm system to better download and receive the PAP use and efficacy information rather than mailing data cards.

Carrier staff feel their company's compliance policies work well; suspending a driver from the road until they can show adequate compliance is critical to demonstrating the carrier's safety culture (although staff reported that non-compliance costs the company significant losses in revenue). OSA program staff also agreed that their policies to limit DOT physician certifications for drivers with OSA to ensure they meet compliance standards before they are given long-term certification cards work well. OSA provider staff reported that their role in this part of the program is to monitor compliance, work with drivers who are having trouble with compliance, and notify carrier staff of non-compliant drivers. They emphasized that they do not make decisions regarding pulling drivers from the road or allowing them to drive, which is the responsibility of the carrier staff. Some staff also reported significant fuel costs with OSA drivers as they are allowed additional idling time to use their PAP machines.

OSA program staff stressed the importance of communication and synchrony between all players, including driver, OSA provider staff, and carrier personnel. OSA provider staff noted that it can be challenging to communicate with drivers as some do not have cellular phones or rely only on computers in their truck cabs. It can be difficult to reach them, get messages to them, and then wait for a return phone call. Program staff emphasize to drivers the importance of communicating with them regarding all issues, problems, or setbacks they may experience with PAP treatment and compliance, as the staff can only help them and advocate for them if they know what is going on. OSA provider staff also noted challenges with carrier staff, including delays in getting inverters installed in trucks and prioritizing getting drivers back on the road before they are fully trained and equipped to begin PAP treatment. They felt that education plays a key role in garnering this support from fleet staff and a suggestion from OSA provider staff was to improve and increase the OSA education that the fleet staff receive.

OSA provider staff noted that an important element of long-term medical management of drivers is reviewing and considering their medical history and progress throughout the OSA program to ensure they are receiving proper diagnoses, treatment, and medical care. This requires constant communication and coordination between OSA provider staff, carrier staff, and drivers. Program staff indicated that a goal for long-term medical management of drivers with OSA is to increase driver participation in the company's health and wellness initiatives.

Theme 6: Summary of Program Outcomes

After discussing all components in the OSA program, including screening, education, testing, treatment, and compliance, drivers were asked to list benefits and drawbacks they experienced while participating in the OSA program. Carrier and OSA provider staff were asked to list and discuss supports that assisted in the implementation of the OSA program for company drivers, as well as challenges they faced.

Driver Feedback and Supporting Quotes: Below are benefits drivers experienced from participating in the SNI or JBH OSA program.

Benefits: Drivers reported having better quality sleep and getting deeper sleep since starting PAP treatment. Participants also claimed that being on PAP has reduced or stopped their snoring, which has a positive impact for them as well as their sleeping partners. Drivers reported feeling better rested and having more energy since being on PAP treatment for their OSA. Some reported that they are able to maintain their energy without requiring as much sleep as they used to. Many drivers were excited about the health benefits and improvements they have noticed since beginning PAP treatment for their OSA. Some drivers noticed that PAP treatment improved their driving because they were more alert and less fatigued while driving. A few drivers reported no improvements or benefits from participating in their carrier's OSA program.

Drawbacks: Below are drawbacks that drivers experienced from participating in the SNI or JBH OSA program. Drivers disliked the PAP device and features of the machine, including the humidification and the mask, which most drivers had experienced problems with. Many drivers reported their spouse, sleeping partner, or family members poking fun at them for their machine and how they looked with it. Drivers also disliked that their sleep revolved around the PAP device. Drivers cited that their carrier was not up front about the OSA testing and the requirements of the program until they were at the point that they could not leave the program without being fired from the company. Drivers stated dislikes and drawbacks with their OSA testing experiences, both with the laboratory PSG and the portable testing device. The drivers' main concern with the portable device was the accuracy and thoroughness of the test. The primary complaint drivers had with the PSG was the uncomfortable testing experience, including having to sleep in an unfamiliar place and being connected to multiple wires. Drivers disliked the PAP data cards and found it a hassle to send them to OSA provider staff. Some drivers reported that PAP treatment actually gave them less morning energy than they had

before they began treatment. Many drivers reported feeling discomfort during sleep when they began PAP treatment. Some drivers reported still feeling this way after months and years of trying to adjust to PAP. Some driver participants reported that they never saw or met with a sleep physician, which they disliked. Some drivers met only with a sleep technician during testing and diagnosis and preferred to see and talk to a sleep physician. Drivers reported that the logistics of the trucking industry often made it difficult to get the support they needed to comply with PAP treatment. Drivers disliked that PAP treatment for OSA was a life-changing event that carries into all areas of their life, including work and personal time. Some drivers disliked that their carrier mandated their PAP use on their nights off. They did not appreciate that their compliance was expected during their personal time away from work. Some also noted the inconvenience of moving their PAP machines between sleeping locations (i.e., truck cab and home) and having to take it on vacations.

Program Staff Feedback and Supporting Quotes: Below are supports that assisted the program staff in implementing the OSA program with SNI or JBH drivers.

Supports: OSA program staff reported that program operations and management is a significant support of the OSA programs and their sustainability within fleet operations. OSA program staff noted the importance of having carrier support of the program, including management, fleet staff, the maintenance team, and the occupational health team. Program staff noted that the OSA provider staff does a great job with all facets of the OSA program and they are an integral reason that each OSA program has been successful. Specifically, staff noted that their follow-up with drivers after they have been identified with OSA, put on treatment, and are back on the roads is a huge support for the program, as drivers always have a knowledgeable team to refer to. Program staff reported that the carriers' focus on safety and driver health was a primary driving factor and support as each OSA program was designed and developed. Recognizing safety as a core value of the carriers supports and drives the success of each OSA program. OSA program staff also commented that testimonials from drivers that have had success with the program are often encouraging to newly diagnosed drivers, which supports them as they adjust to life with PAP treatment.

Challenges: Below are challenges that program staff faced while implementing the OSA programs with company drivers. Program staff reported that drivers struggled with adjusting to PAP treatment and it could be challenging for staff to encourage and support drivers when they were resistant to PAP. Staff reported that the logistics of the trucking industry and the mobile workforce of drivers can be challenging to schedule and route drivers to sites for OSA testing. Some staff reported that the organization, collection, and reporting of data related to the OSA program is currently limited and could be improved upon as the OSA programs expand. Staff reported that gaining driver buy-in and acceptance of the OSA program is a significant challenge they face with many drivers. Staff reported that the time lags within the program, often between OSA screening and testing, can be challenging given the number of drivers that are screened and identified for testing. Driver's mobility and schedules can add to this challenge.

Program staff reported technological limitations that introduced unique challenges for them to deal with, including data collection limitations of the portable monitoring testing device, and issues with the PAP compliance data cards that are submitted to the OSA provider by drivers.

CONCLUSIONS

Summary of Driver Opinions and Perceptions

Overall, the majority of drivers expressed satisfaction from participating in their carrier's OSA program. Drivers reported the benefits of the programs, including that their quality of sleep was better, they had more energy and felt better rested, they were experiencing improved health, and they were less worried that they would fall asleep while driving. Drawbacks of the programs reported by drivers included discomfort while sleeping with the PAP device and mask discomfort, and complaints about the PAP device (including using it at home and cleaning and maintaining it). Drivers also complained about being "tied to" the PAP device, having to use the device during their personal time, and treatment being a life-long adjustment.

Drivers in one OSA program felt the screening process they experienced as part of their carrier's OSA program was not explained to them up front and the context of the questionnaires they completed was vague. Drivers from another OSA program recalled that once they agreed to participate in the OSA program and complete the screening process, they were unable to back out of the program (which they believed should have been disclosed up front). Some drivers felt the screening process was fast-paced – which some appreciated – and others were concerned about the thoroughness with which they were screened. Some drivers also recalled significant gaps between when they were screened for OSA and when they were tested for OSA.

Drivers reported receiving educational materials about their carriers' OSA program and policies via carrier newsletters, pamphlets, broadcasts, and network portals. Driver recalled receiving general information about OSA from OSA provider staff, but suggested that viewing a video about the disorder would have been helpful. Few drivers reported receiving general health and wellness education, as it relates to OSA, as part of the OSA program education they received. All drivers reported receiving adequate education about PAP treatment and the device, but many would have liked to receive information about additional treatment options (such as losing weight and lifestyle modifications) to control OSA. Drivers felt that communities, including law enforcement, would benefit from education about OSA and how it affects CMV drivers and their regulations (i.e., idling regulations).

Drivers disliked that they could not refuse OSA testing after they were screened as "high risk." They also expressed positive and negative opinions about the laboratory PSG and the portable monitoring test for OSA diagnosis. They felt the PSG was a very uncomfortable test, yet thorough and reliable; drivers reported that the portable device

was more comfortable and convenient, but they had less confidence in the set-up and the results. Drivers received their sleep test results from their OSA provider staff; however, while some felt the reports were adequate, others felt the information they received was inadequate. Drivers also reported not interacting or meeting with a sleep physician, which bothered some participants, but others felt the sleep technician that consulted with them was adequate. Drivers reported they would prefer to have the option to re-test for OSA if they perceived they were inaccurately diagnosed. Some drivers also reported that it was a conflict of interest to be tested and prescribed PAP by the same group and there should be a separation of these two steps to ensure that the company selling the PAP machines was not profiting from diagnosing drivers with OSA.

PAP treatment was recommended and prescribed to all driver participants with OSA. Some drivers were also recommended adjunct treatments to accompany PAP use, including weight loss through healthy eating and exercise. Drivers unanimously stressed the difficulty of making these lifestyle modifications given the nature of the trucking industry. Drivers felt that PAP use in the truck was fairly easy but some found it challenging to comply with treatment at home, citing that they would forget to bring their machine home with them or just not want to. Drivers reported that proper mask fit, humidification, and cleaning and maintaining the PAP device are keys to effective treatment and staying compliant. Drivers cited the challenges to compliance, including PAP equipment problems and logistical issues, adjusting to PAP, and having adequate idling time to run their PAP machines during sleep. Some drivers reported being reprimanded by their fleet managers for exceeding idling regulations in order to use their PAP devices. Drivers stressed the importance of receiving support from and communicating with their fleet managers and OSA providers.

Summary of Staff Opinions and Perceptions

Overall, OSA program personnel believed their OSA programs were successful and were eager to continue refining and improving the programs. OSA program personnel cited several supports that aided in implementing and maintaining the OSA programs, including having a supportive team of carrier and OSA provider staff that prioritized roadway safety and driver health. Another significant support noted by staff was having an effective compliance monitoring protocol in place accompanied by consistent follow-up with drivers. Staff also reported challenges they faced while implementing and maintaining the OSA programs, including gaining driver acceptance of the program and significant time delays between screening and testing drivers for OSA due to the high volume of drivers at risk for OSA. Staff also noted logistical challenges inherent to the trucking industry and the mobile workforce of drivers, as well as collecting and organizing PAP compliance data due to the volume of data received.

OSA program staff reported that having several ways to screen and identify drivers that should be tested for OSA is critical for this population due to drivers' desire to avoid PAP treatment and fears of being terminated for having OSA. The latter issue is especially important and there was some evidence that OSA-positive drivers were more

likely to stay with their respective fleets than were non-OSA positive drivers. Thus, carriers implementing an OSA program should be clear that a positive OSA test will not result in termination.

OSA program staff believed that establishing a good rapport with drivers early in the process was critical for gaining driver trust and acceptance of the program. Staff recommended training for DOT examiners so they are more aware of OSA symptoms, the health and safety risks of untreated OSA, and how to identify drivers at risk for the disorder. Staff felt that in addition to OSA and health screening questionnaires, assessing anthropometrics and performing a physical examination to screen drivers was important. Personnel emphasized the need for coordination and communication between drivers, the carrier, and the OSA provider. Staff also encouraged the involvement of the Occupational Health team, as these individuals are more aware and involved in drivers' health histories and medical information; thus, they can recommend drivers for OSA testing. Staff also emphasized the importance of having a protocol in place to identify the level of OSA risk for drivers and prioritize those at highest risk for immediate testing.

Staff highlighted the importance of educating drivers about the policies and procedures in each carrier's OSA program as well as general OSA education as early as the first meeting with drivers. Staff found that educating drivers about OSA and the OSA program as a group, rather than individually, was supportive for drivers and more efficient for the staff. Carrier staff believed that medical/health education as it relates to OSA should be provided by qualified individuals, such as the occupational health team or the OSA provider staff. OSA program staff also highlighted the need for support groups or driver mentors for drivers newly diagnosed with OSA. OSA program staff agreed that carrier staff would benefit from OSA education, as it would help them support their drivers with OSA. OSA provider staff felt that DOT physicians should receive more education regarding OSA and how to screen CMV drivers (this would aid in the early identification and testing for OSA).

Given the two different OSA testing methods used by the fleets and OSA providers, staff opinions on testing were very different. Program staff at one of the OSA programs noted that nationwide participating sleep laboratories are critical for the success of an OSA program with a large, nationwide carrier (given the logistical issues in such a distributed organization). Program staff involved in the other OSA program felt strongly that testing drivers over the road with an appropriate portable device is more convenient and minimizes time away from work and family. Program staff did note pros and cons with both OSA testing methods. Program staff recommended a portable monitoring device that included technologies and features to ensure chain of custody and channels to monitor and record EEG and leg movement data. OSA provider staff felt it was important inform a driver that he/she has sleep apnea, but also to review their sleep test results with them and explain the details of the diagnosis (thereby reducing confusion and involving the driver in the process). Program staff agreed that prioritizing a quick turnaround (less than 24 hours) from when drivers are tested and diagnosed to

treatment set-up and sending them back out on the road is critical for the industry and the livelihood of the driver. Finally, it is important for the OSA program staff to communicate and coordinate with the DOT certifying physician so everyone is informed of the driver's diagnosis and what type of certification card he/she may receive (3- or 6-month versus 1- or 2-year).

Program staff agreed that APAP is the preferred first-line treatment for drivers and that proper mask fit is critical for PAP compliance. Staff noted the importance of the power inverter for PAP use in most trucks. OSA provider staff highlighted the utility of the PAP compliance records for tracking PAP use and treatment efficacy, but also for indicating other sleep disorders or the need for follow-up PSG to assess more complicated sleep issues. Staff noted the importance of the wireless PAP monitoring device, ResTraxx™, for daily compliance monitoring which allows for early identification of problems, with quick resolution, to keep drivers in compliance with treatment. OSA provider staff felt the data cards for monitoring compliance were adequate, but there was opportunity for improvements. Staff unanimously agreed that communication between the OSA provider, carrier staff, and drivers was critical for success in the compliance monitoring part of the OSA program. Providing drivers with the tools they needed to be successful with PAP treatment – including all equipment, replacement parts and accessories, and provider support and availability – was critical for immediate and long-term success with PAP. OSA program staff felt that their program protocol to pull non-compliant drivers from the road until they could demonstrate compliance was an effective method for establishing the importance of PAP compliance. Finally, driver champions (i.e., drivers who were successful with OSA treatment), were an effective group to speak to, work with, and support newly diagnosed drivers or those who were having trouble with PAP treatment.

RECOMMENDATIONS

Several recommendations resulted from the focus groups with drivers and staff. Being up front and honest with drivers about the OSA program and what they are being screened for was important to drivers and critical to gaining their trust and cooperation. It is recommended that carriers include subjective and objective assessments to screen drivers for OSA, including sleep and health questionnaires, physical examinations, and personal observations. Involving the carrier's occupational health team at this point in the program is recommended, as they are often more familiar with the drivers' medical and health history and can be helpful in recommending drivers for OSA testing. Having a graded rating system for OSA screening to assess drivers as high, medium, and low risk for OSA is recommended so the highest risk drivers are prioritized for OSA testing.

Providing drivers with an OSA educational video and information about the carrier's OSA program – including what is expected of participating OSA drivers – early in the process is important. Providing education to drivers about additional treatment options, such as losing weight and lifestyle modifications to control OSA, is also recommended.

Additionally, educating carrier staff about OSA is recommended as it will enable them to better assist and support their drivers with OSA.

Pros and cons accompany each testing modality for OSA. Laboratory PSG is considered the gold standard for diagnosing OSA; however, it is expensive and requires access to a sleep laboratory. Portable sleep monitoring is more cost-effective and convenient for drivers; however, there are concerns regarding chain of custody and limitations of the physiological data collected. It is recommended that each carrier evaluate the needs and parameters of their OSA program when determining with their OSA provider how to test drivers for OSA.

APAP is the recommended first-line treatment device for drivers with OSA and providing drivers with the appropriate mask is crucial for PAP success and compliance. Carriers and OSA providers should have detailed compliance monitoring protocols in place and drivers should be aware of these policies, which should include a removal process for drivers who are non-compliant. Wireless compliance monitoring devices are recommended for all newly diagnosed OSA drivers for daily compliance downloads until they have established adequate patterns of compliance. Data cards are an acceptable way to monitor long-term compliance for drivers that have an established record of PAP compliance.

Providing drivers with 24-hour support as they adjust to PAP treatment is critical, as patterns of PAP compliance are established within the first two weeks of treatment and it is important to identify and resolve any issues. It can be challenging to get replacement parts, supplies, and equipment to drivers when they are over the road; thus, it is important for the OSA program team (carrier and OSA provider staff) and drivers to work together to route drivers and send supplies to a convenient pick-up location to ensure uninterrupted PAP use. OSA treatment is a life-changing event for CMV drivers; therefore, ensuring they have a solid support team is important. Organizing driver support groups for drivers to share problems and solutions, and using driver champions to speak to, work with, and support fellow drivers is recommended.

When possible, it is recommended that there be a quick turnaround (less than 24 hours) from when drivers are tested and diagnosed to treatment set-up and sending OSA-positive drivers back on the road. This is critical for the industry and the livelihood of the driver. Finally, it is important for all OSA program players, including drivers, carrier staff, and OSA provider staff, to communicate and coordinate throughout each step of the OSA program to ensure the success of an OSA program for CMV operations.

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APPENDIX A: Instructor Resources and Module References

Below is a list of all references and instructor resources for each of the 10 FMP training modules. These references are listed in the order in which they appear in the respected module.

MODULE 1: FMP INTRODUCTION AND OVERVIEW

1. New South Wales Mine Safety Advisory Council (2009). Fatigue management plan: A practical guide to developing and implementing a fatigue management plan for the NSW mining and extractives industry. (http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0017/302804/Guide-to-the-Development-of-a-Fatigue-Management-Plan-Amended-17-6-10.pdf) (Slide 7).

2. Moscovitch, A., et al. (2006). *Development of a North-American Fatigue Management Program for commercial motor carriers: Phase II (Pilot Study)* (TP 14828E). Background information on fatigue in Commercial Vehicle Operations (Slide 10).

3. National Transportation Safety Board. (1995). *Safety study: Factors that affect fatigue in heavy truck accidents* (NTSB No. SS-95/01). Fatigue and Commercial Motor Vehicles (Slide 11).

4. Knipling, R.R., & Wang, J.S. (1994). Crashes and Fatalities Related to Driver Drowsiness/Fatigue. Study assessing the prevelance of Commercial motor vehicle drivers asleep at the wheel (Slide 11).

5. Federal Motor Carrier Safety Administration. (2006). *Report to Congress on the Large Truck Crash Causation Study* (Report No. MC-R/MC-RRA). Research examining factors involved in large vehicle crashes (Slide 11).

6. Saltzman, G. M., & Belzer, M. H. (2007). *Truck driver occupational safety and health: 2003 conference report and selective literature review* (DHHS [NIOSH] Publication No. 2007-120). Discussion on the health and wellness implications of fatigue (Slides 12 and 13).

7. Fourie, C., Holmes, A., & Bourgeois-Bougrine, S. (2010). *Road Safety Research Report No. 110. Fatigue Risk Management Systems: A Review of the Literature.* Review of Fatigue Risk Management Systems and the benefits of an FMP (Slide 16).

MODULE 2: SAFETY CULTURE AND MANAGEMENT PRACTICES

1. Geller, E. S. (2001). *The psychology of safety handbook.* Provides overall discussion on occupational safety and safety culture. Referenced through the entire module (Slides 7-8, 17- 18, 20, 23-24, 32, 45, 52, 54-56, 60, 66, and 71).

2. Jex, S. M. (2002). *Organizational psychology: A scientist-practitioner approach.* Review of safety culture (Slides 7 and 36-38)

3. Treat et al. (1979). *Tri-level study of the causes of traffic accidents: Final report volume I: Causal factor tabulations and assessments* (DOT HS-805 085). Factors that contribute to traffic crashes (Slide 9)

4. Hendrix et al. (1999). *The relative frequency of unsafe driving acts in serious traffic crashes* (DTNH22-94-C-05020). Factors that contribute to traffic crashes (Slide 9).

5. Federal Motor Carrier Safety Administration. (2006). *Report to Congress on the Large Truck Crash Causation Study* (Report No. MC-R/MC-RRA). Research examining factors involved in large vehicle crashes (Slide 9).

6. New South Wales Mine Safety Advisory Council (2009). Fatigue management plan: A practical guide to developing and implementing a fatigue management plan for the NSW mining and extractives industry. (http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0017/302804/Guide-to-the-Development-of-a-Fatigue-Management-Plan-Amended-17-6-10.pdf) (Slides 11 and 12).

7. International Civil Aviation Organization (2011). Fatigue risk management systems: Manual for Regulators (Doc 9966). (http://www.icao.int/safety/fatiguemanagement/FRMS Tools/Doc 9966 - FRMS Manual for Regulators.pdf) (Slides 11 and 12).

8. Hollander, E. P., & Offerman, L. R. (1990). Power and leadership in organizations: Relationships in transition. *American Psychologist, 45,* 179-189. Reviews the impact of leadership and power in organizations (Slide 30).

9. Greenberg, D.B., & Strasser, S. (1991). The role of situational and dispositional factors of enhancement of personal control in organizations. In L.L. Cumings & B.M Staw (Eds.), *Research in organization behavior* (pp. 45–111). Review of employee empowerment in organizations (Slide 30).

10. Bowen, D., & Lawler, E. (1992). The empowerment of service workers: What, why, how, and when? *Sloan Management Review, 33,* 31-39. Review of employee empowerment in organizations (Slide 30).

11. Psoinos, A., & Smithson, S. (2002). Employee empowerment in manufacturing: A study of organizations in the UK. *New Technology, Work, and Employment, 17,* 132-148. Reviews the benefits of employee empowerment in organizations (Slide 31).

12. Mullins, L. J., & Peacock, A. (1991). Managing through people: Regulating the employment relationship. *Administrator, December,* 45-55. Reviews the benefits of employee empowerment in organizations (Slide 31).

13. Greasley, K., et al. (2004). Understanding empowerment from an employee perspective: What does it mean and do they want it? *Team Performance Management, 14,* 39-55. Reviews the benefits of employee empowerment in organizations (Slide 31).

14. Meyer, J. P., & Allen, N. J. (1991). A three-component conceptualization of organizational commitment. *Human Resource Management Review, 1,* 61-89. Reviews the factors that contribute to organizational commitment (Slide 36).

15. University of Pittsburg. http://www.sleep.pitt.edu/content.asp?id=1484&subid=2316. Sleep Quality Questionnaire (Slide 73).

MODULE 3: DRIVER EDUCATION

1. Thiffault, P. (2011). *Addressing Human Factors in the Motor Carrier Industry in Canada,* Canadian Council of Motor Transport Administration. General review of human performance factors in commercial driving, including driver fatigue (Slide 19).

2. Wylie, C.D., Shultz, T., Miller, J.C., Mitler, M.M., & Mackie, R.R. (1996). *Commercial Motor Vehicle Driver Fatigue and Alertness Study*, Federal Highway Administration, U.S. Department of Transportation, Washington, DC. First major naturalistic driving (instrumented vehicle) study of commercial driver alertness. Among other findings, highlighted importance of circadian rhythms and individual differences in fatigue susceptibility (Slides 25 and 72).

3. Itoi, A., Cilveti, R., Voth, M., Bezalel, D., Hyde, P., Gupta, A., & Dement, W.C. (1993). *Can Drivers Avoid Falling Asleep at the Wheel? Relationship between Awareness of Sleepiness and Ability to Predict Sleep Onset*. AAA Foundation for Traffic Safety. Sleep deprivation study showing that people often cannot predict imminent falling asleep (Slide 26).

