Transport Canada Transports Canada

EFFECTS OF A FATIGUE MANAGEMENT PROGRAM ON FATIGUE IN THE COMMERCIAL MOTOR VEHICLE INDUSTRY

< FIELD TESTS AND RESULTS >

FMCSA Motor Carrier Safety Advisory Committee (MSCAC) Meeting

Aug. 30 - Sept. 1, 2010
Alexandria, Virginia

Canada

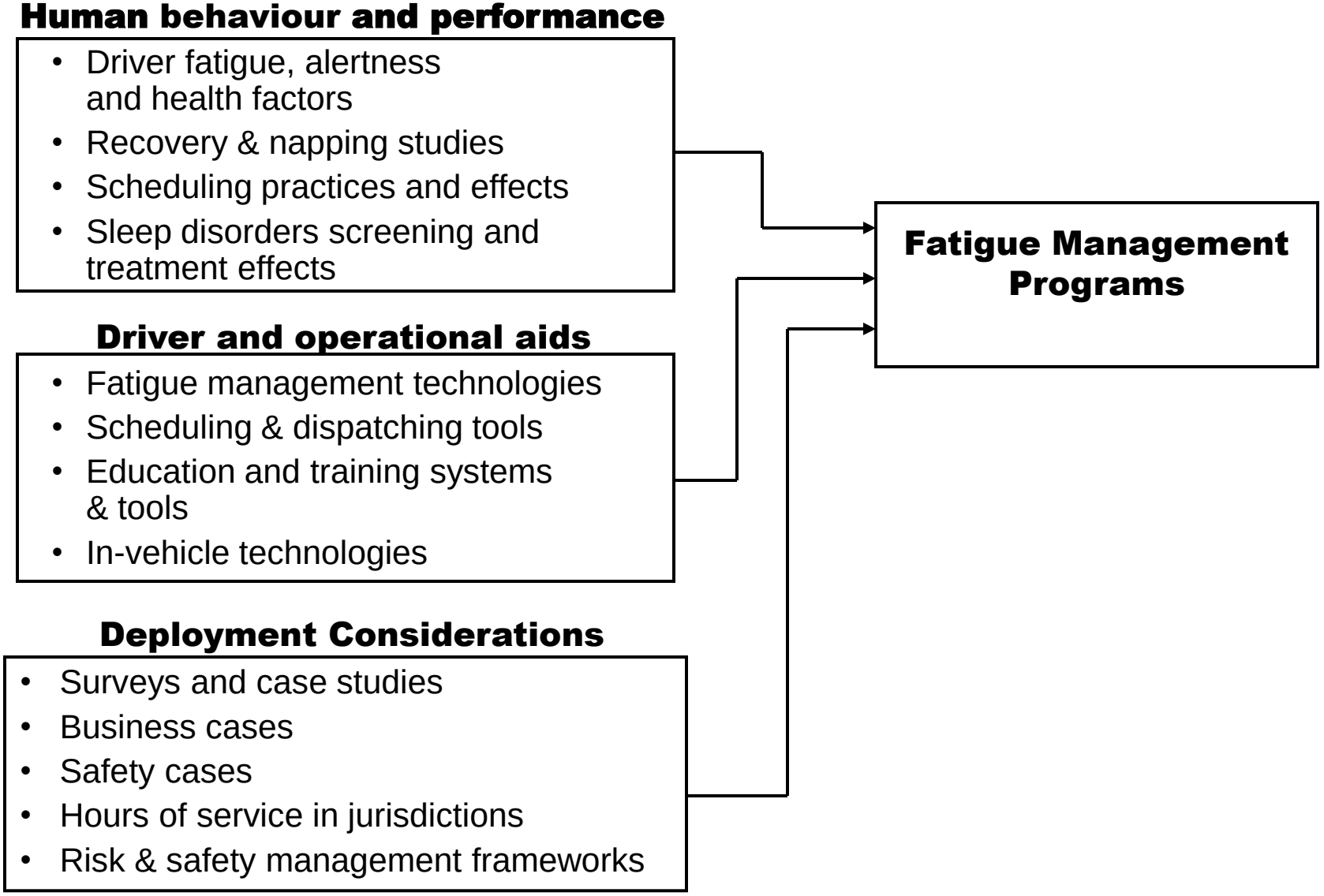
PRESENTATION OUTLINE

- Background
- Overview
- FMP intervention
- Results of FMP intervention
- Moving forward with FMP: challenges and state-of-practice

RESEARCH & EVOLUTIONARY PROCESS

Over 20 years of Canada/U.S. collaboration on fatigue related research that has greatly expanded the knowledge base in the field and society's understanding of the challenges and opportunities to do better.