4. Stutts, J.C., Wilkins, J.W., & Vaughn, B. V. (1999). *Why Do People Have Drowsy Driving Crashes; Input from Drivers Who Just Did*. AAA Foundation for Traffic Safety. Available at www.aaafoundation.org. Cited in slide 3-27, 3-28. Study which interviewed drivers who had fallen asleep at the wheel (Slides 27 and 28)

5. Saltzman, G.M. & Belzer, M.H. (2007). *Truck Driver Occupational Safety & Health; 2003 Conference Report and Selective Literature Review*. NIOSH Publication No. 2007-120, 2007. Available at cdc.gov/niosh. Study of truck driver health and long work hours (Slides 31 and 32).

6. Balkin, T.J. (2011). Health effects of fatigue. *Presentation at Transportation Research Board Research on Fatigue in Transit Operations: A Conference*. Washington, D.C., Oct. 12-13, 2011. Presented Walter Reed Army Institute for Research sleep deprivation data showing that, to some extent, extra sleep can be "banked" for several days or more (Slide 35).

7. Arnold, P. K. & Hartley, L. R. (1998) It's not just hours of work: ask the drivers. In Hartley, L. R. (ed.) *Managing Fatigue in Transportation*. Oxford: Elsevier Science Ltd. Data on the raised relative risk of hazardous incidents or nodding off associated with less than 6 hours of sleep (Slide 38).

8. Knipling, R.R. (2009). *Safety for the Long Haul; Large Truck Crash Risk, Causation, & Prevention*. American Trucking Associations (ATA). ISBN 978-0-692-00073-1. Chapter 5 of book is on driver fatigue. Addresses fatigue crashes, factors affecting fatigue and alertness, sleep hygiene, and other fatigue-related topics (Slides 39-41, 64, 71, 122, and 138-139).

9. Starnes, M. (2006). *LTCCS: An Initial Overview*. NHTSA National Center for Statistics & Analysis, DOTR HS 810 646. Summary of major large truck crash causation statistics from the Large Truck Crash Causation Study (Slides 41 and 81).

10. National Transportation Safety Board (NTSB). (1990). *Safety Study: Fatigue, Alcohol, Other Drugs, and Medical Factors in Fatal-to-the-Driver Heavy Truck Crashes*. Report No. NTSB/SS-90/02. Crash investigation study highlighting fatigue as the biggest cause of these kind of crashes (Slide 42).

11. Balkin, T.J., Thorne, D., Sing, H., Thomas, M., Redmond, D.P., Wesensten, N., Russo, M., Williams, J., Hall, S., & Belenky, G.L. (2000). *Effects of Sleep Schedules on Commercial Motor Vehicle Driver Performance*, FMCSA Technical Report No. DOT-MC-00-133, U.S. Department of Transportation, Washington, DC. Laboratory study of sleep deprivation effects. Showed that continued sleep deprivation results in progressive, cumulative declines in performance over multiple days (Slide 61).

12. Rosekind, M.R., R.C. Graeber, D.F.Dinges, L.J. Connell, M.S. Rountree, & K. Gillen (1994). *Crew Factors in Flight Operations IX: Effects of Planned Cockpit Rest on Crew Performance and Alertness in Long-Haul Operations*. NASA Technical Memorandum 108839, NASA Ames Research Center, CA. Study of trans-Pacific airline pilots showing that planned naps greatly reduced subsequent pilot errors (Slide 62).

13. Dawson, D. & Reid, K. (1997) Fatigue, alcohol and performance impairment. *Nature*, *388*, 235. Study showed that, on some performance tests, sleep loss can have effects similar to alcohol intoxication (Slide 66).

14. Hickman, J.S., Knipling, R.R., Olson, R.L., & Hanowski, R.J. (in press). *Commercial Vehicle Data Collection & Countermeasure Assessment Project. Phase I: Preliminary Analysis of Data Collected in the Drowsy Driver Warning System Field Operational Test—Task 3: Preliminary Analysis of Partial Countermeasure Data.* Contract No. DTNH22-00-C-07007, Task Order 21. Washington, DC: Federal Motor Carrier Safety Administration, USDOT. Naturalistic driving study which also collected data on driver subject height, weight, and BMI (Slides 71 and 95).

15. FMCSA. (2010). *FMCSA Medical Examiner Handbook*; Available online at http://nrcme.fmcsa.dot.gov/mehandbook/MEhandbook.htm. General reference on driver medical conditions relating to safety (Slide 73).

16. Xie, W., Chakrabarty, S., Levine, R., Johnson, R., & Talmage, J.B. (2011). Factors associated with obstructive sleep apnea among commercial motor vehicle drivers, *Journal of Occupational and Environmental Medicine*, *53,* 169-173. Study finding high association between obesity and OSA (Slide 75).

17. Pack, A.I., Dinges, D.F., & Maislin, G. (2002). *A Study of the Prevalence of Sleep Apnea Among Commercial Truck Drivers*. Trucking Research Institute and the University of Pennsylvania, FMCSA Report No. FMCSA-RT-02-030. Study examined a sample of commercial drivers to determine OSA incidence (28%) (Slide 76).

18. Sassani, A., Findley, L.J., Kryger, M., Goldlust, E., George, C., & Davidson, T.M. (2004). Reducing motor-vehicle collisions, costs, and fatalities by treating obstructive sleep apnea syndrome. *Sleep, 27,* 453-458. This study reviewed the literature on increased crash risk associated with OSA and the overall societal costs of OSA-related motor vehicle crashes (Slide 76).

19. Siebert, K. (2012). Preliminary data from 2011 National Institute of Occupational Safety & Health (NIOSH) survey of commercial driver health. *Transportation Research Board Annual Meeting*, Washington, DC. New survey of truck driver health-related behaviors and conditions, with comparisons to the general U.S. population. In general, this study shows key driver health indices worsening over recent years (Slides 89, 95, and 96).

20. Roberts, S., & York, J. (2009). *Design, Development, and Evaluation of Driver Wellness Programs.* FMCSA Report No. MC-00-193. General U.S. DOT report on commercial driver health and wellness. Review driver health statistics from other studies, surveyed drivers and companies, and outlined concepts of positive behavior change (Slide 89 and 99).

21. Holmes, S.M, Power, M.L., & Walker, C.K. (1996). A Motor Carrier Wellness Program: Development and Testing. *American Society of Transportation Logistics: Transportation Journal*, *35,* 33–48. Survey of commercial driver food preferences and other health-related behaviors (Slide 91).

22. Krueger, G.P., & Leaman, H. M. (2011). *Synthesis Report #19: Effects of Psychoactive Chemicals on Commercial Driver Health and Performance: Stimulants, Hypnotics, Nutritional, and Other Supplements*. TRB Commercial Truck & Bus Synthesis Program. ISSN 1544-6808, ISBN 978-0-309-14322-6. Detailed review of the effects of various drugs on driver performance (Slides 91, 101-104, and 106).

23. Wiegand, D.M., Hanowski, R.J., Olson, R., & Melvin, W. (2008). *Fatigue Analyses from 16 Months of Naturalistic CMV Driving Data*, Draft Final Report, FHWA Report.

Naturalistic driving study related driver drowsiness to factors like obesity. Also recorded safety belt use, finding that obese drivers were less likely to wear their safety belts, and more likely to be drowsy while driving (Slide 95).

24. Korelitz, J.J., Fernandez, A.A., Uyeda, V.J., Spivey, G.H., Browfy, B.L., & Schmidt, R.T. (1993). Health habits and risk factors among truck drivers visiting a health booth during a trucker trade show. *American Journal of Health Promotion*, *8,* 117-123. Driver survey (Slides 95-96).

25. Orris, P. et al., (1997). Stress among package truck drivers. *American Journal of Industrial Medicine, 31,* 202-210. Survey found that package delivery drivers had average stress levels greater than 91% of U.S. population on stress scale (Slide 97).

26. Dingus, T.A., Neale, V.L., Garness, S.A., Hanowski, R.J., Keisler, A.S., Lee, S.E., Perez, M.A., Robinson, G.S., Belz, S.M., Casali, J.G., Pace-Schott, E.F., Stickgold, R.A., & Hobson, J.A. (2002). *Impact of Sleeper Berth Usage on Driver Fatigue.* Final Report, NHTSA Contract No. DTFH61-96-00068. Naturalistic driving study which compared the sleep, alertness, and safety of team and solo drivers (Slides 138-139).

27. Knipling, R.R. (2006). *Sleeper Berth Use in Two Up Motor Transport Operations,* Research report prepared for the Australia National Transport Commission, ISBN 1 921168 17 X, Available at www.ntc.gov.au. (Slides 138-139).

ADDITIONAL REFERENCES

28. American Transportation Research Institute (ATRI). *Understanding Fatigue and Alert Driving Instructor Materials*. In partnership with FMCSA. Undated (circa 1999). Earlier fatigue and wellness education program.

29. Dewar, R.E. & Olson, P.L. (2002). *Human Factors in Traffic Safety*, Lawyers & Judges Publishing Company, Inc., Tucson, AZ, ISBN 0-913875-47-3. Textbook on numerous driver performance issues, including driver fatigue.

30. Fourie, C., Holmes, A., Bourgeois-Bougrine, S., Hilditch, C., & Jackson, P. (2010). *Fatigue Risk Management Systems: A Review of the Literature*, Clockwork Research Ltd, ISBN 978 1 84864 027 6, London: Department for Transport. Literature review on driver fatigue and fatigue management systems.

31. Fourie,C., Holmes, A., Hilditch, C., Bourgeois-Bougrine, S., & Jackson, P. (2010). *Interviews with Operators, Regulators and Researchers with Experience of Implementing Fatigue Risk Management Systems*, Dept. for Transport Road Safety Research Report No. 120, Clockwork Research Ltd, ISBN 978 1 84864 105 1, London.

32. Jackson, P., Hilditch, C., Holmes, A., Reed, N., Merat, N. & Smith, L. (2011). *Fatigue and Road Safety: A Critical Analysis of Recent Evidence,* Clockwork

Research and Transport Research Laboratory University of Leeds London: Department for Transport.

33. Krueger, G.P., Brewster, R.M., Dick, V.R., Inderbitzen, R.E., & Staplin, L. (2007). *Synthesis Report #15: Health & Wellness Programs for Commercial Drivers*. TRB Commercial Truck & Bus Synthesis Program. ISSN 1544-6808, ISBN 978-0-309-09887-8. Available at http://www.trb.org/Publications/Blurbs/159032.aspx. Literature review and survey relating to motor carrier health and wellness programs (Slide 65).

34. Moore-Ede, M. (1993). *The Twenty-Four Hour Society*. Addison-Wesley Publishing Co., ISBN 0-201-57711-9. Book on sleep, circadian rhythms, and work-related sleep deprivation in modern society (Slide 43).

MODULE 4: FAMILY EDUCATION

1. National Transportation Safety Board (NTSB). (1990). *Safety Study: Fatigue, Alcohol, Other Drugs, and Medical Factors in Fatal-to-the-Driver Heavy Truck Crashes*. Report No. NTSB/SS-90/02. Crash investigation study highlighting fatigue as the biggest cause of these kind of crashes (Slides 8 and 27).

2. Saltzman, G.M. & Belzer, M.H. (2007). *Truck Driver Occupational Safety & Health; 2003 Conference Report and Selective Literature Review*. NIOSH Publication No. 2007-120. Available at cdc.gov/niosh. Study of truck driver health and long work hours (Slides 18-19).

3. Balkin, T.J. (2011). Health effects of fatigue. *Presentation at Transportation Research Board Research on Fatigue in Transit Operations: A Conference*. Washington, D.C., Oct. 12-13, 2011. Presented data showing that, to some extent, extra sleep can be "banked" for several days or more (Slide 22).

4. Knipling, R.R. (2009). *Safety for the Long Haul; Large Truck Crash Risk, Causation, & Prevention*. American Trucking Associations (ATA). ISBN 978-0-692-00073-1. Chapter 5 of book is on driver fatigue. Addresses fatigue crashes, factors affecting fatigue and alertness, sleep hygiene, and other fatigue-related topics (Slide 25 and 42).

5. Arnold, P. K. & Hartley, L. R. (1998) It's not just hours of work: Ask the drivers. In Hartley, L. R. (ed.) *Managing Fatigue in Transportation*. Oxford: Elsevier Science Ltd. Data on the raised relative risk of hazardous incidents or nodding off associated with less than 6 hours of sleep (Slide 26).

6. Balkin, T.J., Thorne, D., Sing, H., Thomas, M., Redmond, D.P., Wesensten, N., Russo, M., Williams, J., Hall, S., & Belenky, G.L. (2000). *Effects of Sleep Schedules on Commercial Motor Vehicle Driver Performance*, FMCSA Technical Report No. DOT-MC-00-133, U.S. Department of Transportation, Washington, DC. Laboratory study of sleep deprivation effects. Showed that continued sleep deprivation results in progressive, cumulative declines in performance over multiple days (Slide 39).

7. Rosekind, M.R., Graeber, R.C., Dinges, D.F., Connell, L.J., Rountree, M.S., & Gillen, K. (1994). *Crew factors in flight operations IX: Effects of planned cockpit rest on crew performance and alertness in long-haul operations*. NASA Technical Memorandum 108839, NASA Ames Research Center, CA. Study of trans-Pacific airline pilots showing that planned naps greatly reduced subsequent pilot errors (Slide 40).

8. Wylie, C.D., Shultz, T., Miller, J.C., Mitler, M.M., & Mackie, R.R. (1996). *Commercial Motor Vehicle Driver Fatigue and Alertness Study*, Federal Highway Administration, U.S. Department of Transportation, Washington, DC. First major naturalistic driving (instrumented vehicle) study of commercial driver alertness. Among other findings, highlighted importance of circadian rhythms and individual differences in fatigue susceptibility (Slides 41 and 46).

9. Moore-Ede, M. (1993). *The Twenty-Four Hour Society*. Addison-Wesley Publishing Co., ISBN 0-201-57711-9. Book on sleep, circadian rhythms, and work-related sleep deprivation in modern society (Slide 43).

10. Dawson, D. & Reid, K. (1997) Fatigue, alcohol and performance impairment. *Nature*, *388*, 235. Study showed that, on some performance tests, sleep loss can have effects similar to alcohol intoxication (Slide 44).

11. Xie, W., Chakrabarty, S., Levine, R., Johnson, R., & Talmage, J.B. (2011). Factors associated with obstructive sleep apnea among commercial motor vehicle drivers. *Journal of Occupational and Environmental Medicine, 53,* 169-173, Study finding high association between obesity and OSA (Slide 53).

12. Pack, A.I., Dinges, D.F., & Maislin, G. (2002). *A Study of the Prevalence of Sleep Apnea Among Commercial Truck Drivers*. Trucking Research Institute and the University of Pennsylvania, FMCSA Report No. FMCSA-RT-02-030. Study examined a sample of commercial drivers to determine OSA incidence (28%) (Slide 55).

13. Roberts, S., & York, J. (2000). *Design, Development, and Evaluation of Driver Wellness Programs.* FMCSA Report No. MC-00-193. General U.S. DOT report on commercial driver health and wellness. Review driver health statistics from other studies, surveyed drivers and companies, and outlined concepts of positive behavior change (Slides 63, 71, and 73).

14. Siebert, K. (2012). Preliminary data from 2011 National Institute of Occupational Safety & Health (NIOSH) survey of commercial driver health. *Transportation Research Board Annual Meeting*, Washington, DC, January, 2012. New survey of truck driver health-related behaviors and conditions, with comparisons to the general U.S. population (Slides 63, 69, and 70).

15. Holmes, S.M, Power, M.L., & Walker, C.K. (1996). A motor carrier wellness program: Development and testing. *American Society of Transportation Logistics:*

Transportation Journal, 35, 33–48. Survey of commercial driver food preferences and other health-related behaviors (Slide 65).

16. Korelitz, J.J., Fernandez, A.A., Uyeda, V.J., Spivey, G.H., Browfy, B.L., & Schmidt, R.T. (1993). Health habits and risk factors among truck drivers visiting a health booth during a trucker trade show. *American Journal of Health Promotion, 8,* 117-123. Driver survey (Slide 65).

17. Krueger, G.P., Brewster, R.M., Dick, V.R., Inderbitzen, R.E., & Staplin, L. (2007). *Synthesis Report #15: Health & Wellness Programs for Commercial Drivers*. TRB Commercial Truck & Bus Synthesis Program. ISSN 1544-6808, ISBN 978-0-309-09887-8. Available at http://www.trb.org/Publications/Blurbs/159032.aspx. Literature review and survey relating to motor carrier health and wellness programs (Slide 65).

18. Hickman, J.S., Knipling, R.R., Olson, R.L., & Hanowski, R.J. (in press). *Commercial Vehicle Data Collection & Countermeasure Assessment Project. Phase I: Preliminary Analysis of Data Collected in the Drowsy Driver Warning System Field Operational Test—Task 3: Preliminary Analysis of Partial Countermeasure Data.* Contract No. DTNH22-00-C-07007, Task Order 21. Washington, DC: Federal Motor Carrier Safety Administration, USDOT. Naturalistic driving study which also collected data on driver subject height, weight, and BMI (Slide 69).

19. Wiegand, D.M., Hanowski, R.J., Olson, R., & Melvin, W. (2008). *Fatigue Analyses from 16 Months of Naturalistic CMV Driving Data*, Draft Final Report, FHWA Report. Naturalistic driving study related driver drowsiness to factors like obesity. Also recorded safety belt use (Slide 69).

20. Orris, P. et al. (1997). Stress among package truck drivers. American Journal of Industrial Medicine*, 31,* 202-210. Survey found that package delivery drivers had average stress levels greater than 91% of U.S. population on stress scale (Slide 71).

21. Krueger, G.P., & Leaman, H. M. (2011). *Synthesis Report #19: Effects of Psychoactive Chemicals on Commercial Driver Health and Performance: Stimulants, Hypnotics, Nutritional, and Other Supplements*. TRB Commercial Truck & Bus Synthesis Program. ISSN 1544-6808, ISBN 978-0-309-14322-6. Detailed review of the effects of various drugs on driver performance (Slides 76-77).

MODULE 5: TRAIN-THE-TRAINER FOR DRIVER EDUCATION AND FAMILY EDUCATION

Note: Sources cited in duplicated Module 3 slides are indicated by the Module 5 slide number followed by the corresponding Module 3 slide number.

1. Birnbrauer, H. & Tyson, L. A. (1985). Identifying, selecting, and training technical instructors. Chapter in *The ASTD Handbook for Technical and Skills Training*. H. Birnbrauer (Ed.). American Society for Training and Development. Article in technical skills training compendium (Slides 14-15).

2. Brock, J. F., Short, J., Camden, M. C., Hickman, J. S., Vlahos, N. J., & Bergoffen, G. (2011). *Efficacy of Web-Based Instruction to Provide Training on Federal Motor Carrier Safety Regulations*, FMCSA-RRR-11-012. General review of the advantages, disadvantages, and applications of web-based instruction in the commercial motor transport industry (Slide 19).

3. Knowles, M. (1980). *The Modern Practice of Adult Education*, Cambridge Press, pp. 57-58. Older, classic textbook on adult education (Slide 25).

4. Silber, K. H., & Steinicki, M. B. (1987). Writing training materials. Paper 14 in *Training and Development Handbook: A Guide to Human Resource Development*, 3rd Edition. R. L. Craig (Ed.), McGraw-Hill Book Company, ISBN 0-07-013353, pp. 263-285 (Slide 27).

5. Thiffault, P. (2011). *Addressing Human Factors in the Motor Carrier Industry in Canada,* Canadian Council of Motor Transport Administration. General review of human performance factors in commercial driving, including driver fatigue (Slide 61; Module 3 slide 19).

6. Wylie, C.D., Shultz, T., Miller, J.C., Mitler, M.M., & Mackie, R.R. (1996). *Commercial Motor Vehicle Driver Fatigue and Alertness Study*, Federal Highway Administration, U.S. Department of Transportation, Washington, DC. First major naturalistic driving (instrumented vehicle) study of commercial driver alertness. Among other findings, highlighted importance of circadian rhythms and individual differences in fatigue susceptibility (Slides 68 [Module 3 slide 25] and 110 [Module 3 slide 72]).

7. Itoi, A., Cilveti, R., Voth, M., Bezalel, D., Hyde, P., Gupta, A., & Dement, W.C. (1993). *Can drivers avoid falling asleep at the wheel? Relationship between awareness of sleepiness and ability to predict sleep onset*. AAA Foundation for Traffic Safety. Sleep deprivation study showing that people often cannot predict imminent falling asleep (Slide 69; Module 3 slide 26).

8. Stutts, J.C., Wilkins, J.W., & Vaughn, B. V. (1999). *Why do people have drowsy driving crashes: Input from drivers who just did*. AAA Foundation for Traffic Safety. Available at www.aaafoundation.org. Study which interviewed drivers who had fallen asleep at the wheel (Slides 70 [Module 3 slide 27] and 71 [Module 3 slide 28]).

9. Saltzman, G.M. & Belzer, M.H. (2007). *Truck Driver Occupational Safety & Health; 2003 Conference Report and Selective Literature Review*. NIOSH Publication No. 2007-120. Available at cdc.gov/niosh. Study of truck driver health and long work hours (Slides 74 [Module 3 slide 31] and 75 [Module 3 slide 32]).

10. Balkin, T.J. (2011). Health effects of fatigue. *Presentation at Transportation Research Board Research on Fatigue in Transit Operations: A Conference*. Washington, D.C., Oct. 12-13, 2011. Presented Walter Reed Army Institute for Research sleep deprivation data showing that, to some extent, extra sleep can be "banked" for several days or more (Slide 78; Module 3 slide 35).

11. Arnold, P. K., & Hartley, L. R. (1998) It's not just hours of work: ask the drivers. In Hartley, L. R. (ed.) *Managing Fatigue in Transportation*. Oxford: Elsevier Science Ltd. Data on the raised relative risk of hazardous incidents or nodding off associated with less than 6 hours of sleep (Slide 81; Module 3 slide 38).

12. Knipling, R.R. (2009). *Safety for the Long Haul; Large Truck Crash Risk, Causation, & Prevention*. American Trucking Associations (ATA). ISBN 978-0-692-00073-1. Chapter 5 of book is on driver fatigue. Addresses fatigue crashes, factors affecting fatigue and alertness, sleep hygiene, and other fatigue-related topics (Slides 82-84 [Module 3 slides 39-41], 102 [Module 3 slide 64], 109 [Module 3 slide 71], 158 [Module 3 slide 122], and 174-175 [Module 3 slides 138-139]).

13. Starnes, M. (2006). *LTCCS: An Initial Overview*. NHTSA National Center for Statistics & Analysis, DOTR HS 810 646. Summary of major large truck crash causation statistics from the Large Truck Crash Causation Study (Slides 84 [Module 3 slide 41] and 119 [Module 3 slide 81]).

14. National Transportation Safety Board (NTSB). (1990). *Safety Study: Fatigue, Alcohol, Other Drugs, and Medical Factors in Fatal-to-the-Driver Heavy Truck Crashes*. Report No. NTSB/SS-90/02. Crash investigation study highlighting fatigue as the biggest cause of these kind of crashes (Slide 85; Module 3 slide 42).

15. Balkin, T.J., Thorne, D., Sing, H., Thomas, M., Redmond, D.P., Wesensten, N., Russo, M., Williams, J., Hall, S., & Belenky, G.L. (2000). *Effects of Sleep Schedules on Commercial Motor Vehicle Driver Performance*, FMCSA Technical Report No. DOT-MC-00-133, U.S. Department of Transportation, Washington, DC. Laboratory study of sleep deprivation effects. Showed that continued sleep deprivation results in progressive, cumulative declines in performance over multiple days (Slide 99; Module 3 slide 61).

16. Rosekind, M.R., Graeber, R.C., Dinges, D.F., Connell, L.J., Rountree, M.S., & Gillen, K. (1994). *Crew Factors in Flight Operations IX: Effects of Planned Cockpit Rest on Crew Performance and Alertness in Long-Haul Operations*. NASA Technical Memorandum 108839, NASA Ames Research Center, CA. Study of trans-Pacific airline pilots showing that planned naps greatly reduced subsequent pilot errors (Slide 100; Module 3 slide 62).

17. Dawson, D. & Reid, K. (1997) Fatigue, alcohol and performance impairment. *Nature, 388,* 235. Study showed that, on some performance tests, sleep loss can have effects similar to alcohol intoxication (Slide 104; Module 3 slide 66).

18. Hickman, J.S., Knipling, R.R., Olson, R.L., & Hanowski, R.J. (in press). *Commercial Vehicle Data Collection & Countermeasure Assessment Project. Phase I: Preliminary Analysis of Data Collected in the Drowsy Driver Warning System Field Operational Test—Task 3: Preliminary Analysis of Partial Countermeasure Data.* Contract No. DTNH22-00-C-07007, Task Order 21. Washington, DC: Federal Motor Carrier Safety Administration, USDOT. Naturalistic driving study which also collected

data on driver subject height, weight, and BMI (Slides 109 [Module 3 slide 71] and 136 [Module 3 slide 95]).

19. FMCSA. (2010). *FMCSA Medical Examiner Handbook*. Available online at http://nrcme.fmcsa.dot.gov/mehandbook/MEhandbook.htm [October 21, 2010]. General reference on driver medical conditions relating to safety (Slide 111; Module 3 slide 73).

20. Xie, W., Chakrabarty, S., Levine, R., Johnson, R., & Talmage, J.B. (2011). Factors associated with obstructive sleep apnea among commercial motor vehicle drivers. *Journal of Occupational and Environmental Medicine, 53,* 169-173. Study finding high association between obesity and OSA (Slide 108; Module 3 slide 75).

21. Pack, A.I., Dinges, D.F., & Maislin, G. (2002). *A Study of the Prevalence of Sleep Apnea Among Commercial Truck Drivers*. Trucking Research Institute and the University of Pennsylvania, FMCSA Report No. FMCSA-RT-02-030. Study examined a sample of commercial drivers to determine OSA incidence (28%) (Slide 114; Module 3 slide 76).

22. Sassani, A., Findley, L.J., Kryger, M., Goldlust, E., George, C., & Davidson, T.M. (2004). Reducing motor-vehicle collisions, costs, and fatalities by treating obstructive sleep apnea syndrome. *Sleep, 27,* 453-458. This study reviewed the literature on increased crash risk associated with OSA and the overall societal costs of OSA-related motor vehicle crashes (Slide 114; Module 3 slide 76).

23. Siebert, K. (2012). Preliminary data from 2011 National Institute of Occupational Safety & Health (NIOSH) survey of commercial driver health. *Transportation Research Board Annual Meeting*, Washington, DC, January, 2012. New survey of truck driver health-related behaviors and conditions, with comparisons to the general U.S. population. In general, this study shows key driver health indices worsening over recent years (Slides 130 [Module 3 slide 89] and 136-137 [Module 3 slides 95-96]).

24. Roberts, S., & York, J. (2000). *Design, Development, and Evaluation of Driver Wellness Programs.* FMCSA Report No. MC-00-193. General U.S. DOT report on commercial driver health and wellness. Review driver health statistics from other studies, surveyed drivers and companies, and outlined concepts of positive behavior change (Slides 130 [Module 3 slide 89] and 140 [Module 3 slide 99]).

25. Holmes, S.M, Power, M.L., & Walker, C.K. (1996). A motor carrier wellness program: Development and testing. *American Society of Transportation Logistics: Transportation Journal*, *35,* 33–48. Survey of commercial driver food preferences and other health-related behaviors (Slide 132; Module 3 slide 91).

26. Krueger, G.P., & Leaman, H. M. (2011). *Synthesis Report #19: Effects of Psychoactive Chemicals on Commercial Driver Health and Performance: Stimulants, Hypnotics, Nutritional, and Other Supplements*. TRB Commercial Truck & Bus Synthesis Program. ISSN 1544-6808, ISBN 978-0-309-14322-6. Detailed

review of the effects of various drugs on driver performance (Slides 132 [Module 3 slide 91], 142-145 [Module 3 slides 101-104], and 147 [Module 3 slide 106]).

27. Wiegand, D.M., Hanowski, R.J., Olson, R., & Melvin, W. (2008). *Fatigue Analyses from 16 Months of Naturalistic CMV Driving Data*, Draft Final Report, FHWA Report. Naturalistic driving study related driver drowsiness to factors like obesity. Also recorded safety belt use, finding that obese drivers were less likely to wear their safety belts, and more likely to be drowsy while driving (Slide 136; Module 3 slide 95).

28. Korelitz, J.J., Fernandez, A.A., Uyeda, V.J., Spivey, G.H., Browfy, B.L., & Schmidt, R.T. (1993). Health habits and risk factors among truck drivers visiting a health booth during a trucker trade show. *American Journal of Health Promotion*, *8,* 117-123. Driver survey (Slides 136-137 [Module 3 slides 95-96]).

29. Orris, P. et al. (1997). Stress among package truck drivers. *American Journal of Industrial Medicine, 31,* 202-210. Survey found that package delivery drivers had average stress levels greater than 91% of U.S. population on stress scale (Slide 138; Module 3 Slide 97).

30. Roberts, S., & York, J. (2000). *Design, Development, and Evaluation of Driver Wellness Programs.* FMCSA Report No. MC-00-193. Major U.S. DOT study on commercial driver wellness and wellness programs (Slides 130 and 205-217).

31. Krueger, G.P., Brewster, R.M., Dick, V.R., Inderbitzen, R.E., & Staplin, L. (2007). *Synthesis Report #15: Health & Wellness Programs for Commercial Drivers*. TRB Commercial Truck & Bus Synthesis Program. ISSN 1544-6808, ISBN 978-0-309-09887-8. Synthesis study discussing key elements of wellness programs and providing case study examples (Slide 132).

32. Dingus, T.A., Neale, V.L., Garness, S.A., Hanowski, R.J., Keisler, A.S., Lee, S.E., Perez, M.A., Robinson, G.S., Belz, S.M., Casali, J.G., Pace-Schott, E.F., Stickgold, R.A., & Hobson, J.A. (2002). *Impact of Sleeper Berth Usage on Driver Fatigue.* Final Report, NHTSA Contract No. DTFH61-96-00068. Naturalistic driving study which compared the sleep, alertness, and safety of team and solo drivers (Slides 174-175 [Module 3 slides 138-139]).

33. Knipling, R.R. (2006). *Sleeper Berth Use in Two Up Motor Transport Operations,* Research report prepared for the Australia National Transport Commission, ISBN 1 921168 17 X, Available at www.ntc.gov.au (Slides 174-175 [Module 3 slides 138-139]).

34. Prochaska, J.O, DiClemente, C.C., & Norcross, J.C. (1992). In search of how people change: applications to the addictive behaviours. *American Psychologist*, *47,* 1102-1114. Journal article (Slide 205).

35. Simons-Morton, B., McLeroy, K. R., & Wendel, M.L. (2012). *Behavior Theory in Health Promotion Practice and Research*. Jones and Bartlett Learning, ISBN-13:

978-0-7637-8679-3. Textbook on principles of behavior and psychology related to health behaviors (Slide 205).

36. Greene, G. W., et al. (1994). Transtheoretical model for reducing dietary fat to 30 percent of energy or less. *Journal of the American Dietetics Association*, 1105-1110. Article based on the five steps/stages of behavior change as presented in the slides (Slides 206-211).

37. Knipling, R.R. (2009). *Safety for the Long Haul; Large Truck Crash Risk, Causation, & Prevention*. American Trucking Associations (ATA). ISBN 978-0-692-00073-1. Textbook on large truck safety, including a long chapter on driver fatigue and material on driver training (Slide 218).

38. Geller, E.S. (2001). *The Psychology of Safety Handbook*. Boca Raton, FL: CRC Press. Textbook based on behavioral psychology and Behavior-Based Safety (BBS) (Slide 219).

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39. Driscoll, M. (2002). *Web-Based Training; Creating E-Learning Experiences*. Jossey-Bass/Pfeiffer, San Francisco, ISBN 0-7879-5619-8. Textbook on developing and implementing web-based training.

40. United Nations Economic and Social Commission for Asia and the Pacific. (2001). *Train-the-Trainer Training Fundamentals; Instructor's Reference Manual.* ST/ESCAP/2158, Available at http://www.unescap.org/ttdw/common/TFS/FFMultimodalTx/TOT.pdf.

MODULE 6: SHIPPERS AND RECEIVERS

1. NTSB. (1990). *Safety Study: Fatigue, Alcohol, Other Drugs, and Medical Factors in Fatal-to-the-Driver Heavy Truck Crashes*. Report No. NTSB/SS-90/02. In-depth investigations of 182 fatal-to-the-driver large truck crashes (Slide 11).

2. FMCSA Analysis Division. (2011). 2009 Large Truck and Bus Crash Facts. Publication FMCSA-RRA-11-025. Annual report on truck and bus crashes, available on the FMCSA website (Slides 12 and 33).

3. Balkin, T.J., Thorne, D., Sing, H., Thomas, M., Redmond, D.P., Wesensten, N., Russo, M., Williams, J., Hall, S., & Belenky, G.L., (2000). *Effects of Sleep Schedules on Commercial Motor Vehicle Driver Performance*, FMCSA Technical Report No. DOT-MC-00-133, U.S. Department of Transportation, Washington, DC. Walter Reed Army Institute of Research sleep deprivation study employing commercial drivers as subjects (Slide 15).

4. Rosekind, M.R., Graeber, R.C., Dinges, D.F., Connell, L.J., Rountree, M.S., & Gillen, K. (1994). *Crew Factors in Flight Operations IX: Effects of Planned Cockpit Rest on*

Crew Performance and Alertness in Long-Haul Operations. NASA Technical Memorandum 108839, NASA Ames Research Center, CA. Experimental study of the benefits of planned napping for pilots of trans-Pacific airline flights (Slide 16).

5. Knipling, R.R. (2009). *Safety for the Long Haul; Large Truck Crash Risk, Causation, & Prevention*. American Trucking Associations (ATA). ISBN 978-0-692-00073-1. Comprehensive textbook on large truck safety and safety management (Slide 18).

6. Dawson, D. & Reid, K. (1997) Fatigue, alcohol and performance impairment. *Nature, 388,* 235. Experimental study comparing performance effects of sleep deprivation to those of alcohol intoxication. Note that findings of equivalence for some performance metrics do not necessarily imply equivalence for safety in general; alcohol causes multiple performance and behavioral effects which, in total, are generally worse than those of fatigue (Slide 19).

7. Campbell, K.L. (2005). *Estimates of the Prevalence and Risk of Fatigue in Fatal Crashes Involving Medium/Heavy Trucks Update for 1991-2002 TIFA Files*. Letter report to FMCSA, Feb. 25, 2005. (Also cited in the FMCSA 2007 HOS Regulatory Impact Analysis). Study looked at police-reported fatigue in fatal large truck crashes as a function of hours-of-driving. Note that extremely long driving hours in excess of HOS limits may also be associated with other unsafe driving practices in addition to extreme fatigue (Slide 20).

8. Chen, K.J., Pecheux, K.K., Farbry, J. Jr, & Fleger, S.A. (2002). *Commercial Vehicle Driver Survey: Assessment of Parking Needs and Preferences*. FHWA Final Report No. FHWA-RD-01-160. National survey of large truck parking shortages in both public rest areas and truck stops (Slide 28).

9. Trombly, J. W. (2003). *Dealing with Truck Parking Demands: A Synthesis of Highway Practice*. National Cooperative Highway Research Program (NCHRP) Synthesis 317, Transportation Research Board. Review of effective practices for reducing the parking shortage (Slide 28).

10. FHWA OMC. (1998). *Shipper involvement in HOS violations: Tech Brief.* FHWA-MCRT-99-004. Study based on focus group discussions with motor carrier managers (Slides 31 and 45).

11. Government Accountability Office (GAO). (2011). *More Could Be Done to Determine Impact of Excessive Loading and Unloading Wait Times on Hours of Service Violations*, GAO-11-198, Available at http://www.gao.gov/new.items/d11198.pdf. Recent study, including survey of effects of loading/unloading delays on drivers and carriers (Slides 23, 34, and 35).

12. Miao, Q., Wang, B.X., & Adams, T.M. (2011). *Assessing the Value of Delay to Truckers and Carriers*. Texas Transportation Institute, Report No. CFIRE 03-15; UTCM 09-00-45. Analysis of cost impact of traffic delays on large truck transport (Slide 34).

13. Knipling, R.R. & Nelson, K.C. (2011). *Safety Management in Small Motor Carriers*. CTBSSP Synthesis 22, TRB, ISBN 978-0-309-22340-9, http://www.trb.org/Publications/PubsCTBSSPSynthesisReports.aspx. Synthesis report on safety management in small motor carriers. Includes a literature review, survey, and case study interviews. Identifies effective safety management practices (Slide 37).

14. Truckload Carriers Association and the National Industrial Transportation League. (2011). *Code of Ethics: Voluntary Guide to Good Business Relations for Shippers, Receivers, Carriers, and Drivers.* Downloaded from http://www.nitl.org/guide.htm, July 27, 2011. Voluntary guidelines described in the slides (Slides 42-44).

15. Moore, B. (2007). An integrated approach to the regulation of heavy vehicles. National Transport Commission Australia. *23rd World Roads Congress*, Paris, 17-21 September 2007. Review article on emerging approaches to heavy vehicle safety regulations, including fatigue management programs as a substitute or supplement to Hours-of-Service regulations (Slide 45).

16. Knipling, R.R. (2011). *Potential Safety Benefits of Motor Carrier Operational Efficiencies*. CTBSSP Synthesis 20, TRB, ISBN 978-0-309-14350-9, http://www.trb.org/Publications/PubsCTBSSPSynthesisReports.aspx. Review of the literature and carrier surveys on relationship between various efficiency- and mobility-promoting practices and safety outcomes (Slides 49-50).

MODULE 7: MOTOR CARRIER MANAGEMENT SLEEP DISORDERS SCREENING AND TREATMENT

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APPENDIX B: Example Terms of Reference for the FMP Steering Committee (adapted from ICAO, 2011[9])

[Inset Company Name] Terms of Reference: FMP Steering Committee

Purpose
The Fatigue Management Program Steering Committee (FMPSC) is responsible for coordinating all fatigue management activities at [inset company name]. This includes responsibility for gathering, analyzing, and reporting on data that facilitates the assessment of fatigue among commercial motor vehicle (CMV) drivers. The FMPSC is also responsible for ensuring that the FMP meets the safety objectives defined in the FMP Policy, that HOS requirements are met, and that the FMP facilitates the management of safety risks in general.

Terms of Reference
The FMPSC is directly responsible to the VP of Safety and reports through the Department of Safety. Its membership includes at least one representative of each of the following groups: management, dispatch, and drivers.

The tasks of the FMPSC are to:

- Develop, implement, and monitor processes for identification of fatigue hazards;
- Ensure that comprehensive risk assessment is undertaken for fatigue hazards;
- Develop, implement, and monitor measures and countermeasures to manage identified fatigue hazards;
- Develop, implement, and monitor effectiveness of FMP performance metrics;
- Be responsible for the design, analysis, and reporting of studies that measure driver fatigue, when such studies are needed for the identification of hazards, or for monitoring the effectiveness of controls and mitigations;
- Ensure that all relevant personnel receive appropriate FMP education and training, and that training records are kept as part of the FMP documentation;
- Develop and maintain strategies for effective communication with all parties;
- Ensure drivers and other relevant personnel receive responses to their fatigue reports;
- Communicate fatigue risks and the performance of the FMP to top management;
- Develop and maintain FMP documentation;
- Ensure that it has adequate access to scientific and medical expertise as needed, and that it documents recommendation made by these specialist advisors and the corresponding actions taken;
- Keeps informed of scientific and operational advances in fatigue risk management principles and practices; and
- Manage effectively and be accountable for FMP resources.

The FMPSC will meet monthly. Minutes will be taken during meetings and distributed within 10 working days after each meeting. The FMPSC will present an annual budget request in [designated part of the financial cycle] and an annual report of all expenditures.

APPENDIX C: Example FMP Policy (adapted from ICAO, 2011[9])

FMP Policy Example 1 (adapted from ICAO, 2011)

[Insert Company Name] Fatigue Management Program Policy

As a commitment to the continuous improvement of safety, [insert company name] has a Fatigue Management Program (FMP) to management fatigue-related risks.

This FMP applies to all operations in [insert company name]. The FMP manual describes the processes used for identifying fatigue hazards, assessing the associated risks, and developing, implementing, and monitoring controls and mitigations.

Under this policy:

Management is responsible for:

- Providing adequate resources for the FMP;
- Providing adequate staffing levels to minimize fatigue risk;
- Providing drivers with adequate opportunities for recovery sleep between duties;
- Creating an environment that promotes open and honest reporting of fatigue-related hazards and incidents;
- Providing fatigue management training to drivers, dispatch, and other FMP support staff;
- Demonstrating active involvement in and understanding of the FMP;
- Ensuring that the fatigue risks within their area(s) of responsibility are management appropriately;
- Regularly consulting with drivers regarding the effectiveness of the FMP; and
- Demonstrating continuous improvement and providing an annual review of the FMP.

Drivers are responsible for:

- Making appropriate use of rest periods (between shifts and periods of duty) to obtain sleep;
- Participating in fatigue management training and education;
- Reporting fatigue-related hazards and incidents as described in the FMP manual;
- Complying with the FMP Policy;
- Informing their manager or supervisor immediately prior to or during work if;
    - They know or suspect they or another driver are suffering from unacceptable levels of fatigue; or
    - They have any doubt about their or another driver's capability to accomplish their duties.

Fatigue Management must be considered a core value of our business as it provides a significant opportunity to improve the safety and efficiency of our operation and to maximize the well being of our staff.

Policy authorized by:

(Signed)_____
[Insert title of accountable Executive]

Date:_____

FMP Policy Example 2 (adapted from RTA[110])

[Insert Company Name] Fatigue Management Program Policy

The purpose of this policy is to establish the requirements for managing driver fatigue in [Insert Company Name]. It is intended that this policy will reduce the risk of fatigue-related injuries and incidents in the workplace.

Scope and coverage
This policy applies to all employees, especially those whose work involves shift work, extended hours, and on-call arrangement.

Policy statement
[Insert Company Name] is committed to providing and maintaining safe systems of work for all its employees, including those drivers whose work involves shift work, extended hours, or on-call arrangements.

Fatigue is a mental or physical exhaustion that prevents a person from functioning normally and can impair safe work performance.

Fatigue can be caused by both work and non-work related factors. Non-work related factors include family responsibilities, social activities, health issues (such as sleep disorders), study commitments, and sporting commitments. Work factors include shift work, especially night shifts, working unusual shifts, and working extended hours.

While not all people respond to fatigue in the same way, fatigue can cause reduced concentration, impaired coordination, compromised judgment, and slower reaction times; ultimately increasing the risk of incidents and injuries.

Responsibilities
Managers and drivers have a responsibility to ensure that fatigue does not impact the safety, health, and well-being of themselves and others.

Under this policy:

Management is responsible for:

- Applying risk management in consultation with staff, especially in consultation with drivers;
- Ensuring systems of work that minimize the risk of fatigue, for example: reasonable rosters, reasonable overtime practices, and adequate opportunities for recuperation between shifts;
- Providing opportunities for drivers to obtain adequate rest from work;
- Monitoring workloads, work patterns, dispatch practices, and roster arrangements to ensure drivers are not placed at risk from fatigue;

- Consulting with drivers when introducing shift work or new roster systems; and
- Providing information, instruction, and training about fatigue risks to health, safety, and well-being of drivers.

Drivers are responsible for:

- Participating in risk management processes;
- Using time off from work to recuperate in order to be fit and able for the next shift;
- Participating in education and training in order to gain an understanding of fatigue;
- Avoiding behaviors and practices that contribute to the development of fatigue, and which could place themselves and others at risk; and
- Recognizing signs of fatigue that could place health, safety, and well-being of themselves and others at risk and reporting this to their manager or supervisor.

Policy authorized by:

(Signed)_____
[Insert title of accountable Executive]

Date:_____

APPENDIX D: NAFMP Informational Posters

Be alert!

The Fatigue Management Program (FMP) gives you the education and training you need to stay alert and combat fatigue. Sleep disorder education can help you diagnose problems that may lead to fatigue. Scheduling tools, fatigue monitoring, and management technologies can help control the symptoms of fatigue and teach you how to recognize a situation where you are fatigued before it becomes dangerous.

With the Fatigue Management Program, our goal is for you to be alert behind the wheel at all times.

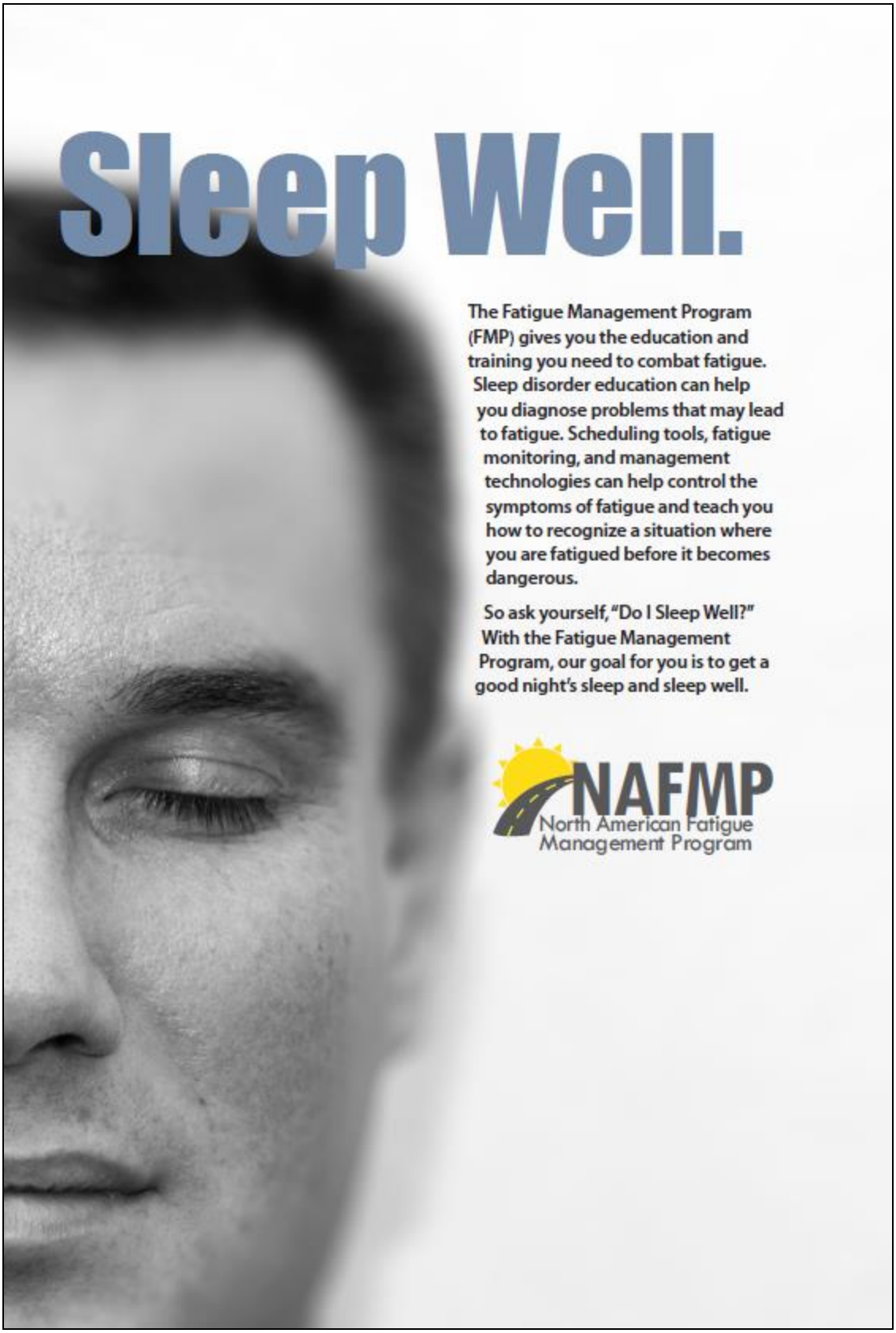
NAFMP
North American Fatigue Management Program

Keep your eyes open

The Fatigue Management Program (FMP) gives you the education and training you need to stay focused and combat fatigue. Sleep disorder education can help you diagnose problems that may lead to fatigue. Scheduling tools, fatigue monitoring, and management technologies can help control the symptoms of fatigue and teach you how to recognize a situation where you are fatigued before it becomes dangerous.