RESEARCH & EVOLUTIONARY PROCESS



RESEARCH & EVOLUTIONARY PROCESS
THE ESSENCE

- Driver sleep disorders
  - Prevalence: higher proportion in driver population
  - Performance impacts: clear impacts but less so on driving performance
- Driver individual differences
  - Small percentage accounts for a much larger proportion of problem (10% versus 50% ‘rule’)
- Driver on-duty schedules
  - HOS: dealing with the law of large numbers
    - Violations: issues of enforcement, EOBR, etc.
    - Are they upper limits that can be sustained indefinitely
    - Do they allow drivers to ‘have a life’, which impacts off-duty behaviour
  - Night versus day driving: clear differences
- Driver off-duty schedules
  - demands of ‘living’ in social, family & economic circles
  - Night versus day sleep: clear differences
- Driver self-monitoring for condition and performance: we’re very poor at doing this
- Corporate culture: where are our priorities and how do we project these
- Societal culture: where are our priorities and how do we reflect & enforce these

NORTH AMERICAN FATIGUE MANAGEMENT PROGRAM FOR COMMERCIAL MOTOR CARRIERS

- Phase 1 (Beta test): focus groups and runs with six drivers in Alberta to identify and beta test subjective and objective tools for use in data collection
- Phase 2 (Pilot Test) with 45 drivers in Alberta, Quebec and Texas for protocol development, test procedures and tools and obtain some preliminary data and feedback[1]
- Phase 3 (Field Test) with 121 drivers in Alberta, Quebec and California to evaluate the effects of an FMP on driver fatigue and company operations compared with baseline[2]

1. Development of a North-American Fatigue Management Program for Commercial Motor Carriers, Phase II (Pilot Study), TP 14828E, January 2006, Transport Canada.
2. Effects of a Fatigue Management Program on Fatigue in the Commercial Motor Carrier Industry, TP 14921E, August 2009, Transport Canada.

NORTH AMERICAN FATIGUE MANAGEMENT PROGRAM FOR COMMERCIAL MOTOR CARRIERS

OVERVIEW OF PHASE 3 FIELD TEST & RESULTS

SPONSORS

- Alberta Transportation (AT)
- Alberta Workers' Compensation Board (WCB)
- Commission de la santé et de la sécurité du travail du Québec (CSST)
- Federal Motor Carrier Safety Administration (FMCSA)
- Société de l'assurance automobile du Québec (SAAQ)
- Transport Canada (TC)
- In-kind, operational, and other financial support:
  - Alberta Motor Transport Association (AMTA)
  - American Transportation Research Institute (ATRI)
  - Association du camionnage du Québec (ACQ)
  - Canadian Trucking Alliance (CTA)
  - Respironics Inc.

RESEARCH GROUP

Contractor & research team leader

- Human Factors North Inc. (Alison Smiley, Ph.D., CCPE)

Alberta group

- Research team: SagaTech Electronics Inc. (John Remmers, M.D)
- Volunteer Motor Carrier: ECL Group

California group

- Research team: Alertness Solutions Inc. (Mark Rosekind, Ph.D.)
- Volunteer Motor Carrier: JB Hunt

Quebec group

- Research team: Alpha Logik Inc. (Diane Boivin, M.D. Ph.D.)
- Volunteer Motor Carrier: Robert Transport

STUDY GOALS

- To implement a comprehensive FMP, involving:
  - Sleep disorders screening and treatment
  - Educational sessions at all levels of company
  - Driver sleep disorder screening and treatment
  - Scheduling support
- To assess the implementation of the FMP through pre/post FMP comparisons of:
  - Drivers' fatigue, sleep duration, performance and satisfaction levels
  - Corporate measures (e.g., absenteeism, claims), perception of fatigue management practices and policies