With the Fatigue Management Program, our goal is for you to keep your eyes open and on the road at all times.

NAFMP
North American Fatigue Management Program


Sleep Well.
The Fatigue Management Program (FMP) gives you the education and training you need to combat fatigue. Sleep disorder education can help you diagnose problems that may lead to fatigue. Scheduling tools, fatigue monitoring, and management technologies can help control the symptoms of fatigue and teach you how to recognize a situation where you are fatigued before it becomes dangerous.
So ask yourself, "Do I Sleep Well?" With the Fatigue Management Program, our goal for you is to get a good night's sleep and sleep well.
NAFMP
North American Fatigue Management Program

Stay Awake!

The Fatigue Management Program (FMP) gives you the education and training you need to combat fatigue. Sleep disorder education can help you diagnose problems that may lead to fatigue. Scheduling tools, fatigue monitoring, and management technologies can help control the symptoms of fatigue and teach you how to recognize a situation where you are fatigued before it becomes dangerous.

With the Fatigue Management Program, our goal for you is to control fatigue and stay awake.

NAFMP
North American Fatigue Management Program

APPENDIX E: Fatigue Self-Report Form (adapted from ICAO, 2011[9])

Is confidentiality required? ☐ **Yes** ☐ **No**

Name: Employee No:

When did fatigue occur?

Trip description: _____

Section of trip when fatigue occurred: From: _____ To: _____
Hours from start of drive when fatigue occurred: _____
Hours from last rest opportunity when fatigue occurred: _____

Team driving? ☐ **Yes** ☐ **No**

What happened?

Describe how you felt.

_____

_____

Please circle how you felt:

1. Fully alert, wide awake
2. Alert, but not at peak
3. OK, somewhat fresh
4. A little tired, less than fresh
5. Moderately tired
6. Extremely tired, very difficult to concentrate
7. Completely exhausted

Please mark the line below with an "X" at the point that indicates how you felt:

Alert _____ Drowsy

Why did it happen?

Were you experiencing fatigue prior to duty? ☐ **Yes** ☐ **No**
How long had you been awake when you became fatigued? _____
How much sleep did you have in the 24 hours before you became fatigued? _____
How much sleep did you have in the 72 hours before you became fatigued? _____

Stressful drive? ☐ **Yes** ☐ **No**
Drive start time: _____
Previous drive stop time: _____
Other comments: _____

_____

What did you do (Actions taken to reduce or manage fatigue)?

_____

_____

What could be done (Suggested corrective actions)?

_____

_____

APPENDIX F: Driver Questionnaire (adapted from Moscovitch et al., 2006[3])

Fatigue Management Program
[Insert Company Name]

Driver Questionnaire

The Fatigue Management Program (FMP) represents a proactive preventative effort to address fatigue management in the commercial motor carrier industry.

However, the success of this project rests on the participation of the commercial drivers that take part. Please take the time to fill out all forms with care and ensure that all tasks are performed as the instructions dictate.

Your cooperation is greatly appreciated and we thank you for your time and effort.

Thank you for your assistance in completing this questionnaire. Your valuable feedback will help us in determining the overall effectiveness of the Fatigue Management Program (FMP) from a driver's perspective.

Please read and answer each question carefully. Your time and cooperation in filling out this survey is greatly appreciated.

General Information Section

1. Age: _____ 2. Gender: □ Male □ Female

3. Height: _____ (□ CM / □ inches) 4. Weight: _____ (□ lbs / □ kg)

5. a. How many years have you been a commercial driver? _____ (years)

   b. How many years have you been driving for this company? _____ (years)

6. Type of route schedule: □ Variable □ Fixed

7. In general, are you working the same hours day-to-day or do they change?

   □ Same hours □ Hours change

8. How many years have you been doing this type of schedule? _____ (years)

9. What percentage of your driving is done between midnight and 6:00am?

   □ Less than 25% □ 25 – 49% □ 50 – 74% □ 75 – 100%

10. Primary type of operation you currently perform (check all that apply).

    □ Bus □ Tanker □ Reefer □ Dry Van □ Flatbed
    □ Hazardous Materials □ Load/Unload □ Other (specify): _____

11. How far did you continue with formal education?

    □ Some high school □ Grade 12 diploma □ Some college
    □ University degree □ Technical school □ Other (specify): _____

Medical Information Section

1. Do you take any prescription or non-prescription medication on a regular basis?

   □ No □ Yes → If yes, please fill in the table below.

Type of Medication	Medical Condition

2. Do you have any other medical problems on an ongoing basis?
   (i.e., high blood pressure, epilepsy, diabetes)

   □ No □ Yes → If yes, please describe below.

   _____
   _____

3. Do you routinely take on the road with you any prescription or non-prescription medications (i.e., caffeine pills, sleeping pills, aspirin, natural alternatives/herbal remedies)?

   □ No □ Yes → If yes, please list what type(s):

   _____
   _____

4. a. Do you currently smoke cigarettes? □ Yes □ No

   b. If yes, how many cigarettes do you smoke on average per day? _____

   c. If no, have you ever smoked? □ Yes □ No

   d. If yes, how long ago did you quit? _____ (years)

5. How many cups of caffeinated coffee, tea, or cola do you driver on average ***per day***?

   □ 0 – 1 □ 2 – 3 □ 4 – 5 □ More than 5

6. How often do you drink alcohol?

   □ Daily □ Several times a week □ Weekly □Rarely □ Never

Scheduling and Sleep Section

1. On average, how many ***hours of work*** do you do each week?

   □ Less than 30 □ 30-39 □ 40-49 □ 50-59 □ 60-69 □ 70 or more

2. On average, how many ***hours of driving*** do you do each week?

   □ Less than 30 □ 30-39 □ 40-49 □ 50-59 □ 60-69 □ 70 or more

3. What hours are you ***commonly*** working (Please use the 24 hour clock)?

   (i) From: _____ To: _____ (ii) From: _____ To: _____ (iii) From: _____ To: _____

4. Given your most common schedule, what time do you consider the ***beginning*** of the day (Please use the 24 hour clock)?

   _____

5. a. How frequently do you participate in loading and unloading?

   □ Never □ Few trips □ Some trips □ Most trips □ Every trip

   b. If you do help load, how long on average does it take? _____ (minutes)

6. In a typical 24-hour period, how many sleep periods (of greater than 1.5 hours) do you take while on a trip?

   □ None □ 1 sleep period □ 2 sleep periods □ 3 or more sleep periods

7. a. When do you like taking your main sleep period?

   Before a duty period

   As soon as I get home

   b. Why do you prefer sleeping at this time? _____

8. Where do you spend your main sleep period?

   □At home □ Motel □ Sleeper berth □ Other (specify): _____

9. a. In a typical 24-hour period how many naps do you take? _____

   b. On average, how long do you nap for? _____ (minutes)

10. How would you rate your sleep in a berth compared to that at home?

Worse			Same			Much Better
☐	☐	☐	☐	☐	☐	☐

11. How much sleep do you feel you get?

Too Little			Just Right			Too Much
☐	☐	☐	☐	☐	☐	☐

12. Do you find daytime sleeping as restful as nighttime sleeping?

Much Less			Same			Much More
☐	☐	☐	☐	☐	☐	☐

13. Have you found it more difficult to cope with driving schedules as you have grown older?

Much Less			Same			Much More
☐	☐	☐	☐	☐	☐	☐

14. One hears about "morning" and "evening" types of people. Which of these types do you consider yourself to be?

More Morning			Neutral			More Evening
☐	☐	☐	☐	☐	☐	☐

15. When you are slowed down by driving conditions, how often do you get less sleep in order to keep up with your delivery schedule?

Never			Sometimes			Always
☐	☐	☐	☐	☐	☐	☐

16. When you are required to do physical tasks related to your driving, such as loading, unloading, or putting on tire chains, how does this affect your alertness on the road? Are you:

Less Alert			No Change			Alert Longer
☐	☐	☐	☐	☐	☐	☐

17. How do long waits (due to road closures or loads not ready) affect your alertness on the road? Are you:

Less Alert			No Change			Alert Longer
☐	☐	☐	☐	☐	☐	☐

18. To what extent does your scheduling allow for unexpected events (e.g., poor weather, mechanical problems)?

No Time Allowed	Never Enough Time	Usually not Enough Time	Sometimes not Enough Time	Enough Time
☐	☐	☐	☐	☐

19. To what extent does your scheduling allow time for rest and meal breaks?

No Time Allowed	Never Enough Time	Usually not Enough Time	Sometimes not Enough Time	Enough Time
☐	☐	☐	☐	☐

20. How much involvement do you have in determining your schedule?

No Involvement	Some Involvement	A lot of Involvement
☐	☐	☐

21. How often do you exceed the speed limit to meet a deadline?

Never	Few Trips	Some Trips	Most Trips	Every Trip
☐	☐	☐	☐	☐

22. How often does your schedule differ from company policy?

No Time Allowed	Never Enough Time	Usually not Enough Time	Sometimes not Enough Time	Enough Time
☐	☐	☐	☐	☐

23. a. In normal situations, how many hours do you like to driver before stopping for a break? _____ (hours)

b. In normal situations, how long is your usual stop? _____ (hours)

Sleep and Well-Being Information Section

How often do you?

	Never		Sometimes		Always
1. Feel fit and healthy	□	□	□	□	□
2. Fall asleep easily	□	□	□	□	□
3. Wake up easily	□	□	□	□	□
4. Sleep well through the night	□	□	□	□	□
5. Feel moody or grumpy	□	□	□	□	□
6. Feel tired and drained of energy	□	□	□	□	□
7. Feel short of breath	□	□	□	□	□
8. Suffer from constipation or diarrhea	□	□	□	□	□
9. Feel your heart racing or skipping	□	□	□	□	□
10. Have headaches	□	□	□	□	□
11. Momentarily freeze on the job when you are extremely tired	□	□	□	□	□
12. Find your appetite disturbed	□	□	□	□	□
13. Suffer from heartburn, indigestion, stomach ache	□	□	□	□	□
14. Feel nauseous	□	□	□	□	□
15. Feel dizzy	□	□	□	□	□

16. Feel dissatisfied with your sex life	□	□	□	□	□
17. Engage in regular physical activity	□	□	□	□	□
18. Experience lapses in your attention	□	□	□	□	□
19. Eat 3 nutritious meals a day	□	□	□	□	□

I am satisfied with…

	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
20. The kind of work I do (commercial driving)	□	□	□	□	□
21. The job as a whole	□	□	□	□	□
22. The shift cycle I drive (i.e., days-on, days-off)	□	□	□	□	□
23. The schedule I drive (i.e., daily time of work)	□	□	□	□	□

Coping with Shiftwork Section

People use different methods to cope with fatigue and commercial driving. Which of the following methods do you use?

To help cope with fatigue I…

	Never		**Sometimes**		**Always**
1. Try to get an adequate amount of sleep daily	□	□	□	□	□
2. Nap to catch up on sleep at home	□	□	□	□	□
3. Nap on breaks	□	□	□	□	□

	Never		Sometimes		Always
4. Take a short walk to get some fresh air	□	□	□	□	□
5. Drink water at work when I am tired	□	□	□	□	□
6. Drink coffee, tea, or cola to perk me up	□	□	□	□	□
7. Have a smoke when I feel tired	□	□	□	□	□
8. Exercise regularly	□	□	□	□	□
9. Avoid alcohol	□	□	□	□	□
10. Eat nutritiously	□	□	□	□	□
11. Take vitamins, health supplements, etc.	□	□	□	□	□

	Never		Sometimes		Always
12. Read in bed to fall asleep	□	□	□	□	□
13. Keep my bedroom very dark while I sleep	□	□	□	□	□
14. Tale a hot shower or bath	□	□	□	□	□
15. Tell my spouse (and/or family) to keep quite while I sleep	□	□	□	□	□
16. Drink alcoholic beverages to fall asleep	□	□	□	□	□
17. Perform relaxation exercises or yoga	□	□	□	□	□
18. Engage in sexual activity	□	□	□	□	□
19. Try to avoid working overtime	□	□	□	□	□
20. Have a smoke to relax	□	□	□	□	□
21. Watch TV to relax	□	□	□	□	□
22. Take some time to just be alone	□	□	□	□	□
23. Plan my time carefully	□	□	□	□	□
24. Spend time with my spouse and/or family	□	□	□	□	□

Fatigue and Alertness Section

	Very Low	Low	Average	High	Very High
1. How *physically* demanding is your work?	□	□	□	□	□
2. How *mentally* demanding is your work?	□	□	□	□	□
3. How *stressful* is your work?	□	□	□	□	□
4. How *boring* is your work?	□	□	□	□	□
5. How *fatiguing* is your work?	□	□	□	□	□

	5 or Less Hours	5 Hours	6 Hours	7 Hours	8 or More Hours
6. How many hours of sleep per day do you feel you *need* to feel alert and well rested?	□	□	□	□	□
7. How many hours of sleep per day on average are you *actually getting* on days that you work?	□	□	□	□	□
8. How many hours of sleep on average are you actually getting on your *days off*?	□	□	□	□	□

9. In the last 3 months, on how many trips do you notice each of the following while driving?

	Never	Few Trips	Some Trips	Most Trips	Every Trip
a) Sore eyes	☐	☐	☐	☐	☐
b) Lossess of concentration	☐	☐	☐	☐	☐
c) Stiffness, cramps, or feeling uncomfortable	☐	☐	☐	☐	☐
d) Yawning	☐	☐	☐	☐	☐
e) Unintentional changes in speed	☐	☐	☐	☐	☐
f) Delayed or poor gear changing	☐	☐	☐	☐	☐
g) Delays in breaking	☐	☐	☐	☐	☐
h) Steering over marked lines	☐	☐	☐	☐	☐
i) Poor overtaking decisions	☐	☐	☐	☐	☐
j) Headaches	☐	☐	☐	☐	☐

	Never	Seldom	Sometimes	Frequently	Almost Always
10. How frequently do you use *stimulants* (caffeine, nicotine, etc.) to help yourself stay awake and mentally alert?	☐	☐	☐	☐	☐
11. How frequently do you use *sleeping pills* to help yourself fall asleep?	☐	☐	☐	☐	☐
12. How frequently do you use *alcoholic beverages* to help yourself fall asleep?	☐	☐	☐	☐	☐

	Never	Seldom	Sometimes	Frequently	Almost Always
13. Do you generally have trouble falling asleep?	☐	☐	☐	☐	☐
14. Are you a sound sleeper (once you fall asleep, you generally stay in deep sleep until it's time to get up)?	☐	☐	☐	☐	☐
15. How often would you start a trip already tired?	☐	☐	☐	☐	☐
16. How often are you fatigued to the point that you drift into sleep while working?	☐	☐	☐	☐	☐
17. How often has fatigue caused you to be absent from work in the past year?	☐	☐	☐	☐	☐
18. Do you feel your current schedule is making your overly tired or fatigued?	☐	☐	☐	☐	☐
19. If yes, does this fatigue make you frequently feel drowsy while working?	☐	☐	☐	☐	☐

	No Control	Little Control	Some Control	A lot of Control	Total Control
20. How much control do you have over when and where you stop for a rest?	☐	☐	☐	☐	☐

	Never	Several Times a Year	Several Times per Month	Several Times per Week	Once of More per Shift
21. How often do you feel so tired that your driving is impaired?	☐	☐	☐	☐	☐
22. How often do you feel *physically* fatigued to the point where you are not physically or mentally effective while working?	☐	☐	☐	☐	☐

	Never	Several Times a Year	Several Times per Month	Several Times per Week	Once of More per Shift
23. How often do you become irritable while working?	☐	☐	☐	☐	☐
24. How often do you feel bored while driving?	☐	☐	☐	☐	☐
25. How often do you make mistakes or mental errors while working?	☐	☐	☐	☐	☐

	Never	Seldom	Don't Know	Often	Almost Always
26. Do you awaken frequently during sleep?	☐	☐	☐	☐	☐
27. Do you feel tired when you wake up?	☐	☐	☐	☐	☐

	None	One or Two	Three or Four	Five or Six	Seven or More
28. How many times in the past year have you briefly nodded off or fallen asleep while driving to or from work?	□	□	□	□	□
29. How many motor vehicle crashes or near-crashes did you have in the past year?	□	□	□	□	□

	1-17	18-20	21-23	24-26	27 or More
30. During the last two weeks that you worked, what was the longest number of hours you went without sleep?	□	□	□	□	□

	Does not Apply	No Problem	Slight Problem	Moderate Problem	Major Problem
31. How much of a problem is being “too tired” to do anything with your family?	□	□	□	□	□

	Almost Never	Quite Seldom	Don't Know	Quite Often	Almost Always
32. How often is your appetite disturbed?	□	□	□	□	□

33. a. Would you tell your supervisor if you were worried about being too tired to ***start*** driving?

Yes Maybe No

b. If you answered "no" or "maybe", please explain:

_____

_____

34. Would you tell your supervisor if you were worried about being too tired to ***continue*** driving?

Yes Maybe No

b. If you answered "no" or "maybe", please explain:

_____

_____

Family, Partners, and Friends Section

1. Living status:

□ Living Alone □ Shared Accommodation

□ Living with Partner □Living with Family

	Yes	No	N/A
2. Do you have any children in the household?	□	□	□
3. If yes, are any children 6 years old or younger?	□	□	□
4. Do you feel that fatigue due to your work schedule or your schedule in general, has affected your family life?	□	□	□
5. Do you feel the need to sacrifice some sleep time in order to spend more time with your family or friends?	□	□	□

Quality of Life Section

Please answer every question. Some questions look like others, but each one is different. Please take the time to read and answer each question carefully by marking the box that best represents your response

	Excellent	Very Good	Good	Fair	Poor
1. In general, would you say your health is:	□	□	□	□	□

2. The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

	Yes, Limited A lot	Yes, Limited a Little	No, Not Limited at All
a. **Moderate activities,** such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	□	□	□
b. Climbing **several** flights of stairs	□	□	□

3. During the **past 4 weeks**, have you had any of the following problems with your work or regular daily activities as a result of your physical health?

	Yes	No
a. **Moderate activities,** such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	□	□
b. Climbing **several** flights of stairs	□	□

4. During the **past 4 week**, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	Yes	No
a. **Accomplished less** than you would like	□	□
b. Didn't do work or other activities as **carefully** as usual	□	□

	Not at all	A little bit	Moderately	Quite a bit	Extremely

5. During the **past 4 weeks**, how much did <u>pain</u> interfere with your normal work (including both work outside the home and housework)?	□	□	□	□	□

6. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the **past 4 weeks…**

	All the time	**Most of the time**	**A good bit of the time**	**Some of the time**	**A little of the time**	**None of the time**
a. Have felt calm and peaceful	□	□	□	□	□	□
b. Did you have a lot of energy	□	□	□	□	□	□
c. Have you felt downhearted and blue	□	□	□	□	□	□

	All the time	**Most of the Time**	**Some of the Time**	**A little of the Time**	**None of the Time**
7. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting your friends, relatives, etc.)?	□	□	□	□	□

Satisfaction Section

	None		Some		A lot
1. How would you rate your current level of knowledge on fatigue and fatigue management?	□	□	□	□	□

	Not at all		Somewhat		A lot
2. Generally, how much do you think ***drivers*** could benefit from a fatigue management program?	□	□	□	□	□
3. Specifically, how much could ***you*** benefit from participation in a fatigue management program?	□	□	□	□	□
4. How much do you think ***your family*** could benefit from information on fatigue and living with a shift worker countermeasures?	□	□	□	□	□

	None		Some		A lot
5. Rate your typical level of fatigue:	□	□	□	□	□

	Very Poor				Very Effectively
6. How effectively do you deal with fatigue?	□	□	□	□	□

7. What are your most effective ways of dealing with fatigue?

_____

_____

_____

This is the end of the Driver Questionnaire. Thank you for taking the time to complete this questionnaire on your current experiences of fatigue.

APPENDIX G: En-Route Driver Questionnaires (adapted from Moscovitch et al., 2006[3])

Fatigue Management Program

[Insert Company Name]

En-Route Driver Fatigue Questionnaires

BEGINNING OF SHIFT – Please enter the current date and time: _____

At this time you will need to do the following short tasks in order:

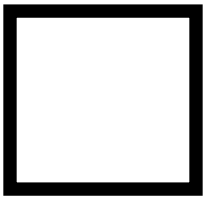
1. En-Route Driver Rating
2. Current Mood Assessment

En-Route Driver Rating

Please read the following seven statements. In the box, write the number that best describes how you feel right now.

1. **Feeling active and vital, alert, wide-awake**
2. **Functioning at a high level, but not at peak**
3. **Relaxed, not at full alertness, responsive**
4. **A little foggy, not at peak, let down**
5. **Fogginess, losing interest in staying awake, slowed down**
6. **Sleepiness, prefer to be lying down**
7. **Almost in reverie, sleep onset soon, hard to stay awake**

How I feel right now:



Please describe how you have been feeling by rating the following signs and symptoms.

	Not at all	A little	Somewhat	Quite a bit	Extremely
General discomfort	☐	☐	☐	☐	☐
Stomach disturbances	☐	☐	☐	☐	☐
Headache	☐	☐	☐	☐	☐
Yawning	☐	☐	☐	☐	☐
Dizziness	☐	☐	☐	☐	☐
Drowsy	☐	☐	☐	☐	☐
Physical fatigue	☐	☐	☐	☐	☐
Mental fatigue	☐	☐	☐	☐	☐
Feelings of indifference	☐	☐	☐	☐	☐
Tension/Anxiety	☐	☐	☐	☐	☐

Current Mood Assessment

Please indicate on the scale below how you feel ***right now*** on the following items:

	Low			**Medium**			**High**
Overall alertness level	□	□	□	□	□	□	□
Overall happiness level	□	□	□	□	□	□	□
Overall level of calmness	□	□	□	□	□	□	□
Overall irritability	□	□	□	□	□	□	□
Current confidence level in abilities	□	□	□	□	□	□	□
Desire to interact with people	□	□	□	□	□	□	□

Before the end of your shift you will have some other things to complete, but for now you have completed the necessary tasks for the beginning of your shift.

MIDDLE OF SHIFT – Please enter the current date and time: _____

At this time you should be at least four (4) hours into your shift and should still have a significant portion of your daily work to complete. Answer the following:

En-Route Driver Rating

Please read the following seven statements. In the box, write the number that best describes how you feel right now.

1. **Feeling active and vital, alert, wide-awake**
2. **Functioning at a high level, but not at peak**
3. **Relaxed, not at full alertness, responsive**
4. **A little foggy, not at peak, let down**
5. **Fogginess, losing interest in staying awake, slowed down**
6. **Sleepiness, prefer to be lying down**
7. **Almost in reverie, sleep onset soon, hard to stay awake**

How I feel right now: ☐

Please describe how you have been feeling by rating the following signs and symptoms.

	Not at all	A little	Somewhat	Quite a bit	Extremely
General discomfort	☐	☐	☐	☐	☐
Stomach disturbances	☐	☐	☐	☐	☐
Headache	☐	☐	☐	☐	☐
Yawning	☐	☐	☐	☐	☐
Dizziness	☐	☐	☐	☐	☐
Drowsy	☐	☐	☐	☐	☐
Physical fatigue	☐	☐	☐	☐	☐
Mental fatigue	☐	☐	☐	☐	☐
Feelings of indifference	☐	☐	☐	☐	☐
Tension/Anxiety	☐	☐	☐	☐	☐

Before the end of you shift you will have some other things to complete, but for now you have completed the necessary tasks for the beginning and middle of your shift.

END OF SHIFT – Please enter the current date and time: _____

At this time you should have completed your shift and should not have any other significant work to complete. You will need to do the following short tasks in order:

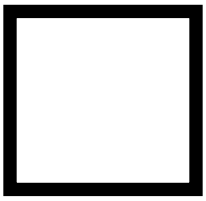
1. En-Route Driver Rating
2. Current Mood Assessment
3. Workload Assessment
4. Fatigue and Alertness Rating
5. Factors Contributing to Your Fatigue

En-Route Driver Rating

Please read the following seven statements. In the box, write the number that best describes how you feel right now.