STUDY PROCESS

- Set up project steering committee
- Issue RFP, contract with winning bidder & develop detailed plan
- Submit protocol to ethics committee
- Recruit companies
  - Present overview to management
  - Sign letter of agreement
  - Set up stakeholder committee
  - Set up implementation committee
- Recruit drivers
- Collect pre-FMP driver and corporate data
- Present educational program at all levels in company
- Screen for sleep disorders and provide treatment
- Collect post-FMP driver and corporate data
- Do data analysis and develop conclusions and recommendations
- Publish final report
- Determine follow-on research

DRIVER REQUIREMENTS

- Volunteers
- 24 – 64 years old
- Male or female
- Passed any physical examination required by law
- Held commercial drivers' licence for at least 3 years
- Agreed to:
  - be tested for sleep disorders and comply with treatment if diagnosed with sleep disorder
  - undertake educational components of FMP
  - Participate in data collection before and after FMP implementation
- Worked
  - wthin relevant hours-of-service regulations
  - Fatiguing schedules as defined by drivers and company dispatchers/managers
  - As 'night drivers'; driving at least 25% of hours between 00:00 to 06:00 during 4-6 days of on-road study period
- Excluded: team drivers, drivers with 'at-fault' involvement in fatal accident in past 3 years, prior conviction of logbook falsification, or with any history of unsafe driving

DRIVER SAMPLE

- Total of 121 drivers recruited and completed pre-FMP data collection
- 94 completed clinical screening
- 77 completed post-FMP data collection
  - Québec n=29
  - Alberta n=23
  - California n=25
- Reason for participation in study (top 3 of 8 factors presented)
  - Possibility of being treated by a sleep disorder specialist
  - To take part in the fatigue management training given by scientific team
  - Free access to CPAP (continuous positive airway pressure) machine

CORPORATE MEASURES: VARIED BY SITE AND AVAILABILITY

QUEBEC

- Accidents (count & description)
- Road infractions (count)
- Absent days (count & reason)
- Total driving time (hours:minutes)
- Total waiting time during duty (hours:minutes)
- Total rest time (hours:minutes)
- Distance treavelled (kilometres)
- Panic brake (count)

ALBERTA

- Accident data (count)
- Driving code violations (count)
- Rapid speed changes (count)
- Kilometres driven (count)
- Workers' compensation data[1]
- Black box data
  (excess speed, hard brake, fuel economy)
- Insurance claims
- Sleep apnea claims
- Driving time
- Waiting time

1: collected pre-FMP only

ALBERTA-CALIFORNIA-QUEBEC

AMSE Questionnaire: Alertness Management Strategies Evaluation (for corporate approaches to fatigue management

CALIFORNIA

- Accident data
- Workers' compensation data

FMP INTERVENTION

SLEEP DISORDER SCREENING AND TREATMENT

- Consent form
- Home recorder for initial screening
- ESS (Epworth Sleepiness Scale), SAQLI (sleep apnea-related quality of life), ANC (Adjusted neck circumference)
- Physician visit
- Diagnosis and treatment
  (CPAP machine, dental appliance, sleep hygiene tips)
- Assessment of adherence

EDUCATION PROGRAM

- Four modules (90 minutes each)
  - Core
  - Trip Planning
  - Wellness and Lifestyle
  - Sleep and Sleep Disorders
- Educational quizzes for each module
- Bi-monthly newsletters
- Train-the-trainer approach
  (although not used for 2 of 3 participating companies)
- Significant adjustments had to be made to original plan to make educational program feasible and practical in various company environments

DRIVER DATA COLLECTION

2 rest days	4 - 6 duty days	2 rest days
• Sleep-wake log • Actigraphy • Mood/fatigue assessment • PVT	• Sleep-wake log • Actigraphy • Mood/fatigue assessment • Workload assessment • Factors contributing to fatigue • Critical incidents • PVT	• Sleep-wake log • Actigraphy • Mood/fatigue assessment • PVT

RESULTS OF FMP INTERVENTION

SLEEP SCREENING RESULTS

- Based on RDI (respiratory disturbance index) values: 71% with sleep apnea; 32% moderate to severe
- ANC good predictor
- Wide range of adherence to CPAP: 5%, 60%, 69% (possibly related to in-person contacts with medical staff)

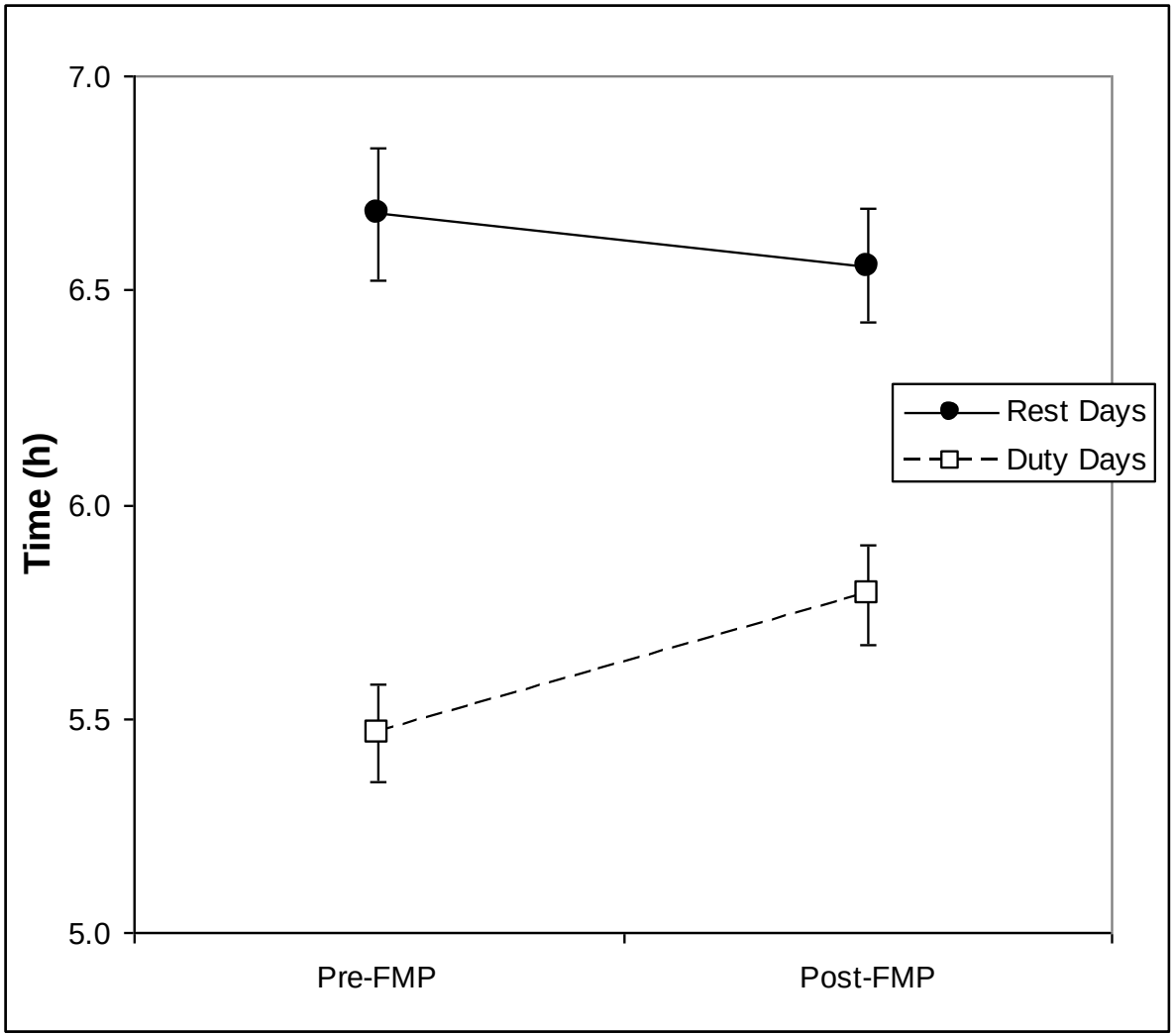
HYPOTHESIS 1

⇛ FMP will improve drivers' awareness of good sleep practices resulting in increased sleep time and quality