8. **Feeling active and vital, alert, wide-awake**
9. **Functioning at a high level, but not at peak**
10. **Relaxed, not at full alertness, responsive**
11. **A little foggy, not at peak, let down**
12. **Fogginess, losing interest in staying awake, slowed down**
13. **Sleepiness, prefer to be lying down**
14. **Almost in reverie, sleep onset soon, hard to stay awake**

How I feel right now:



Please describe how you have been feeling by rating the following signs and symptoms.

	Not at all	A little	Somewhat	Quite a bit	Extremely
General discomfort	□	□	□	□	□
Stomach disturbances	□	□	□	□	□
Headache	□	□	□	□	□
Yawning	□	□	□	□	□
Dizziness	□	□	□	□	□
Drowsy	□	□	□	□	□
Physical fatigue	□	□	□	□	□

Mental fatigue	□	□	□	□	□
Feelings of indifference	□	□	□	□	□
Tension/Anxiety	□	□	□	□	□

Current Mood Assessment

Please indicate on the scale below how you feel ***right now*** on the following items:

	Low			**Medium**			**High**
Overall alertness level	□	□	□	□	□	□	□
Overall happiness level	□	□	□	□	□	□	□
Overall level of calmness	□	□	□	□	□	□	□
Overall irritability	□	□	□	□	□	□	□
Current confidence level in abilities	□	□	□	□	□	□	□
Desire to interact with people	□	□	□	□	□	□	□

Workload Assessment

Workload has to do with the specific requirements and the level of effort needed to perform your job. Workload is affected by the job itself, your physical and mental state, and the surrounding environment. This can be divided into a number of components, as indicated below.

For each of the following, mark the box that most appropriately describes the workload ***you experienced*** on the job today.

	Low			**Medium**			**High**
Mental demand	□	□	□	□	□	□	□
Visual demand	□	□	□	□	□	□	□
Physical demand	□	□	□	□	□	□	□
Temporal demand	□	□	□	□	□	□	□
Performance	□	□	□	□	□	□	□
Effort	□	□	□	□	□	□	□
Frustration level	□	□	□	□	□	□	□
Overall workload level	□	□	□	□	□	□	□

Fatigue and Alertness

	Very Low	Low	Average	High	Very High
How *physically* demanding is you work?	□	□	□	□	□
How *mentally* demanding is your work?	□	□	□	□	□
How *stressful* is your work?	□	□	□	□	□
How *boring* is your work?	□	□	□	□	□
How *fatiguing* is your work?	□	□	□	□	□

Factors Contributing to Your Fatigue

Please rate how the following factors contributed to your fatigue ***today***.

	Major Effect	Minor Effect	No Effect	N/A
Having to load and unload	□	□	□	□
Rest breaks too short	□	□	□	□
Not getting enough sleep	□	□	□	□
Lack of rest areas	□	□	□	□
Poor road conditions	□	□	□	□
Heavy traffic	□	□	□	□
Bad weather	□	□	□	□
Poor diet and irregular eating	□	□	□	□
Split shift with long break (over 3 hours)	□	□	□	□
Difficult customers/passengers	□	□	□	□

Please use the space below for any comments that you might have from your shift today.

Comments:

_____

_____

_____

All survey tasks for today should be complete now that your shift is over.

Thank you for providing you fatigue-related information today!

APPENDIX H: Checklist to Establish the Fatigued State (adapted from ICAO, 2011[9])

QUESTIONS	BEST CASE SCENARIOS	INVESTIGATOR'S NOTES
QUANTITY OF SLEEP ***(Establish whether or not there was a sleep debt)***		
How long was last consolidated sleep period?	7.5 to 8.5 hours	
Sleep start time?	Normal circadian rhythm, late evening	
Awake time?	Normal circadian rhythm, early morning	
Was your sleep interrupted (for how long)?	No	
Any naps since your last consolidated sleep?	Yes	
Duration of naps	Opportunity for restorative sleep (1.5-2 hours) or strategic (20 min) nap prior to start of late shift	
Describe your sleep patterns in the last 72 hours (Apply sleep credit).	2 credits for each hour of sleep; loss of one credit for each hour awake – should be a positive value	
QUALITY OF SLEEP ***(Establish whether or not sleep was restorative)***		
How did the sleep period relate to the individual normal sleep cycle (i.e., start/finish time)?	Normal circadian rhythm, late evening/early morning	
Sleep disruptions?	No awakenings	
Sleep environment?	Proper environmental conditions (quite, comfortable, temperature, fresh air, own bed, dark room)	
Sleep pathologies (disorders)	None	

WORK HISTORY *(Establish whether hours worked and type of duty or activities involved had an impact on sleep quantity and quality)*		
Hours on duty and/or on call prior to the occurrence?	Situation dependent – hours on duty and/or on call and type of duty that ensure appropriate level of alertness for the task	
Work history in preceding week?	Number of hours on duty/on call and type of duty that do not lead to a cumulative fatigue	
Irregular Schedules ***(Establish whether the scheduling was problematic with regards to its impact on quantity and quality of sleep)***		
Was driver a shift worker (working through usual sleep times)?	No (The circadian body clock and sleep of shift workers do not adapt fully)	
If yes, was it a permanent shift?	Yes – days	
If no, was it rotating (vs. regular) shift work?	Yes – rotating clockwise, rotation slow (1 day for each hour delayed), night shift shorter, and at the end of cycle	
How are overtime or double shifts scheduled?	Scheduled when drivers are in the most alert parts of the circadian body clock cycle (late morning, mid evening)	
Scheduling of critical safety tasks?	Scheduled when drivers are in the most alert parts of the circadian body clock cycle (late morning, mid evening)	
Has driver had training on personal fatigue management strategies?	Yes	

APPENDIX I: Establishing the Link between Fatigue and the Unsafe Act(s)/Decisions(s) (adapted from ICAO, 2011[9])

PERFORMANCE INDICATORS	INVESTIGATOR'S NOTES
Attention	
Overlooked sequential task element	
Incorrectly ordered sequential task element	
Preoccupied with single tasks or elements	
Exhibited lack of awareness of poor performance	
Reverted to old habits	
Focused on a minor problem despite risk of a major one	
Did not appreciate gravity of situation	
Did not anticipate danger	
Displayed decreased vigilance	
Did not observe warning signs	
Memory	
Forgot a task or elements of a task	
Forgot the sequence of task or task elements	
Inaccurately recalled operational events	
Alertness	
Succumbed to uncontrollable sleep in form of microsleep, nap, or long sleep episode	
Displayed automatic behavior syndrome	
Reaction Time	
Respond slowly to normal, abnormal, or emergency stimuli	
Failed to respond altogether to normal, abnormal, or emergency stimuli	
Problem-Solving Ability	
Displayed flawed logic	

Displayed problems with arithmetic, geometric, or other cognitive processing tasks	
Applied inappropriate corrective action	
Did not accurately interpret situation	
Displayed poor judgment of distance, speed, and/or time	
Mood	
Was less conversant than normal	
Did not perform low-demand tasks	
Was irritable	
Distracted by discomfort	
Attitude	
Displayed a willingness to take risks	
Ignored normal checks or procedures	
Displayed a “don’t care” attitude	
Physiological Effects	
Exhibited speech effects	
Exhibited reduced manual dexterity	

APPENDIX J: Epworth Sleepiness Scale (*ESS* © MW Johns 1990-1997. Used under license; Johns, MW, 1991[48].)

Epworth Sleepiness Scale

Name: _____ Today's date: _____

Your age (Yrs): _____ Your sex (Male = M, Female = F): _____

How likely are you to doze off or fall asleep in the following situations, in contrast to just feeling tired?

This refers to your usual way of life recently.

Even if you haven't done some of these things recently, try to figure out how they would have affected you.

Use the following scale to choose the **most appropriate number** for each situation:

0 = **no chance** of dozing
1 = **slight chance** of dozing
2 = **moderate chance** of dozing
3 = **high chance** of dozing

It is important that you answer each item as best as you can.

Situation	**Chance of Dozing (0-3)**
Sitting and reading	___
Watching TV	___
Sitting inactive in a public place (e.g., a theater or a meeting)	___
As a passenger in a car for an hour without a break	___
Lying down to rest in the afternoon when circumstances permit	___
Sitting and talking to someone	___
Sitting quietly after a lunch without alcohol	___
In a car, while stopped for a few minutes in traffic	___

THANK YOU FOR YOUR COOPERATION

ESS contact information and permission to use: MAPI Research Trust, Lyon, France. E-mail: PROinformation@mapi-trust.org – Internet: www.mapi-trust.org

APPENDIX K: Functional Outcomes of Sleep Questionnaire

Site: _____ ID #: _____
Date of Data Entry: _____ Trial _____
Name: _____ **Date:** _____

FUNCTIONAL OUTCOMES OF SLEEP QUESTIONNAIRE (FOSQ)

Some people have difficulty performing everyday activities when they feel tired or sleepy. The purpose of this questionnaire is to find out if you generally have difficulty carrying out certain activities because you are too sleepy or tired. In this questionnaire, when the words "sleepy" or "tired" are used, it means the feeling that you can't keep your eyes open, your head is droopy, that you want to "nod off", or that you feel the urge to take a nap. These words do not refer to the tired or fatigued feeling you may have after you have exercised.

DIRECTIONS: Please put a (_) in the box for your answer to each question. Select only **one** answer for each question. Please try to be as accurate as possible. All information will be kept confidential.

	(0) I don't do this activity for other reasons	(4) No difficulty	(3) Yes, a little difficulty	(2) Yes, moderate difficulty	(1) Yes, extreme difficulty
1. Do you have difficulty concentrating on the things you do because you are sleepy or tired?		❒	❒	❒	❒
2. Do you generally have difficulty remembering things, because you are sleepy or tired?		❒	❒	❒	❒
3. Do you have difficulty finishing a meal because you become sleepy or tired?		❒	❒	❒	❒
4. Do you have difficulty working on a hobby (for example, sewing, collecting, gardening) because you are sleepy or tired?	❒	❒	❒	❒	❒

Site: _____ ID #: _____
Date of Data Entry: _____ Trial _____
Name: _____ **Date:** _____

	(0) I don't do this activity for other reasons	(4) No difficulty	(3) Yes, a little difficulty	(2) Yes, moderate difficulty	(1) Yes, extreme difficulty
5.Do you have difficulty doing work around the house (for example, cleaning house, doing laundry, taking out the trash, repair work) because you are sleepy or tired?	❒	❒	❒	❒	❒
6.Do you have difficulty operating a motor vehicle for short distances (less than 100 miles) because you become sleepy or tired?	❒	❒	❒	❒	❒
7.Do you have difficulty operating a motor vehicle for long distances (greater than 100 miles) because you become sleepy or tired?	❒	❒	❒	❒	❒
8.Do you have difficulty getting things done because you are too sleepy or tired to drive or take public transportation?	❒	❒	❒	❒	❒
9.Do you have difficulty taking care of financial affairs and doing paperwork (for example, writing checks, paying bills, keeping financial records, filling out tax forms, etc.) because you are sleepy or tired?	❒	❒	❒	❒	❒

Site: _____ ID #: _____
Date of Data Entry: _____ Trial _____
Name: _____ **Date:** _____

	(0) I don't do this activity for other reasons	(4) No difficulty	(3) Yes, a little difficulty	(2) Yes, moderate difficulty	(1) Yes, extreme difficulty
10. Do you have difficulty performing employed or volunteer work because you are sleepy or tired?	❒	❒	❒	❒	❒
11. Do you have difficulty maintaining a telephone conversation, because you become sleepy or tired?	❒	❒	❒	❒	❒
12. Do you have difficulty visiting with your family or friends in <u>your</u> home because you become sleepy or tired?	❒	❒	❒	❒	❒
13. Do you have difficulty visiting with your family or friends in <u>their</u> home because you become sleepy or tired?	❒	❒	❒	❒	❒
14. Do you have difficulty doing things for your family or friends because you are too sleepy or tired?	❒	❒	❒	❒	❒

	(4) No	(3) Yes, a little	(2) Yes, moderately	(1) Yes, extremely	
15. Has your relationship with family, friends or work colleagues been affected because you are sleepy or tired?	❒	❒	❒	❒	

In what way has your relationship been affected? _____

_____

_____

Site: _____ ID #: _____
Date of Data Entry: _____ Trial _____
Name: _____ **Date:** _____

	(0) I don't do this activity for other reasons	(4) No difficulty	(3) Yes, a little difficulty	(2) Yes, moderate difficulty	(1) Yes, extreme difficulty
16. Do you have difficulty exercising or participating in a sporting activity because you are too sleepy or tired?	❒	❒	❒	❒	❒
17. Do you have difficulty watching a movie or videotape because you become sleepy or tired?	❒	❒	❒	❒	❒
18. Do you have difficulty enjoying the theater or a lecture because you become sleepy or tired?	❒	❒	❒	❒	❒
19. Do you have difficulty enjoying a concert because you become sleepy or tired?	❒	❒	❒	❒	❒
20. Do you have difficulty watching TV because you are sleepy or tired?	❒	❒	❒	❒	❒
21. Do you have difficulty participating in religious services, meetings or a group or club, because you are sleepy or tired?	❒	❒	❒	❒	❒

Site: _____ ID #: _____
Date of Data Entry: _____ Trial _____
Name: _____ **Date:** _____

	(0) I don't do this activity for other reasons	(4) No difficulty	(3) Yes, a little difficulty	(2) Yes, moderate difficulty	(1) Yes, extreme difficulty
22. Do you have difficulty being as active as you want to be in the <u>evening</u> because you are sleepy or tired?		❒	❒	❒	❒
23. Do you have difficulty being as active as you want to be in the <u>morning</u> because you are sleepy or tired?		❒	❒	❒	❒

	(0) I don't do this for other reasons	(4) No difficulty	(3) Yes, a little difficulty	(2) Yes, moderate difficulty	(1) Yes, extreme difficulty
24. Do you have difficulty being as active as you want to be in the <u>afternoon</u> because you are sleepy or tired?		❒	❒	❒	❒
25. Do you have difficulty keeping pace with others your own age because you are sleepy or tired?		❒	❒	❒	❒

	(1) Very Low	(2) Low	(3) Medium	(4) High
26. How would you rate your general level of activity?	❒	❒	❒	❒

Site: _____ ID #: _____
Date of Data Entry: _____ Trial _____
Name: _____ **Date:** _____

	(0) I don't engage in sexual activity for other reasons	(4) No	(3) Yes, a little	(2) Yes, moderately	(1) Yes, extremely
27. Has your intimate or sexual relationship been affected because you are sleepy or tired?	❒	❒	❒	❒	❒
28. Has your desire for intimacy or sex been affected because you are sleepy or tired?	❒	❒	❒	❒	❒
29. Has your ability to become sexually aroused been affected because you are sleepy or tired?	❒	❒	❒	❒	❒
30. Has your ability to "come" (have an orgasm) been affected because you are sleepy or tired?	❒	❒	❒	❒	❒

Thank you for completing this questionnaire.

APPENDIX L: Berlin Questionnaire

Berlin Questionnaire (for sleep apnea)

Scoring Berlin questionnaire

Adapted from: Table 2 from Netzer, et al., 1999. (Netzer NC, Stoohs RA, Netzer CM, Clark K, Strohl KP. Using the Berlin Questionnaire to identify patients at risk for the sleep apnea syndrome. Ann Intern Med. 1999 Oct 5; 131(7):485-91).

The questionnaire consists of 3 categories related to the risk of having sleep apnea. Patients can be classified into High Risk or Low Risk based on their responses to the individual items and their overall scores in the symptom categories.

Categories and scoring:

Category 1: items 1, 2, 3, 4, 5.

Item 1: if '**Yes**', assign **1 point**
Item 2: if '**c**' or '**d**' is the response, assign **1 point**
Item 3: if '**a**' or '**b**' is the response, assign **1 point**
Item 4: if '**a**' is the response, assign **1 point**
Item 5: if '**a**' or '**b**' is the response, assign **2 points**

Add points. Category 1 is positive if the total score is 2 or more points

Category 2: items 6, 7, 8, (item 9 should be noted separately).
Item 6: if '**a**' or '**b**' is the response, assign **1 point**
Item 7: if '**a**' or '**b**' is the response, assign **1 point**
Item 8: if '**a**' is the response, assign **1 point**

Add points. Category 2 is positive if the total score is 2 or more points.

Category 3 is positive if the answer to item 10 is 'Yes' OR if the BMI of the patient is greater than 30kg/m^2

(BMI must be calculated. BMI is defined as weight (kg) divided by height (m) squared, i.e., kg/m^2).

High Risk: if there are 2 or more Categories where the score is positive

Low Risk: if there is only 1 or no Categories where the score is positive

Additional question: item 9 should be noted separately.

BERLIN QUESTIONNAIRE

Height (m) _____ Weight (kg) _____ Age _____ Male/Female

Please choose the correct response to each question.

Category 1

1. **Do you snore?**
   - a. Yes
   - b. No
   - c. Don't know

If you snore:

2. **Your snoring is:**
   - a. Slightly louder than breathing
   - b. As loud as talking
   - c. Louder than talking
   - d. Very loud – can be heard in adjacent rooms

3. **How often do you snore**
   - a. Nearly every day
   - b. 3-4 times a week
   - c. 1-2 times a week
   - d. 1-2 times a month
   - e. Never or nearly never

4. **Has your snoring ever bothered other people?**
   - a. Yes
   - b. No
   - c. Don't know

5. **Has anyone noticed that you quit breathing during your sleep?**
   - a. Nearly every day
   - b. 3-4 times a week
   - c. 1-2 times a week
   - d. 1-2 times a month
   - e. Never or nearly never

Category 2

6. **How often do you feel tired or fatigued after you sleep?**
   - a. Nearly every day
   - b. 3-4 times a week
   - c. 1-2 times a week
   - d. 1-2 times a month
   - e. Never or nearly never

7. **During your waking time, do you feel tired, fatigued or not up to par?**
   - a. Nearly every day
   - b. 3-4 times a week
   - c. 1-2 times a week
   - d. 1-2 times a month
   - e. Never or nearly never

8. **Have you ever nodded off or fallen asleep while driving a vehicle?**
   - a. Yes
   - b. No

If yes:

9. **How often does this occur?**
   - a. Nearly every day
   - b. 3-4 times a week
   - c. 1-2 times a week
   - d. 1-2 times a month
   - e. Never or nearly never

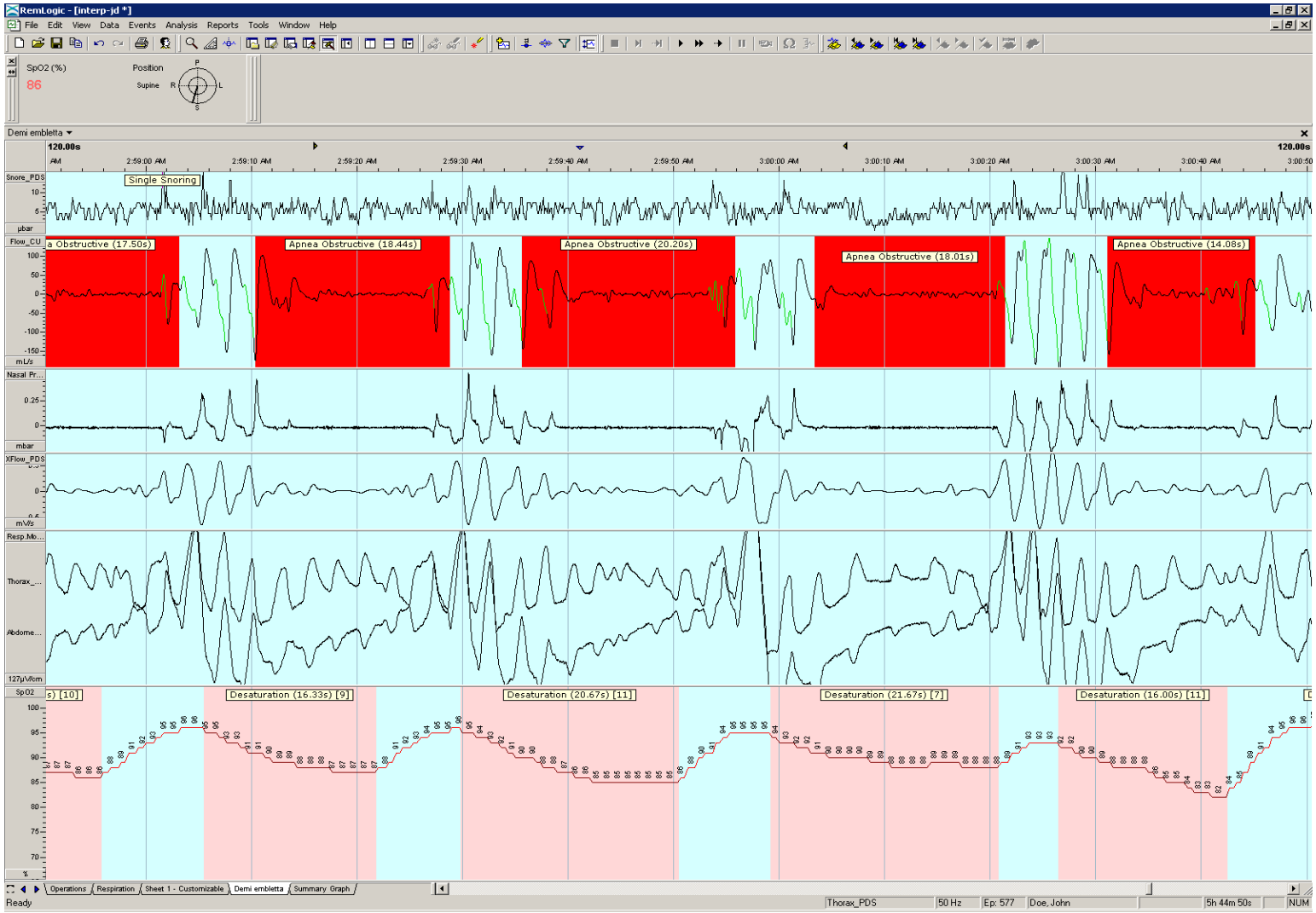
Category 3

10. **Do you have high blood pressure?**
    - Yes
    - No
    - Don't know

APPENDIX M: Precision Pulmonary Diagnostic Somni-Sage® Screening Questionnaire


PRECISION PULMONARY

APPENDIX N: Two Minute Screenshot of Embletta Scored Apnea Data


RemLogic - [interp-jd *]
File Edit View Data Events Analysis Reports Tools Window Help
SpO2 (%)
86
Position
Supine
Demi embletta
120.00s
Single Snoring
Apnea Obstructive (17.50s)
Apnea Obstructive (18.44s)
Apnea Obstructive (20.20s)
Apnea Obstructive (18.01s)
Apnea Obstructive (14.08s)
Desaturation (16.33s) [9]
Desaturation (20.67s) [11]
Desaturation (21.67s) [7]
Desaturation (16.00s) [11]
Operations
Respiration
Sheet 1 - Customizable
Demi embletta
Summary Graph
Ready
Thorax_PDS
50 Hz
Ep: 577
Doe, John
5h 44m 50s
NUM

APPENDIX O: Body Mass Index Table

Body Mass Index Table

	Normal						Overweight					Obese										Extreme Obesity																
BMI	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**
Height (inches)	**Body Weight (pounds)**																																			
58	91	96	100	105	110	115	119	124	129	134	138	143	148	153	158	162	167	172	177	181	186	191	196	201	205	210	215	220	224	229	234	239	244	248	253	258
59	94	99	104	109	114	119	124	128	133	138	143	148	153	158	163	168	173	178	183	188	193	198	203	208	212	217	222	227	232	237	242	247	252	257	262	267
60	97	102	107	112	118	123	128	133	138	143	148	153	158	163	168	174	179	184	189	194	199	204	209	215	220	225	230	235	240	245	250	255	261	266	271	276
61	100	106	111	116	122	127	132	137	143	148	153	158	164	169	174	180	185	190	195	201	206	211	217	222	227	232	238	243	248	254	259	264	269	275	280	285
62	104	109	115	120	126	131	136	142	147	153	158	164	169	175	180	186	191	196	202	207	213	218	224	229	235	240	246	251	256	262	267	273	278	284	289	295
63	107	113	118	124	130	135	141	146	152	158	163	169	175	180	186	191	197	203	208	214	220	225	231	237	242	248	254	259	265	270	278	282	287	293	299	304
64	110	116	122	128	134	140	145	151	157	163	169	174	180	186	192	197	204	209	215	221	227	232	238	244	250	256	262	267	273	279	285	291	296	302	308	314
65	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210	216	222	228	234	240	246	252	258	264	270	276	282	288	294	300	306	312	318	324
66	118	124	130	136	142	148	155	161	167	173	179	186	192	198	204	210	216	223	229	235	241	247	253	260	266	272	278	284	291	297	303	309	315	322	328	334
67	121	127	134	140	146	153	159	166	172	178	185	191	198	204	211	217	223	230	236	242	249	255	261	268	274	280	287	293	299	306	312	319	325	331	338	344
68	125	131	138	144	151	158	164	171	177	184	190	197	203	210	216	223	230	236	243	249	256	262	269	276	282	289	295	302	308	315	322	328	335	341	348	354
69	128	135	142	149	155	162	169	176	182	189	196	203	209	216	223	230	236	243	250	257	263	270	277	284	291	297	304	311	318	324	331	338	345	351	358	365
70	132	139	146	153	160	167	174	181	188	195	202	209	216	222	229	236	243	250	257	264	271	278	285	292	299	306	313	320	327	334	341	348	355	362	369	376
71	136	143	150	157	165	172	179	186	193	200	208	215	222	229	236	243	250	257	265	272	279	286	293	301	308	315	322	329	338	343	351	358	365	372	379	386
72	140	147	154	162	169	177	184	191	199	206	213	221	228	235	242	250	258	265	272	279	287	294	302	309	316	324	331	338	346	353	361	368	375	383	390	397
73	144	151	159	166	174	182	189	197	204	212	219	227	235	242	250	257	265	272	280	288	295	302	310	318	325	333	340	348	355	363	371	378	386	393	401	408
74	148	155	163	171	179	186	194	202	210	218	225	233	241	249	256	264	272	280	287	295	303	311	319	326	334	342	350	358	365	373	381	389	396	404	412	420
75	152	160	168	176	184	192	200	208	216	224	232	240	248	256	264	272	279	287	295	303	311	319	327	335	343	351	359	367	375	383	391	399	407	415	423	431
76	156	164	172	180	189	197	205	213	221	230	238	246	254	263	271	279	287	295	304	312	320	328	336	344	353	361	369	377	385	394	402	410	418	426	435	443

Source: Adapted from *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report.*

APPENDIX P: Supporting Focus Group Quotes

Theme 1: Screening and Evaluation

Driver Feedback and Supporting Quotes: Below are driver quotes regarding screening and evaluation.

- **Driver Quote:** *It was like they don't really tell you what this information is going to be used for. But at the same time it's a little underhanded…the way they went about doing it. Fill out something and then 6 months later somebody tells you you're going for a sleep apnea test. You're like, "for what?!" Just the way they went about it….could have been better.*
- **Driver Quote:** *It was a stupid questionnaire anyway. I mean, half the questions you couldn't answer unless you had someone sleeping next to you. I don't know about you guys but I sleep in the bunk all by myself.*
- **Driver Quote:** *I had to sign to take this questionnaire. Once I took it and I already signed and I tested that I was a good candidate, then I was required to do the physical examination and the medical evaluation for the sleep apnea. I couldn't back out…..I had to do it or walk out the door.*
- **Driver Quote:** *…about the questionnaires, they'll ask you things and you want to answer it truthfully but at the same time it's like, "why are they really asking me this?" The questions they ask you, just like, what's the underlying reason you're asking me this… know how many people would answer that….and that's dealin' with their livelihood.*
- **Driver Quote:** *Well aside from between the screening questionnaire and sleep test there being a 2-year gap for me, that's it. Seriously, when I talked to the occupational health nurse, I asked the question: "How did you identify me for this?"….and the lady said, "Well, you filled out a survey in 2006." This was August/September of 2008." If it was that bloody important, why'd you wait two years?" And she said, "Well we have a backlog."*
- **Driver Quote:** *…and talk to a doctor after you fill it out in case they find you got some weird flags or something. Ask to talk to a doctor who specializes….cause I never talked to one.*
- **Driver Quote:** *I thought it was kind of quick and really fast-paced! And I kind of wondered how they could actually get an opinion with only meeting with you for 1.5-2 hrs. I was wishing that was more of a preliminary thing and then*

go to some sort of more of a lab. You know, if this is going to be a life-altering, life-changing, have to do this for the rest of my working life decision, I want to make sure you guys know what you're talking about and I'm accurately diagnosed, you know! And like I said, I was a little bit, all of a sudden….boom boom boom!

Program Staff Feedback and Supporting Quotes: Below are staff quotes regarding screening and evaluation.

- **Staff Quote:** *When we talk to [drivers] it's a good chance for us to establish that first rapport, this is who we are, this is what you should expect and try to let them know, you know, please ask questions. And it also gives them, the phone calls, gives us a heads up, this is what we're walking into with the different personalities. Which can be really important, sometimes it's good to go in there armored, knowing someone is already coming in angry. So we know we might want to give them some space or try to figure out how to diffuse that, what they're angry about.*

- **Staff Quote:** *There are about three different ways that a guy or gal could be selected for screening…I believe we do catch quite a bit. And it has gotten much better over the years. In other words, when we first began we were a little, "gosh what is the best way to do this?" It was kind of hit and miss. We weren't able to get as many of the screenings processed as we wanted to and now we have gotten a lot more efficient at it. So it has grown over the years and become more efficient, I believe.*
- **Staff Quote:** *Well, COMPANY is one of those great companies that looks at every single DOT long form, to the tune of over 700/month that came into the company. So if we had some concerns, we are able to at any point in time cross-reference the [questionnaire] data with the driver's DOT long form information. Where there is a height, weight, blood pressure, not necessarily a neck size, but there are a couple….. fasting blood sugar, that help us identify. That's one way. The other way is COMPANY is blessed to have an Occupational Health Department, so probably the next deeper dive, although they don't touch as many drivers as the [questionnaire] screening tool, they're not touching the entire fleet, but many drivers that are out for medical conditions, COMPANY has an excellent return to work process where there are a lot of medical records being reviewed, so the medical team at COMPANY is another referral source, as is the medial intake team on the front end when a COMPANY newbie is coming through, albeit an experienced or new hire, to COMPANY. There is a front end process whereby they check COMPANY's database to see if this driver was ever screened for sleep apnea, did he test positive? They've got a front end kind of block and tackle process as well.*

- **Staff Quote:** *She uses BMI to a big degree, she does a lot with BMI. BMI greater than 33 was one of her first cut-offs, so that was her first pass. But then after that it was symptoms too... And as the program's gone on and more*

people have known about it, there have actually been situations where either the DOT certifying physician will call me and say, "hey, I have a driver who happened to mention this and so we're recommending he have a study – does he qualify to be in the study?" So sometimes it's a self-report thing, some drivers have heard about it and are trying to figure out how they can get enrolled. So it's gone from just the Study Coordinator having to screen the records, to some of it is word of mouth amongst drivers who are safety team members, or the DOT physician.

- **Staff Quote:** *Most men don't want to talk to doctors so they'll put it [scheduling] off and they'll kind of ignore the message and another month goes by. So you end up at times with a very long lag time. That concerns me. That worries me because what if he falls asleep behind the wheel in the meantime.*

- **Staff Quote:** *What I like about the screening process is the fact that it was inherently designed to work in an environment where the drivers are fearful of providing you with honest answers. The screening tool was designed with that in mind, to be much more objective in helping select the high-risk candidates.*

- **Staff Quote:** *I think that DOT examiners are out there looking at drivers for all the other reasons that a DOT would consider them a 'not go' but not all of them are out there looking and screening and being aware of the risks of sleep apnea.*

- **Staff Quote:** *What I would love to see attached to it is some biometrics with it. So I put the driver on the scale, I take a tape measure around his/her neck to get a little bit finer data, if you will. That's what I like about it and that's where I see the possibility of some improvement.*
- **Staff Quote:** *Long term, we could be looking at multiple things, which I think would be an improvement. The data from their physical that could show additional co-morbidities which could be indicators of OSA, as well as BMI and neck circumference. And then having the questionnaire online that we could also use in conjunction with that to get a more holistic picture of those drivers we believe that need to be tested. And that's our long term view. So you're looking at all that data together at once.*

- **Staff Quote:** *Actually, I have another thought for the screening process that was a positive. It is a good tool, going back looking at it afterwards if there's a problem with compliance or there's a problem with the driver using different devices because the physical exam gives us a lot of data about the guys and their facial anomalies, number one, which is one particular guy, but other guys in the group, also looking if they're having problems with nasal congestion. If they have other anatomic issues, it's actually quite helpful.*

- **Staff Quote:** *Because [the physical exam] is something that, in all of the original discussions, we decided is an important thing to have because if someone has a physical obstruction that is seen, then we may not do the ambulatory test. So it's my understanding that they look at both the nasal and the throat airways and look for physical obstructions that might preclude us from using the ambulatory test.*

Theme 2: Education and Outreach

Driver Feedback and Supporting Quotes: Below are driver quotes regarding education and outreach.

- **Driver Quote:** *Yeah, she told me you had to have 2 full weeks of compliance and they can take you off, no matter how long it takes, if it takes 2 weeks or it takes 2 months. You gotta have 2 straight weeks of compliance and then you go to the [data] card.*
- **Driver Quote:** *She told me where [OSA] comes from, as far as it stopping your breathing, what it can cause, spiking your blood pressure and it can cause a rise in….. I think she said if you already have high blood pressure it can cause your blood pressure to elevate even higher or if you don't have a problem with your blood pressure it could cause you to have problems. I think that's what she said.*
- **Driver Quote:** *They gave me pamphlets. The tech that helped me, he sat there with me and my wife and he explained it very well. Then I went on the Internet also, but there was still a lot of things that you didn't know, you just had to pretty much…some of it was still trial and error. I don't know what they could have done different. I think they don't want to give you everything up front and scare you off, but I don't know how they could change it. They don't want to give you everything and then the machine comes back and you know it's nothing. I guess it seemed adequate to me.*
- **Driver Quote:** *I couldn't even get anybody to give me a good explanation of what a hypopnea was versus an apnea event. I at least have Internet access in my truck and I got on my laptop and I did all my own research on sleep apnea causes, complications, what can happen if it goes untreated and all that stuff.*
- **Driver Quote:** *I think a video or something would have really been helpful. Go into detail as to what it is so you could understand really what it is instead of just reading a pamphlet, or having somebody just go over the basics, you know, you stop breathing at night and it causes… They told us what it caused but I think that may be helpful,*

just more detail, a video, something online to watch. Like a 'you've been diagnosed' video or something. It could explain it in more detail.

- **Driver Quote:** *Of course they tell you to lose weight. She gave me some more information that I had before. I've actually gained weight since I've been driving. They tell you to lose weight and I'm like, I'm on the road every day, very seldom do you have access to healthy food and I try to take fruits and stuff like that with me. I'm not gonna lie, it's real easy to run into a truck stop and grab a burger and a milkshake or a soda, French fries….*
- **Driver Quote:** *I wouldn't tell them anything; say everybody got caught with the screening. They didn't tell you what that was going to lead to. The same person that tries to reassure you, saying "it's just for this or it's just for that," those are the same people that screen you. They ask you if you got back pain, if you snore. Those are the same people that you talk to then! And 6 months later I'm sitting up there with all these wires. You really don't know who to trust, who not to trust, I mean I guess if you got a good relationship with your DBL, but I don't even trust him so much. I won't even get my blood pressure checked there [at the terminal]. I monitor my own blood pressure, that's a trust issue with the company.*
- **Driver Quote:** *When I talked to them, they gave me mostly common knowledge type stuff, like to eat fruits and vegetables. To me, it's hard. Some drivers have the big refrigerators in their trucks and I've bought like three of those things, they break and I got tired of buying them so I just keep a cooler with ice in it. I'm not eating the apples; I mean you can a little bit now because it's cool so you put it in the truck. But in the summer time you can't do that. Put a bunch of fruits in there, 2 days later they're rotten. It's kind of hard, I mean I guess you could do it if you really put forth the effort to do it but it's not too convenient to do it.*
- **Driver Quote:** *You are bombarded [with health information] from all sides, not just where you work but you hear that on the news. You hear that everywhere. Healthy living and healthy lifestyle. Unfortunately being an over-the-road trucker does not provide you the environment in which these things happen automatically. You have to make an effort to get that exercise.*
- **Driver Quote:** *The machine education was good. There's nothing to it, you push a button [to use the PAP machine].*
- **Driver Quote:** *I'd have like to known if there are any other treatment options, I mean they didn't really give us… there may not be but they didn't, you know, lose weight and the machines, that's it. I asked her if you can ever come off [PAP treatment] and she said, "yeah, but it's kind of rare." She said if it's all related to your weight and you*

lose the weight you can come off of the machine. She said people that are not overweight and have it; they need it the rest of their lives. She said she supposed it was possible.

- **Driver Quote:** *They went over with me, he was explaining, I have severe [OSA], and they gave the options. And he was like, "surgery, CPAP machine, this, this and this." He explained with my severe case the surgery may not help, it might diminish it some but the amount of times that you're not breathing at night, I suggest a CPAP. Don't waste your time with surgery. So he pretty much went through all the options with fair detail.*

- **Driver Quote:** *I think if the sleep apnea stuff is going to be required by the government, something needs to be done to educate these communities, as far as people of habit, letting truckers idle. Because if we can't idle, we can't use the machine, if we can't use the machine we are not in compliance, so we're parked.*

Program Staff Feedback and Supporting Quotes: Below are staff quotes regarding education and outreach.

- **Staff Quote:** *If we have more than one driver we do everything as a group. The only thing that is done individually [is the physical exam]. So a driver is taken into one of the exam rooms which is more private and that's where he's one-on-one with the technician going over all of the exam procedures. Otherwise they sit in a room and fill out all their questionnaires, privately, but all the education stuff [is] together. It's interesting… it's almost like they're this little team because they went through all this stuff together.*
- **Staff Quote:** *It's evolved more into a question and answer thing. They show up and we try to develop a little before while we're waiting for everybody to convene and we encourage them to ask questions.*
- **Staff Quote:** *The discussion, it sounds like it's really tailored to the individual. He may be a high-functioning person that reads it and goes, "yeah, I get this, I've seen it, I've read about it!" And then somebody else who's not and you need to just tailor it. We talked more about how it relates to the truck driver industry. Drivers, I try to gear it when I'm talking to them about it. Because they tend to listen a little bit more, because it's more applicable to them. So we talk about it general and then specific to the truck drivers.*

- **Staff Quote:** *We do monthly newsletters and four times a year there is an article about sleep apnea in there. It can either be a driver testimony [which is] a driver that has gone through it and understands [the OSA program] and gives their point of view regarding it. Or it can be identifying the myths about sleep apnea that drivers understand if they are called in, why and what the concerns and the risks are to them. Or it could be educating them on the*

medical aspects of it. We also do, we call it [CARRIER] News Network, and it is at our large operating centers – there are televisions where we broadcast company messages. And we have used that venue a couple of times to tell a story. We have brought in drivers who were diagnosed and had them share their story on the [CARRIER] News Network. So those are a couple of pieces that we've done.

- **Staff Quote:** *We have information out on our employee portal, like I said, to give them information about sleep apnea and tell them the program exists. And then in our orientation process, they do discuss some things about fatigue and sleep disorders and things. [We talk] to them about how to control fatigue and what our policy is with the drivers, saying that they're safe enough to drive and we can't, we won't make them drive if they don't feel like they're well enough rested, that kind of thing. But we do have information out on our employee portal that talks about sleep apnea in general and the dangers of sleep apnea and introduces them to our program.*
- **Staff Quote:** *For the drivers that have found it, it's summary enough where they will read it but it gives them enough detail to make them call if they think they have those symptoms, but when I said if they find it, there's lots of information out there for drivers and so it could be introduced either more often or in a more prevalent way, occasionally, that will make it available to drivers who haven't found it potentially.*
- **Staff Quote:** *Well I think we need to be armed with some facts, a better understanding of what OSA actually is, what is happening to your body so when the driver comes to us we have some background… I don't feel like I have those facts to overcome an argument with a driver. We need to educate our front line leaders more.*
- **Staff Quote:** *I really hesitate arming us with things that could get into the medical area. So arming us with education and obviously it is a good thing we know about what issues sleep apnea can cause, I mean it can affect your blood pressure, your DOT physical, your lifestyle. You know at some point we have a gray area. You need to let the medical professionals answer that.*
- **Staff Quote:** *Fleet manager and safety manager education would be helpful in being supportive of the drivers when they need to get back to us. If the people at [CARRIER] that control the routes are a little more understanding of the importance of… some guys have great support from their managers and some guys do not and that also plays a role in their response to compliance.*
- **Staff Quote:** *Just that there's a lot of people involved, there's a lot of personality at [COMPANY] that may not be really understanding of the [OSA program] in itself, and also, you know, what it means to the drivers, and so we tend to run into some barriers in that way in which we need them to understand what this driver needs.*

- **Staff Quote:** *Really to just prepare the drivers, what to expect at the lab. A lot of these drivers call in with a lot of anxiety, a lot of misinformation, and a lot of fear. So she's there to kind of calm everything down, put forth some information and get them to the [sleep] lab in a state where they're not out of control with their anxiety. A lot of [the information given] is driven by the driver. Some drivers are very curious and they want to know, "I've never heard about this" or "this is what I know." It really depends on each driver and what they want to know. So it's a little bit about, "you've been chosen to have a sleep study and this is what sleep apnea is." Then it's a little bit about what to expect at the lab, how you are going to sleep, what's going to happen there so that they have some information about the whole process.*

- **Staff Quote:** *And I'll use [OSA Provider] a lot, I'll call [them] and have them talk to the driver if there is a question or concern about what he is doing or not doing or how the mask fits, and so forth. So I'll use them more so then give them what little bit that I know about it. I'd rather them get the true information from the people that understand it.*
- **Staff Quote:** *Probably where things could be improved, as far as I'm concerned, I think that spending more time with the driver after, if the driver tests positive. Perhaps spending more time with the driver on the set up and education. It's a loaded answer because some of the drivers are in a hurry to leave the lab which ties the lab's hands as to how long they can spend with the driver. That would be my major issue – spending more time with the driver if they test positive.*
- **Staff Quote:** *The only thing that would be improved would be if they were found positive [for OSA] to spend a little bit more time on education with the driver regarding treatment.*
- **Staff Quote***: There's a social psychosocial aspect. You were just diagnosed with sleep apnea; this is a life-changing event. You're getting a lot of information in a short period of time and I think I remember from my training days, people retain, on average, 10% of what they hear in those situations. As much and as often as you can get them information in bits and pieces and immediately following Day 1 where they are handed that PAP therapy. It's going to take repetitive teaching in order for it to really register.*

- **Staff Quote:** *There is a policy we developed before we put our first driver through our program, with the original sleep physician that we used. That policy tells them exactly what is required for usage and what will happen if they do not follow that compliance... and they're given that at the initial testing night, when they're given that information about the program.*

- **Staff Quote:** *We basically [tell the driver] this is where your compliance is, if it's below a certain amount then I am obligated, per the protocol and COMPANY's policy, and they get a copy of COMPANY's noncompliance policy for OSA, they have that in the folder of documents they get.*
- **Staff Quote:** *The vast majority of our drivers are compliant… we tend to have problems with the newly diagnosed. Sometimes they don't understand exactly what the requirements are. Sometimes they won't use it at home. They feel it is okay to go home to get rest and then not get any sleep and come back out and drive. So we kind of have to reinforce that with them.*
- **Staff Quote:** *I think when you're dealing with a large organization versus a small organization, there's some inherent challenges when you're dealing with somebody that large, in terms of standard operating procedures across the board in their infrastructure. How do you get all the driver managers on the same page? How do you get all of the loss prevention leaders on the same page?*
- **Staff Quote:** *There is a slight disconnect between our occupational health department, which are the medical experts, and our front line leaders who are dealing directly with drivers. So I would say that is a watch out. That if other trucking companies were going to do it and you expect your front line leaders to be well-versed on it and calm drivers down and reassure them they probably need to be a little better educated. And we're working on that.*
- **Staff Quote:** *It's an educational component for the occupational medicine team. It's just like physician coordination. It's actually a big part of it, too, because without that, it's hard to get doctors to change what they do. Unless they talk to other doctors they won't listen to you otherwise.*
- **Staff Quote:** *And I think fortunately [CARRIER] does have some driver champions that are willing to talk to drivers. But I would agree, there could be better promotion of that… I thought [NAME] had a really excellent idea as we get into some sort of a blog opportunity for drivers as well as other means of communication. But you are so right; the whole support group philosophy thrives for a reason. The only caution I would have there sometimes, not that they can't support one another, but when it comes to the tips, what some drivers may be passing along as helpful tips may not actually be appropriate.*
- **Staff Quote:** *Some of the things we've talked about doing that I think would be beneficial for a program like this is developing something that is more like a peer group or support group for the drivers, where we have drivers that can have blogs and forums and talk about and through issues and help each other more. Or you can call and talk to a mentor kind of thing. I think that would be very beneficial and we've talked about setting up a whole different*

portal internally for those drivers. If they have sleep apnea they could get access to this portal with other information or that blog out there. I think that would be very beneficial to make it a more inclusive kind of thing, where maybe they don't feel so different about being treated for sleep apnea.

- **Staff Quote:** *And most of the drivers, a lot of them have laptops now, or BlackBerries where they can participate in those blogs and forums online. And if they don't, then that's when they could call and talk to someone, hopefully. I think that would be important long term.*

Theme 3: Testing and Diagnosis

Driver Feedback and Supporting Quotes: Below are driver quotes regarding OSA testing and diagnosis.

- **Driver Quote:** *I don't think it's fair. What I mean by that is, ask my mother, I've been a stomach sleeper since I was a baby so I lay on my stomach to sleep. You can't do that with those wires on you, on top of that you're in a strange place. I don't sleep well the first night anywhere, whether it was the field, the truck, or home, the first night I'm normally up late, two or three in the morning, then I'll finally burn out and go to bed because I'm not comfortable. The second night I'm fine, from then on I'm fine. I don't know how to improve the testing but I just didn't feel it was right. Then on top of that, talk about getting woke up, I was woke up three or four times. Ya know, this came disconnected, that came disconnected. They want to test you and find out whether you're breathing while you're sleeping… great, but you've got to sleep!*

- **Driver Quote:** *As far as comfort, the sleep lab isn't very comfortable because you're wired up from head to toe. But it is more thorough and there is someone there actually watching you and hearing you as you go through the night. And they can notice things, they check for restless leg syndrome and stuff like that.*

- **Driver Quote:** *I guess for me, I wish there would have been a little bit different procedures. First of all, it was a little disorganized when I first got into the program and while I understand…. they just put this equipment on me one night and that's how I got tested. I wish that would have been more of a preliminary thing and once I got that preliminary testing I would have maybe gone into a lab and had a little bit more thorough examination of what my actual condition is and what my problem is.*
- **Driver Quote:** *You know, if this is going to be a life-altering, life-changing, have to do this for the rest of my working life decision, I want to make sure you guys know what you're talking about and I'm accurately diagnosed, you know!*

- **Driver Quote:** *I agree with you to a point. I think it did seem like, I'd sit there and fuss with that machine for an hour to make sure I had it connected correctly. It seems I lucked up and did! I guess they make it kind of streamlined so we don't have to miss as much work. I guess also the cost, also.*
- **Driver Quote:** *I have [had both the laboratory PSA and the portable test]. I don't like the lab either, for the same reason. You want to tear everything all to pieces, you don't really get the comfort level you need to get proper data to them.*
- **Driver Quote:** *Yeah, [the PSG] is more thorough but [the portable test] is quicker.*
- **Driver Quote:** *But then again I was happy with [the portable testing device] because it doesn't take you out of work for a couple of days.*
- **Driver Quote:** *They go over the test results with you in pretty good detail.*
- **Driver Quote:** *On the testing, when I took it, for me, they just didn't give me enough information. They told me, "You were tested for sleep apnea." They didn't tell me there was anything wrong with my sinus or my airway was closing up, or nothing, they didn't tell me none of that.*
- **Driver Quote:** *One comment going back to the sleep study. I never saw a doctor. I was completely diagnosed over the Internet, or whatever it was. They sent my test results to a hospital and the diagnosis came back....I never saw any doctor attached to their name, which kind of ticked me off because, you know, you have sleep apnea, what does it mean? Can you give me an explanation? One of the technicians said, "well your case is pretty mild…you're right near the borderline." And I'm like, "OK, that's great," but I'd like to have heard that from a doctor.*
- **Driver Quote:** *I have no doubts that I have [OSA] but it is kind of fishy, I mean it seems that way anyway. They're selling machines right there where they're diagnosing you. To me, there maybe should be some separation, but I guess that's just the way it is. It's kind of funny going through a study and right after you finish they give you the machine and tell you gotta make sure you do this, don't do this, use purified water and the machine cost X amount of money and stuff. I'm like, you know, this could be a nice little gimmick. You know $1000 a machine or more and everybody that come in got sleep apnea, by coincidence. Could be a nice little gimmick! I guess if you had questions on their ethics, you could probably go get an independent type thing and see if you had it…. but, I'm not paying for it.*

- **Driver Quote:** *Once I took [the OSA test] and I was shown positive it was either you're going to participate in this or you're going to have to find another line of work.*

Program Staff Feedback and Supporting Quotes: Below are staff quotes regarding OSA testing and diagnosis.

- **Staff Quote:** *That is one of the things I think can be improved. And again it is probably just the sheer volume they have to go through, but sometimes we get the call, "hey this guy was identified and it's been a couple of months now so we really got to get him in." So we have to go in hurry-up mode to find a place for them.*
- **Staff Quote:** *I actually have one on that because I had a driver that they say two years prior was borderline and they couldn't determine whether he actually slept or forced himself to stay awake but look asleep. And it took them 2 years to get back to me. So then it was panic time to get him in again. So following up on that I guess would be a little bit more, you know, if we could do better as far as the moderate drivers, the borderline drivers. Because again, it just, all of the sudden I had to go into mode of finding him a clinic within days, when I'm like "okay it's been 2 years, you know, you didn't mind it before." I didn't get any feedback until it was "got to get it done."*

- **Staff Quote:** *Sometimes when they are called for this screen they'll say "well, now wait I'd like to try something else. I'd like to try to lose weight or you know." It is almost like it is almost too late for that to happen by the time they have screened high risk. But they want to do something else to stop that, for even going for the test.*

- **Staff Quote:** *Really it is fairly hands-off unless two things that can be time-intensive are getting a driver to [testing] once they have been identified. So you got to route them there and make sure there is truck parking.... Those are the two things that can be time-intensive.*

- **Staff Quote:** *And we do have drivers that after they do this test they will tell us "I was just awake all night." Now whether or not that actually was true, but they are too tired to drive the next day because they were awake all night because they are just so anxious about being observed and having things stuck on their body. No matter what we do to try and reassure them that this is just a good night's sleep in a nice warm bed and it will be fine in the morning. Some of them are just exhausted at the end of the night.*
- **Staff Quote:** *And I don't know how much you guys have gotten into this but the polysomnogram type one is considered the Cadillac of testing. That is why we went with it….You can do testing, I am sure you guys are aware of this, out in a trailer at a truck stop. There are medical providers who are "doc in a box" if you will. Where they*

literally are going around to truck stops with their set up and doing the testing… We are considering whether or not to expand and use some different testing options but right now we don't believe the scientific evidence supports going to a lesser test if you will and that is mainly because of electroencephalogram monitoring and being sure that the driver is truly asleep. This is observed testing, we visually observe it. If you don't observe it there is a fear that a guy will stay awake all night or he'll put it on his teenage daughter who sleeps like a log or, you know, whatever. So there are a lot of different things.

- **Staff Quote:** *What works well is being able to test these drivers while they're out, over the road, instead of them having to take time… because the one thing they mentioned to me is they don't get very much time at home and they have families. So they don't have to spend a couple of nights in the lab when they have time with their families. So, doing it on the road is a big plus.*
- **Staff Quote:** *There are limitations on the recording device. Since we do not have the capacity to monitor brain waves, we are potentially losing diagnosis of mild or to moderate population of truck drivers that could still be having issues that are affecting alertness and higher functioning that they need to be driving big rigs. So getting a device in there that can monitor EEG, too, would be good in the ambulatory device.*
- **Staff Quote:** *I run through and score the data after an automatic analysis is run; the software has its own automatic analysis for respiratory events, but the human eye is better. So I go through and anywhere between a 5-and, I've gotten a 10-hour study before! And put all the events in, at that point I sent a notification to NAME that the study is ready for interpretation.*
- **Staff Quote:** *If the apneas were not being controlled by the APAP, the data from the machines could tell the physician that, they required the driver to have a lab, or they recommended they come in and have a lab because the apneas were not being controlled.*
- **Staff Quote:** *You know and that falls in line with any medical condition that they have because you know you or I could have high blood pressure or sleep apnea and we are not going to lose our jobs over it. And we probably are not going to hurt anyone else either. You know for a driver it becomes a career-threatening illness for them.*
- **Staff Quote:** *I think most of them are somewhat resistant in the beginning. Some just have more resistance then others. They do feel it is going to affect their job. We feel that eventually it will be a requirement by DOT.*

Theme 4: Training and Treatment

Driver Feedback and Supporting Quotes: Below are driver quotes regarding OSA training and treatment.

- **Driver Quote:** *Overall I'm very satisfied with the PAP.*
- **Driver Quote:** *So I wish there would have been a little more thorough testing of what my actual situation was and then meeting me up with the proper equipment, given that this is a life-changing, forever thing; and I can't even continue to work as a truck driver if I'm not using this thing! So I want to make sure I have not only the proper diagnosis but the proper equipment before you send me out there. So there was a little bit of frustration because I had a mask initially using the full face one, it just didn't work for me at all. I was in misery, just terrible misery.*
- **Driver Quote:** *Well they pretty much say that diet, weight loss, exercise as an overall will help you…will help you with your sleep apnea.*
- **Driver Quote:** *Yeah, because I asked her, once I found out I had to use the PAP machine I wanted to know what I could do to stop this. And she was like, "for some people that's overweight, one of the things that causing them to have sleep apnea in the first place…" and by me being overweight, I was like, "OK, I'll try the weight loss." But like I said, it's kind of hard to do it with the lifestyle of a truck driver. After I asked if weight loss would help, she said it could.*
- **Driver Quote:** *But we all can agree it's just hard as a devil to lose some of this weight with what we do.*
- **Driver Quote:** *Funny, for example, walk out in the cafeteria, I guarantee you're going to find something fried on the counter; you're going to find starches or primary food groups… You go into a Pilot truck stop, other than coffee, there is not much you can eat and stay on a diet. And they try to give you two bags of M&M's for $2, because they have a deal on that each month! … There's a lot of problems out there, industry-wide, not just SNI. Industry-wide there is a big issue with weight and we all know it and we all live out here and this is just a headache for us.*
- **Driver Quote:** *I walk around here [trucking terminal], about a mile around the circumference. You can walk back up into the neighborhood up here. We're all over the road. OK, we go everywhere!… I never know where I'm going to be so you have to find a place to walk. Major cities, you can't walk in major cities. It's dangerous. You can't walk around rest areas 'cause there are other truck drivers driving in, let alone cars that aren't going to notice you. You have to watch, make sure you don't overexert yourself because you're the only person there that's going to get you*

back to medical attention if you need it. You gotta be cautious! There are a lot of things that go into exercise and an exercise plan and it's just difficult to do over the road. And gyms are not a good option because they don't like people like us that drive large vehicles, they don't want us anywhere near them.

- **Driver Quote:** *Now I walk out in the cab of my truck, I've got a cooler and I've got frozen vegetables, frozen spinach, frozen meals. I've got a birch stove; I can put everything together and have me a meal in about an hour going down the road. It's a heck of a lot healthier than anything they serve in here.*

- **Driver Quote:** *I've actually lost, I was getting thick…my BMI was kinda like starting to go [up] and [the OSA provider staff] said, "you really need to write down, look at your diet, your exercise." And I took him at his advice… I've lost about 15 pounds and [my wife] has lost about 46. It has helped tremendously. The diet…getting into an everyday routine is what does it. Just getting used to everyday, you just knowing what to order, what not to eat. If you see a McDonald's you just run the other way.*

- **Driver Quote:** *Just about every operating center we have a physical therapist. You can go in there and ask them questions about it, exercise and diet, but not related to [OSA] specifically. They do have the health [information], maybe they should link the two up a little bit…make it a little bit more specific.*

- **Driver Quote:** *[Carrier's] got a better health and living coach and if you do that program, which is another free program that they offer, they will call you up periodically and say, "How are you eating, are you getting exercise, what's the deal, how are you doing?"*

Program Staff Feedback and Supporting Quotes: Below are staff quotes regarding OSA training and treatment.

- **Staff Quote:** *When we developed the program with [OSA provider], we selected what type of PAP machine we preferred for the driver to receive originally. As far as treatment goes, we said we want the drivers to get APAP, not CPAP.*

- **Staff Quote:** *And I purposely say PAP every time because there are a few drivers who have had to go on a different kind of PAP machine and, if that is the case, because their apneas are not being controlled effectively. In some cases we've had to do [PSGs] for those drivers in order to understand which kind of machine they need to be given and in other cases, the OSA Provider sleep physician could tell from the initial test that he didn't think the APAP would control it, the driver came back, wasn't able to work with it and they were able to provide the other type of PAP machine without having to do a PSG.*

- **Staff Quote:** *Sometimes the use of [PAP], itself, will allow you to see central apnea. It will actually bring out other complex apnea, that's how it's diagnosed, not just based on what we see on the [portable sleep monitoring] test. So you have to follow that very closely because it could give you clues that there are other disorders there. And that's the medical management part.*

- **Staff Quote:** *Well at [CARRIER] this year it's new for our medical plan that we've started to do some things with wellness and part of that is through our medical carrier, they have the ability to ask for some weight loss coaching through a health coach at United Health Care (they're our current medical plan provider). We also have therapists at some of our large operating centers, occupational therapists, who we contract with another organization but they do some weight loss and exercise help for drivers as well. And both of those programs are very new for us.*
- **Staff Quote:** *But that's actually something I think we probably could improve in the trial, is actually providing [OSA treatment] alternatives up front. And give them a lot of other small things that are inexpensive to make the APAP work better. You know, we don't design the trailers or the cabs, so like position of their body is an important part of any kind of PAP, and also the type of pillow they use can be important. Weight loss is a part of this too.*
- **Staff Quote:** *And then the other thing that I think would be beneficial, for all drivers, not just the ones with sleep apnea, is trying to provide them more ways on the truck to help them. Maybe it's just the stretch bands to be able to do some exercise in the truck or by the side of the truck. Things like that that would help with those weight management or diet issues that you mentioned before, that the OSA provider staff does talk to the drivers about.*
- **Staff Quote:** *Just overall we've had these wellness programs for years where we've offered smoking cessation, weight management, and personal coaches for free for these drivers, that help them through these processes before this [OSA] program even. And I will tell you that those programs are not utilized very effectively or often. So I would say it's probably difficult for the driver.*

- **Staff Quote:** *They're given a bag that has the flow generator that's an APAP, the humidifier, it has the tubing, electrical cord, everything they need by the time I'm done handing them masks, they've got everything they need to walk out the door to start therapy.*
- **Staff Quote:** *The [PAP] therapy, they can have all the bells and whistles, but it's not going to do anything for them if they can't tolerate the mask or it doesn't fit well. It's the mask that makes or breaks the deal.*
- **Staff Quote:** *We give them a full face mask and one of the nasal masks. The reason is, when they leave, for the vast majority of them, it's extremely inconvenient to next to impossible for them to just come back here if one mask*

doesn't work. Initially we'd give them one mask, the one that seemed to be the best one. And then I did a lot of mailing masks back and forth, trying to find what works. So we can at least nail down which system they seem to tolerate best. Sometimes we match the perfect mask right then and there, sometimes we don't. Also, it gives them a back-up. Really we give them the two so they can work that out for themselves and help us figure out which one is the best for them.

- **Staff Quote:** *Drivers are given feedback immediately the next morning following their test…which is another thing we think is very important. Because once a commercial truck driver is tested, they cannot drive again until they receive their diagnosis and treatment if they're positive.*
- **Staff Quote:** *For me, the aspect that I really like is being able to not only diagnose the drivers, but get them on medical therapy and have the whole process in under 24 hours, which is amazing, considering when you look at a clinical setting like we have here. And this is a high-risk population so being able to do that, I think, you can't get any better than that!*
- **Staff Quote:** *So where there is another opportunity for process improvement until the technology takes place, is that that driver is immediately, because of a lot of maintenance and facility resources and guys are in there with flat tires that have a hot load, or there are engine stalls, whatever. There's a lot of triaging that goes on in the maintenance and facilities departments as well. The next step is to get them to an operating center that actually has the inverter and the man power to hardwire it into their truck. So sometimes there is a delay from that driver getting that inverter.*
- **Staff Quote:** *And that's part of in the scheduling when COMPANY Coordinator gets in touch with me she sends an email out to all the fleet managers and the maintenance shop saying, "these are the people who are testing, these are the ones who will need power sources if they're positive, so you want to prepare, get equipment ready, get everything together."*
- **Staff Quote:** *In talking to our drivers about how they care for their machines and their hoses and filters and stuff, we discussed, for instance, should we set up some place in our facilities that allow the drivers to go in and wash their hoses and do that more in private than just going into the break room or bathroom and doing that. Maybe there needs to be more acceptance out in just the working world. Like with truck stops – having a place for drivers to be able to do that kind of thing. And care for their equipment the way they need to care for it.*

- **Staff Quote:** *We could improve, and this is actually something we are working on, streamlining our patient support, as far as getting supplies out to people as needed. Many reasons why it's a challenge but one of the reasons is that we initially dispense masks to people. If those don't work and they're over the road, it's tough to help get them the equipment that's going to work for them. So just the distance for some of these drivers.*

Theme 5: Compliance Monitoring and Long-Term Management

Driver Feedback and Supporting Quotes: Below are driver quotes regarding PAP compliance monitoring and long-term management of OSA.

- **Driver Quote:** *I like [PAP treatment], I sleep better with it and I also use it to take a nap. That's the only way I can take a nap because I will not get to sleep otherwise, it helps a lot.*
- **Driver Quote:** *I don't mind doing it when I'm working, but when I'm off I don't want to have to mess with the sucker. I just want to go home, lay back in my bed and just snore if I want to snore! I hate having to do that every night that I'm at home!*
- **Driver Quote:** *My truck broke down, regeneration unit just quit and they put me in a different truck. I ended up going three nights in a row without it, then I went home for Saturday and Sunday, then it was another three nights until I got my regular truck back. I never had them change the inverter and all that. But what I did was I talked to [OSA provider staff] and I told her what had happened. I gave her the monthly card there and I said, "you're gonna find on there that there's gonna show three nights in a row and then another three nights in there where I didn't use it, but this is why." And she said, "OK, that's not a problem."*
- **Driver Quote:** *That's the only way I can use [the PAP machine]. I gotta put water in it…in the humidifier. If I don't, I wake up and my nose is all dried up….I gotta use it. And I can't use the full mask. They tried like 3 masks on me and the one I use now is just the one with only the nostrils. And I can sleep perfectly with that one. Other ones, [I] turn to the left and pull, turn to the right and pull.*
- **Driver Quote:** *First of all, the fellow that designed this thing, can we not, first of all, make that thing smaller? And secondly, when working with the maintenance people, I only have limited storage area in that truck. The first time they put it in, they put it right plop in the middle section underneath the bunk. When they could have put it to one side or the other, and they just ate up 2/3 of the storage area that I have in that truck.*

- **Driver Quote:** *Yeah, [PAP use is] very easy. Easy as sleeping, literally. You've basically just got to put it on and go to sleep.*
- **Driver Quote:** *But as far as difficult or easy, I can't decide difficult or easy because, again, some of these guys sounds like it's a miracle, hallelujah-my life is wonderful now! But for me, I don't like using the machine, I don't like putting the mask on. I do it because I have to for my job. Again, there's been some improvement in my life but I'm not having a miracle like these guys are. Because I don't like wearing it! I don't like having to sleep on my back every night, every single time. So for me, I'm going to have to say difficult for CPAP.*
- **Driver Quote:** *Well, it's not so much using it in the truck, it's breaking it down, taking it home and setting it back up.*
- **Driver Quote:** *So there was a little bit of frustration because I had a mask initially using the full face one, it just didn't work for me at all. I was in misery, just terrible misery.*
- **Driver Quote:** *First of all they sent me off with a mask that didn't work. And I'm like, "I'm dying out here!" I gotta use this thing but I can't use it! It's so uncomfortable, I'm waking up continually, I was almost in tears! I cannot fall asleep with this thing on my face but I gotta use it, you gotta get me a new mask!*
- **Driver Quote:** *For some people [weight loss is] easier than [for] others. I put it in the difficult column because I have lost weight out here and then I stopped what I was doing because of winter and I gained it all back! It's not hard to do if you dedicate yourself to it, but overall it is difficult, at least.*
- **Driver Quote:** *And [weight loss has to do with] what you have to choose from to eat. Either processed food or fried food or cold sandwiches that got fatty meat, cheese. It's not set up for someone to maintain a healthy weight, unless you say "I'm not going to eat too much of anything." You sit in a truck stop any given day and you see a lot of big dogs walking across the parking lot.*
- **Driver Quote:** *There are a lot of things that go into exercise and an exercise plan and it's just difficult to do over the road. And gyms are not a good option because they don't like people like us that drive large vehicles, they don't want us anywhere near them.*
- **Driver Quote:** *The way I exercise, I jump out of the truck, do 10-20 push-ups and when I get up first thing in the morning I do 20 crunches, like every other day. That's all I do, that's all I have time to do. I park my truck further and I walk. I walk all the way across the truck stop and that's how I get my exercise. 10 push-ups every other day, 20 crunches when I first wake up, and just walking and eating the right stuff, not walking to McDonalds but walking to a place where I can get a nice meal.*

- **Driver Quote:** *And I don't know whether it directly relates but every physical therapist [from carrier's health and wellness program] I've ever talked to says, "we need your driver number but only so we can keep demographic information." It's like nobody wants to go in there and talk.*

- **Driver Quote:** *After my initial diagnosis I was given a machine and I had to send in…it was a wireless thing you just stuck on the back of the machine. . . it sent daily transmissions [to the OSA provider team].*

- **Driver Quote:** *Yeah, but as soon as they found out that I was having the inverter changed [in my truck] because of the sleep apnea program, I went right on the priority list and, like I said, it was under an hour to change it over.*
- **Driver Quote:** *I don't expect my fleet manager, because he has other trucks, so I don't expect him to be real deep in it. Hell, I gotta remind him that I have a machine in the truck and he's traded trucks three times, and I'm like, "you have to schedule me to get the inverter!" And I don't even bother telling him anymore!*
- **Driver Quote:** *There was a real conflict there with your fleet managers! On the one hand I would need to run this truck in order to run this machine and I have to use this machine to stay DOT-compliant, but if I actually did that every single night then I'm getting bitched at by my fleet manager because I'm idling my truck too much! And the thing is, you're in a constant fight!*
- **Driver Quote:** *[OSA provider staff] always calls on a Friday, then you pull the truck over, try to call her back and she never answers! And the thing is, they were having problems with me getting the data. Twice I sent it in and it was blank so I had to send it again. So I'd call and say, "Did you get the data?" I didn't hear back from her for like 3 weeks!*

- **Driver Quote:** *So if this [data] card I drop today goes missing, I'm going to get a nasty message next week, asking where my card is. … But this is another weakness in the program. It's just difficult to…..a lot of it's on faith.*

- **Driver Quote:** *I got it, got the machine and did another physical. I actually did two physical exams within 2 or 3 days but I immediately got the 1-year deal. I heard from NAME after that that they started, the doctors started getting queasy about doing the 1-year right off the bat so he knocked it down because he wanted to make sure people were in compliance. Being one of the earlier guys, I guess, they were still figuring things out.*
- **Driver Quote:** *When I did my DOT physical about 4 months ago, they didn't even know anything [about my OSA]! I actually snitched on myself.*

Program Staff Feedback and Supporting Quotes: Below are driver quotes regarding PAP compliance monitoring and long-term management of OSA.

- **Staff Quote:** *When we developed the program with OSA PROVIDER, we… said we want the drivers to get APAP not CPAP, we want the wireless monitoring, we want this periodic monitoring, which is the compliance piece of it, and we will pay for masks to make sure that the drivers… through our study we're going to pay for the original mask and replacement masks throughout this 12 months to make sure they're given everything they need to be successful and that we agreed to pay for the labs and follow-up kind of stuff because that was something we wanted to make sure is that we got these guys who had never been tested or treated in the past, off to a good start and provided everything in the process they needed to be successful.*

- **Staff Quote:** *The vast majority of our drivers are compliant but we tend to have problems with the newly diagnosed. Sometimes they don't understand exactly what the requirements are. Sometimes they won't use it at home. They feel it is okay to go home to get rest and then not get any sleep and come back out and drive. So we kind of have to reinforce that with them.*

- **Staff Quote:** *As an overall group [compliance is] good. We have more that are complying than are not. We've lost less than 10% to noncompliance out of the program altogether, you know where the driver decided they weren't going to use it and we were going to pull them off the truck so they self-terminate. We have other drivers, we probably have at least 35-40% who struggle and have to have repeat visits to have mask fittings or education or more serious discussion. I would say 35-40% at least, yeah. Because it's not an easy thing to acclimate to.*

- **Staff Quote:** *If you are just thinking about the machine itself, claustrophobia and the uncomfortableness of that mask is the biggest complaint. That is the largest complaint. And I can't sleep with it on. And when you think about our drivers versus drivers who are home every night …it is not a great lifestyle anyway for sleeping and when then they have to use a mask it is really important that we strive to get them the best mask, the most comfortable fit that they can. You know if the humidifier is needed 'cause that aids their nasal passages and their congestion level that is administered properly. So it is really critical to get that machine right.*

- **Staff Quote:** *It's also cumbersome because it robs the drivers of some of their storage space under the bunks. I know that's probably an issue, I hear about it all the time, I hear it! These trucks weren't designed to have that inverter in there with this wire coming through, so they have to cut a hole for the wiring. And the experiences have been variable. Some guys are in and out and I've had guys that wait until almost midnight before they get their inverter put in their truck.*

- **Staff Quote:** *I think it is just an understanding from our department… we do realize that this could be a difficult adjustment for them to be a commercial truck driver… they do need to be on treatment and to be consistent with their treatment and follow the COMPANY requirements or it can affect their livelihood.*
- **Staff Quote:** *You know… so you try and put yourself in their position at the same time but not just shutting them out and pushing them towards someone else… but you know you have that type of relationship with your driver. Some things you can say with and to your driver to make them feel comfortable in using the machine.*
- **Staff Quote:** *Well actually it is OSA PROVIDER that monitors PAP compliance. And then they communicate with us and OC health. Also, their data program is very easy to read. I like the format of their data presentation around usage. It is a neat calendar kind of format; you can easily read the program indicators to see how long he's used it, whether the machine didn't have a read out or if there was a mechanical malfunction.*
- **Staff Quote:** *If the driver is not working with OSA PROVIDER then they notify me. So, it's whether a notification that OSA PROVIDER comes back with to say that this driver will not communicate with them or this driver needs to come in and get a mask fitting so that we can reduce leaks, or this driver needs a lab. At that point is when [the carrier] is contacted.*
- **Staff Quote:** *But they have to make the conscious decision because I think that is personal. I'm not going to tell you to exercise, you know. You want to be fat you can be fat. If you want to smoke for 20 years it is all on you. You know, we are responsible for compliance and this is a business. We are here to make money and provide a service to a customer and I am not going to sit there and have a conversation with a driver about why he can't walk a mile a day when I've got guys waiting on the line that actually need business-related items. I mean I think that is crossing, it can come from occupational health, it can come from other sources, but it doesn't need to be coming from an operations group that are responsible for utilizing capital equipment and generating revenue with those assets you know.*
- **Staff Quote:** *One of the things that I think works well…..I like the ResTraxx™ monitoring that we do. That really helps our knowledge of how their acclimating is going.*
- **Staff Quote:** *That first month [of compliance monitoring] is a critical intervention point.*
- **Staff Quote:** *In the very beginning the drivers are instructed that they have to leave everything plugged in together and the power plugged in all the time so the ResTraxx™ can transmit. Sometimes they're worried about that, they might put everything away and try to get it out in time when they think the transmission is going to happen and we*

miss data. If we have missed data we have to call them and try to find out, is it because they're out of range? Is it because they have everything unplugged? And tell them to plug things back in and I have to request histories from ResTraxx™. So that can be challenging with them.

- **Staff Quote:** *A lot of drivers are good about sending [the compliance data cards] back. We had a batch of bad cards for some reason! I've had a few drivers that have had to send me a couple of cards because I couldn't read them. For the most part they do work pretty well! One of the things I don't like is that it only can record 6 months' worth of information and so I have to really look at a couple of reports overall. And some of their specific programs can be quirky and have issues. But it allows us to give the drivers really good feedback about how they're doing.*

- **Staff Quote:** *The first step is to get them on the APAP and just see what happens. Sometimes the use of a device, itself, will allow you to see central apnea. It will actually bring out other complex apnea, that's how it's diagnosed, not just based on what we see on the test. So you have to follow that very closely because it could give you clues that there are other disorders there. And that's the medical management part.*
- **Staff Quote:** *Now, I also said it depends because if we have diagnosed a driver with OSA and they're a part of our program, and yet, the data from the machine indicates that the driver's apneas are not being controlled effectively, which could be an indication of more complex sleep apnea or another sleep disorder, then as part of our trial, we are paying for those labs and our drivers are going to the COMPANY lab, having the overnight evaluation, having the consultation with COMPANY and being treated for those things. Because at that point, COMPANY PHYSICIAN is their physician because they agreed to go through the lab. Now, those sleep disorders, unless it is one that would disqualify them from driving, we find out about because the driver has to be DOT re-certified. We are facilitating their treatment of other sleep disorders, I should say.*

- **Staff Quote:** *So we had talked about long term, if this is regulation, we'd have to at least get it once a year because we'd have to know the driver was being compliant before they could get their DOT recertification. But we're thinking we probably want to do it at least twice a year. And it may be every 3 months.*
- **Staff Quote:** *We take meticulous notes on our phone calls, email correspondence, we keep all of that. Because if we need to back up a driver with, "look they're really trying but here's what's going on," we can do that. Or, just the opposite, if we can't get ahold of somebody and we're asking for help but we're not getting responses back, then we've got something on it as well.*

- **Staff Quote:** *A lot of drivers are good about sending [the data cards] back. We had a batch of bad cards for some reason! I've had a few drivers that have had to send me a couple of cards because I couldn't read them. For the most part they do work pretty well! One of the things I don't like is that it only can record 6 months' worth of information and so I have to really look at a couple of reports overall. And some of their specific program can be quirky and have issues. But it allows us to give the drivers really good feedback about how they're doing.*
- **Staff Quote:** *Because we depend on those data cards, there is a lot of opportunity for problems. Yesterday I counted 167 cards that had errors on them and I'm working with the manufacturer to understand why these cards are coming to me with errors. Is it a problem in transit, is it the postal system, is there a magnetic issue? Did some of my drivers know that, well, if they don't download it properly it buys them another month of driving non-compliant or giving them time to come into compliance – absolutely! So I think that until these technological holes improve, we have to deal and manage with the data cards.*
- **Staff Quote:** *It is a well-run program, I think; it's very hands-off when it does fall out of compliance, when a driver does fall out of compliance there are some consequences, but on the whole it is a pretty self-sustaining program from an operations perspective.*
- **Staff Quote:** *I feel like not only as part of the role of making sure that equipment is installed, when a driver is not compliant we feel like that is a safety violation and we shut the driver down when they are not compliant.*
- **Staff Quote:** *If they're below compliance, we work out, based on how low they are, what they can do to get that up. And most of the drivers, they might be angry to hear, if they don't do something quick they may not get that letter for the next [certification] card. But once I explain that I'm trying to do this to help them so they can stay on the road, they'll do what they need to and they'll get extra [compliance data] cards to us and prove their compliance…Sometimes, they're trying but they may have issues. They may have some physiological issues or sinus issues that have to be addressed with additional therapy. So they may not necessarily get the 1-year card but they might get another 90 day [card] while we're working out issues. Sometimes we extend the ResTraxx™ monitoring.*
- **Staff Quote:** *And if they're below compliance, the typical policy with them is they get pulled off the road for a week to prove for that week that they can be onboard and be compliant. And once that's proven, then we can start them over again but they're monitored more closely. And like you were saying, they get weaned off..*
- **Staff Quote:** *We basically [tell the driver], "This is where your compliance is, if it's below a certain amount then I am obligated, per [the carrier's] policy, to report that to the project manager and your fleet manager and then they*

will discuss with you what they want to do." I don't want the drivers feeling like we are pulling them off the road if that's the decision that's made. I try to be very clear with them about what our role is. And I try to be very clear with the fleet managers too. If I get one who's not sure what to do and they call me and say, "Well what are you telling me to do?" I'm telling you to call the COMPANY Coordinator, so you guys can make a decision because I'm not telling you who drives and who doesn't. It's not our role in that.

- **Staff Quote:** *Also, there is a cost involved with . . . we have certain idle percentages that drivers have to hit. Those without sleep apnea are allowed 5%, for instance, for this quarter. If they do have sleep apnea they are allowed 40%. And that amounts to about 10 hours a day of idle time. So you multiply that by how many gallons of fuel they are going to burn to regenerate the sleep apnea machine so that they can use it again. So there is definitely a big cost associated.*

- **Staff Quote:** *The most challenging thing is communication, especially if a driver does not have a cell phone. We have a couple drivers who are OBC only, onboard computers only, so that is very difficult to get messages to them and then wait for them to call back. And then, if they do have a cell phone, and that doesn't always work, so the communication issue can be very challenging. People who work at night and sleep during the day…that's a whole other correspondence issue because we're working on opposite schedules.*
- **Staff Quote:** *And the drivers, one of the things is getting them to understand to get onboard with corresponding with us. If they have to call me everyday to tell me what their issues are so we can record them, then do it. Some of these guys have a very, "I'll just put my head down and do what I'm told and not make any waves." But then if they're having problems and not telling us, that's another one of the challenges. When it comes down to I have to look at their compliance numbers and if those aren't where they think they are based on their effort, that's just a big challenge for us.*
- **Staff Quote:** *Yeah, that was kind of like part of it… well, a lot of times it's 'cause they don't have to wait because they are busy or backed up. We've heard some attitude problems with some of the personnel in regards to that.*
- **Staff Quote:** *Fleet manager and safety manager education would be helpful in being supportive of the drivers when they need to get back to us. But if the people at CARRIER that control the routes are a little more understanding of the importance of…some guys have great support from their managers and some guys do not and that also plays a role in their response to compliance.*

- **Staff Quote:** *One of the things we also do as part of the medical management is when we're doing the download, the scoring, and the interpreting, we're also looking at the medical history. Oftentimes it's informative because they may have elements on their sleep test that are not just straightforward. So we can pick up all those little variations and that will inform the compliance team when they're out there talking to the guy who says, "I'm not doing well," well, it's probably because he has restless leg syndrome as well. And he probably also has heart failure and he may also have Cheyenne Stokes respirations or complex apnea. So it kind of helps us in our compliance program.*
- **Staff Quote:** *We do have those [health] programs and our longer term view was to try and facilitate the driver using more than one of these if they have a medical condition. We have a third party that identifies drivers at risk for certain medical conditions and contacts them and we don't know which drivers they contact. Our thought was to have those drivers work with that group to try and help improve their overall health, long-term.*

Theme 6: Summary of Program Outcomes

Driver Feedback and Supporting Quotes: Below are benefits drivers experienced from participating in the SNI or JBH OSA program.

- **Driver Quote:** *My quality of sleep is a little better.*
- **Driver Quote:** *I find myself yawning a lot less. Truth of the fact is that I probably wasn't getting good sleep so that's a good thing.*
- **Driver Quote:** *But now sleeping on the machine, I don't snore at night, my wife tells me, "you slept the whole night and you didn't snore." So I know its benefitting her too as well as me.*
- **Driver Quote:** *I was waking up a lot in the middle of the night but I'm not doing that as much to urinate.*
- **Driver Quote:** *I like [the PAP treatment], I sleep better with it and I also use it to take a nap. That's the only way I can take a nap because I will not get to sleep otherwise, [the PAP] helps a lot.*
- **Driver Quote:** *I now have more energy. But see there's a downside to that – at the end of the work day I've noticed I'm still ready to do another 10 hour!*
- **Driver Quote:** *I'm not nearly as tired when I get ready to shut down at night.*
- **Driver Quote:** *I sleep less but I have the same energy.*

- **Driver Quote:** *I notice I have a lot more energy. I used to have a large thermos that I used to keep full and just chug the coffee to stay awake during the day. Sometimes in the middle of the day I would just be useless. A lot of times I'd have to pull the truck over and go to sleep, which greatly impacts your day if you have to work a 14-hour day. I'm not doing that anymore. One cup of coffee, if any. Some days I don't pick up a cup of coffee at all.*
- **Driver Quote:** *I normally was a light sleeper, but since I've been on the machine, I get into a deeper sleep. I don't hear as much going on around me as I did before I started on the machine.*
- **Driver Quote:** *Well, I like that it keeps you alive cuz you never know; they tell you you might die without [PAP treatment].*
- **Driver Quote:** *I'm making better eating choices [since being on PAP treatment]. Just to give you a quick example. When I had my ambulatory test done, I could not walk from my truck to the testing trailer there, about maybe 100 yards, without stopping to catch my breath. After a couple of months with that machine I could walk 2.5 miles. I would just get out there and start walking. But I was 315 pounds when I went up for that test. Doctor never once mentioned about losing weight. You know, it's just better eating choices, having more energy, just being active and the pounds started coming off!*
- **Driver Quote:** *This has energized me so much it's lifted my attitude in a positive way. I feel mentally better because of this and what it's done for me. I haven't had any aches and pains since I started! I'm saying it has improved to such a point I can use my hands better! My circulation is better, my sight is better! My last physical I didn't need my glasses to pass the physical. It's been wonderful for me – I'm really upbeat about it. I could go on all day about my positive view of it… my whole body is operating better!*
- **Driver Quote:** *I've been in the program about 8 months now. What it's done for me is that I deal with high blood pressure and diabetes. When I sleep at night, sometimes I used to wake up with a terrible headache and my heartbeat fluttering, it would be beating so that I could feel it right there in my temple. And that's before I started in the program. Once I got on this program, matter of fact I haven't had it since I got on it, about 8 months ago!*
- **Driver Quote:** *My blood pressure came down in 3 months…after being on this [program].*
- **Driver Quote:** *I've lost a few pounds, not a lot but a few pounds over the past 7 months, probably 10 or 15 pounds.*
- **Driver Quote:** *I've been in the program 18 months. When I got the initial [sleep] testing I was having 69 apnea events per hour, so for 7 hours I had over 400 times when I stopped breathing! If I have 1 [apnea] per hour now, it's a lot. I've lost over 100 pounds. I couldn't say this18 months ago but I used to wet the bed every night and I*

couldn't understand why. Being a man, I was 50 years old; I thought it was my prostate. I used to have to line my bed with those puppy training pads, just to keep the bed from getting all soaked. Ever since I started the [PAP] treatment I haven't had that problem once. They said it's because if your body isn't getting enough oxygen during the night when it sleeps, your whole body shuts down, your kidney shuts down, you liver shuts down. I guess my case was so severe that my kidneys were shutting down and I was wetting the bed.

- **Driver Quote:** *I can drive better.*
- **Driver Quote:** *It was always a concern of mine, am I going to fall asleep at some point [while driving]? I don't have that problem anymore.*
- **Driver Quote:** *Actually marital life is better because [I'm not] snoring! I can't tell you the last time we had an argument! We're like two teenagers. Just not only my sleep [is improved], but her sleep also, for those who have a partner.*
- **Driver Quote:** *My likes, I don't really notice anything about it that improves……I don't really have any likes about it.*
- **Driver Quote:** *I can't tell any difference before, let's say I went 6 months without it, no difference.*

Drawbacks: Below are drawbacks that drivers experienced from participating in the SNI or JBH OSA program.

- **Driver Quote:** *I've only got one dislike. The blasted machine, depending on your elevation, depending on your atmosphere, where you are, whether the humidity is high or anything; it will inadvertently fill up with water, the mask will come loose and I'm having to make constant adjustments, that sort of thing.*
- **Driver Quote:** *I have one more for you. I wanted to add one with the humidity. I don't use the humidity, because it will, it doesn't know when to stop… and you just wake up and it's like, just water everywhere!*
- **Driver Quote:** *The one thing, I have a full facial mask, and it does cause your eyes to water. You may see the discolorations on my nose as well as my eyes are puffy. Because you wake up and both your eyes are just red. I started noticing I'm rubbing this eye raw because it just waters during the day from having that mask on at night.*
- **Driver Quote:** *The mask is the biggest aggravation.*
- **Driver Quote:** *My girlfriend, every once in a while when she spends the night, since I wore the nasal [mask], she calls me Snufflupagus. That's when I tell her it's time for her to go home!*

- **Driver Quote:** *I just have a problem with being on [the PAP]! It's not that I mind being in compliance or using it. I just don't like my life being attached to a machine! I'd rather breathe on my own and be happy….that's just me. It's the biggest drawback I've got with it…I don't want to be on a machine.*

- **Driver Quote:** *I guess since we're talking about the CARRIER'S policy, I somewhat agree about how they kinda forced it on us without a lot of explanation going in. They didn't say it was going to be monitored, which I don't really have a problem with; I just have a problem with not being told that up front. When they said you're going to do a sleep apnea survey, and then like he said a couple of months later, you've got to go do this and it's going to be monitored or you're not going to work here, it was kind of slammed in your face. I'm glad to have it but I didn't like the way they went about that.*
- **Driver Quote:** *It seemed like it was a little bit sneaky.*
- **Driver Quote:** *Biggest dislike actually was getting into the program…getting inducted into it. I just didn't appreciate the way it was done or how COMPANY's people handled it. At the beginning I didn't know anything, I mean, they could have been a little more……explain a little more, been a little more polite on the phone, I just didn't appreciate it.*
- **Driver Quote:** *To me it's conflict of interest for the people that's doing the sleep apnea [testing] to have the machines, because I didn't even sleep that night, but I was told that I had moderate to severe sleep apnea... Next morning I got up, got a machine, and now I'm stuck with it…can't get off of it.*

- **Driver Quote:** *So I wish there would have been a little more thorough testing of what my actual situation was and then meeting me up with the proper equipment, given that this is a life-changing, forever thing; and I can't even continue to work as a truck driver if I'm not using this thing!*
- **Driver Quote:** *They just put this [portable testing] equipment on me one night and that's how I got tested. I wish that would have been more of a preliminary thing and once I got that preliminary testing I would have maybe gone into a lab and had a little bit more thorough examination of what my actual condition is and what my problem is.*
- **Driver Quote:** *I think I slept about 30 minutes that whole night [of the PSG]. They kept coming in and rummaging around in my room. I'd wake up and they'd be over there in some drawers…people just kept coming in and waking me up and rolling me over and saying this little thing came undone. I woke up about a dozen times and I know they came in the room six or seven times.*

- **Driver Quote:** *I don't like the lab either. You want to tear everything all to pieces; you don't really get the comfort level you need to get proper data to them.*

- **Driver Quote:** *Dislike is probably keep sending the chip in…that's a hassle.*
- **Driver Quote:** *Convenience. You can just leave and somebody call you on your cell phone, "time to send your card back in." I'm like, why didn't y'all call me 2 days ago? … when I'm gone, I'm gone. I'm not going to make a special trip to come back through home to just [to send in my data card]. You could [mail it in while on the road], but a lot of times you go to Occupational Health. Anybody got any envelopes? Anybody got a stamp? So you got to carry those things around. I don't particularly carry those things around.*

- **Driver Quote:** *My dislike is I actually sleep less and I have less energy than I had before. I was a morning person and now I'm not one at all.*
- **Driver Quote:** *I do wish I had my energy back. I will say though, now, I can get in the truck and drive 10 hours down the road.*

- **Driver Quote:** *Sometimes, a lot of times, it'll wake me up, almost every night, at least once [the PAP machine] wakes me up just from drying me out. I go back to sleep well enough but… I just… I wake up coughing and then I gotta rummage around to find a water bottle…hopefully I have one and don't have to get out of my truck and go into a truck stop or something.*
- **Driver Quote:** *Sometimes I wake up a lot adjusting the mask. I never did before; I never woke up at night. …but now I wake up every once and a while. And sometimes I take the mask completely off and I don't know what time I took it off, I have no idea. It's beside me but I don't know when I took it off!*

- **Driver Quote:** *I never saw a doctor. I was completely diagnosed over the Internet, or whatever it was. They sent my test results to a hospital and the diagnosis came back... I never saw any doctor attached to their name, which kind of ticked me off because, you know, you have sleep apnea, what does it mean? Can you give me an explanation? One of the technicians said, "well your case is pretty mild…your right near the borderline." And I'm like, "OK, that's great," but I'd like to have heard that from a doctor.*
- **Driver Quote:** *I just had a lab technician… when I got [to the sleep lab], she was there and hooked everything up to me... I woke up the next morning and she was like, "you stopped breathing five times." She told me that she*

would give me the machine and that was it. I never talked to anyone that said "my name is doctor this or doctor that." I never even asked her what her qualifications was. She had on a white jacket, but that was it. I never talked to a doctor, I talked to my own personal doctor, but not any sleep apnea people.

- **Driver Quote:** *They just said, "Here take this [PAP machine] and go out on the road." And if it's not working it's really hard for us to get it fixed again because I'm wherever and you're over here and how can we meet again? You can't send something to me because I don't know where I'm going to be in 2 days even!*
- **Driver Quote:** *[I have to use the PAP] every single day. I can't take 2-week vacations, I can't go up to Alaska anymore like I used to and go camping in the middle of the woods for a month. I can't do that anymore! My whole life has changed! And not all for the good either!*
- **Driver Quote:** *I'm not going to lie, it was very frustrating up front because when people threaten you with your livelihood… that makes you very unnerving.*
- **Driver Quote:** *I was ready to quit. I was so upset when I did that, it's like, you're telling me if I don't do this now I cannot work for this company anymore? It's like, "I don't want to do this, I want to back out…I do not want to do this!" I felt like cattle in a corral, kept getting narrower and narrower and I ended up going through that shoot, and I wasn't ready to go through that shoot! Now I'm not saying I'm disappointed now, because I have had some improvements in my life, but, I regretted it for a long time. Forever now, as long as I want to be DOT compliant, I have to use this machine. It's like crap, you know!*
- **Driver Quote:** *I don't want to use this sucker when I'm off!*
- **Driver Quote:** *Having to break [the PAP machine] down and take it home or break it down and put it in the truck. If we had two machines, that would be perfect!*
- **Driver Quote:** *And that's part of the pain in the butt that I find, is, even on weekends! I got a daughter that lives almost 200 miles [away]. And I got to take the machine with me when I go out to see her and spend the night…I don't have a choice, I have to use this or I can't work.*

Program Staff Feedback and Supporting Quotes: Below are supports that assisted the program staff in implementing the OSA program with SNI or JBH drivers.

- **Staff Quote:** *It is a well-run program I think, it's very hands-off when it does fall out of compliance, when a driver does fall out of compliance there are some consequences, but on the whole it is a pretty self-sustaining program. From an operations perspective.*

- **Staff Quote:** *You know you try sleeping with something over your face. You know so you try and put yourself in their position at the same time, but not just shutting them out and pushing them towards someone else… but you know you have that type of relationship with your driver. Some things you can say with and to your driver to make them feel comfortable in using the machine.*

- **Staff Quote:** *I think it is a fairly seamless process from our end. Through e-mail, "hey your driver has been identified as potentially having sleep apnea you need to get him routed." We work with PROVIDER to get them in there and they know as soon as the test is over: And if it's here in LOCATION the shop is very good about getting the inverter installed and I mean within 24 hours… if your driver's been diagnosed he has the equipment that he needs and knows how to use it. So I think it is a pretty seamless turnaround.*

- **Staff Quote:** *But OSA PROVIDER does the majority of it because they administer the machines and they will send out new hoses, new masks, and new equipment. So OSA PROVIDER does the majority of the machine work if you will. The hardware work.*

- **Staff Quote:** *I would say the number one complaint that we get from drivers who have been diagnosed is 'Now what do I do? You've given me this machine.' And we know that they are told how to use it but it is a whole different way of sleeping and living with this and then they are frustrated and OSA PROVIDER does a great job of helping them work through those issues if they call.*

- **Staff Quote:** *The staff is extremely good at addressing issues. They are just a facility that this is their position and they are very good staff adjusting to questions asked by the drivers and difficult questions being asked and it can be very beneficial to the driver if the driver reaches out to them. And with the monitoring system too, PROVIDER staff is in contact with them regarding any issues that they are having.*

- **Staff Quote:** *We are fortunate that way because we have always taken such a high road when it comes to safety and they know that culture and they hear it from training, they hear it in the way we dispatch, they hear it all the time, all the training that we do, we can say, "look, we've always considered your safety and your well-being to be the most important thing."*

- **Staff Quote:** *Well I think [drivers] see [that] we care and we do and that is one of our core values—safety.*
- **Staff Quote:** *Health-wise of course…we implement the program for safety and health-wise.*
- **Staff Quote:** *We found that within our own practice, testimonials coming from patients are very important to other people. Because it's changing major behavior. Their night time is a very big, personal time, and we just invaded it.*
- **Staff Quote:** *One of the neat things we have here at LOCATION in the form of education is an individual on our floor that is positive for sleep apnea. And he will do some testimonials with the driver if a guy is really struggling with it. He is very willing to step in and say "Hey, let me tell you about my personal experience." So having that in-house testimonial I feel by NAME has been really helpful with drivers.*

Challenges: Below are challenges that program staff faced while implementing the OSA programs with company drivers.

- **Staff Quote:** *There are many drivers that are struggling for many reasons on APAP. They may have mask leaks; they may have a feeling of suffocation or too much pressure.*
- **Staff Quote:** *When we first began the program four years ago we only had about three sites actually where the sleep study could be done. Now we are up to, I believe, about 15 sites around the country. So initially I would say it was probably more time-intensive with scheduling and routing drivers.*
- **Staff Quote:** *What I would love to see attached to [the screening questionnaire] is some biometrics with it. So I put the driver on the scale, I take a tape measure around his/her neck to get a little bit finer data, if you will. That's what I like about it and that's where I see the possibility of some improvement.*
- **Staff Quote:** *Sometimes the drivers drag their feet about calling occupational health back. One, they may not know what it is and two, they're a little defensive about this sleep apnea issue right now. "I'm not going for the test, there is nothing wrong with me, I don't snore, I don't have this, I sleep just fine" is usually what we hear. From our position we just encourage them to go take the sleep study, if they are not positive they'll get a good night sleep in a nice warm bed and they'll be out the next morning at 8:00 and you know they are on their way. But if they are identified then we try to stress to them that this is for their own safety and the safety of the motoring public. It is not really optional at that point.*

- **Staff Quote:** *So there is a little time lag where [the screening questionnaire] loses its validity, if you will. In other words [the driver] may say, "I took this months and months ago, why am I just now getting called in for this? What is going on?"*

- **Staff Quote:** *There are limitations on the recording device. Since we do not have the capacity to monitor brain waves, we are potentially losing diagnosis of mild or to moderate population of truck drivers that could still be having issues that are affecting alertness and higher functioning that they need to be driving big rigs. So getting a device in there that can monitor EEG too would be good in the ambulatory device.*
- **Staff Quote:** *We have a wonderful process in place and, because of some technology restrictions, it's still a little bit more of a manual process in that there's some exchange of data back and forth that has to go through the mail from the driver to [the OSA provider]. Certainly we look to explore other venues that could make that happen in this*