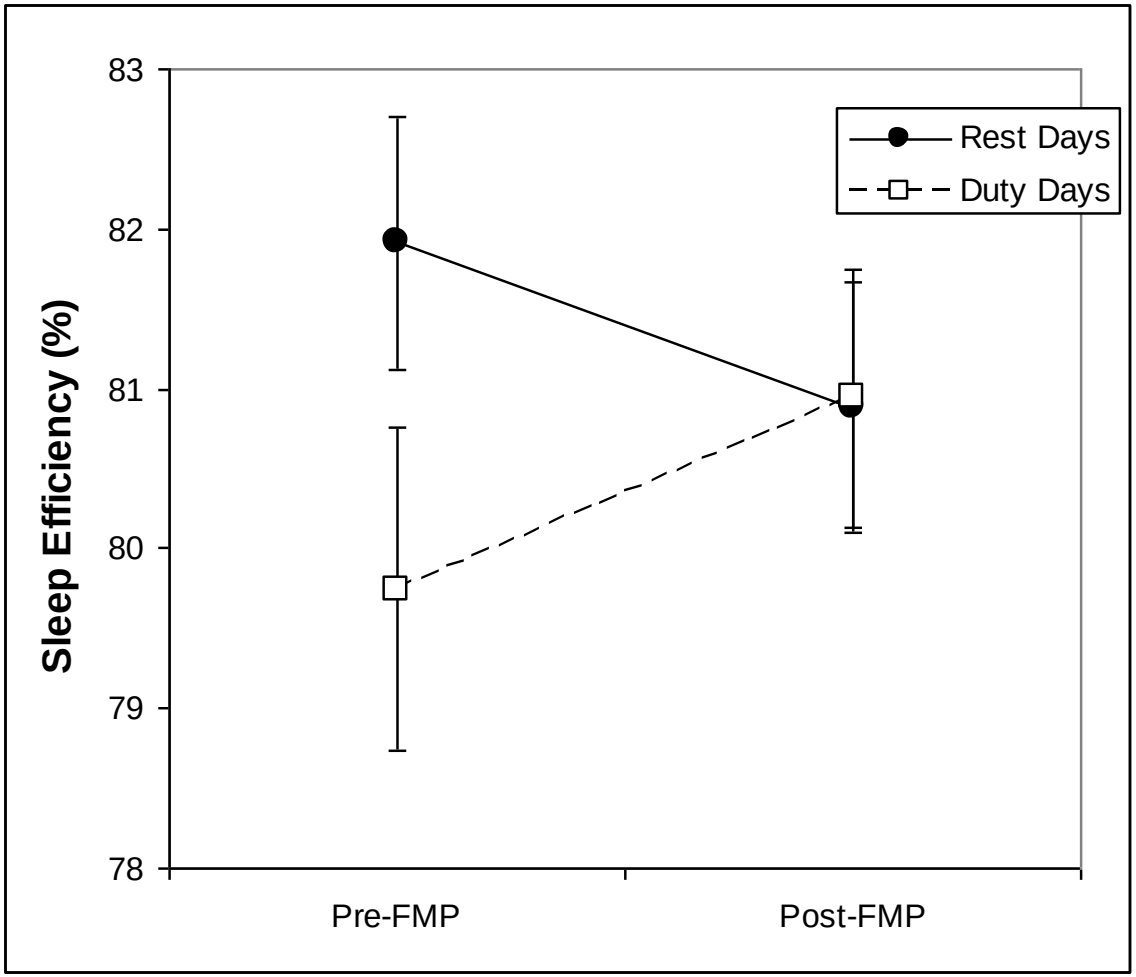
⇛ Post-FMP versus pre-FMP: duty days

- Reported sleep quality improved
- Main sleep period
  - Sleep duration 20 min longer
  - Sleep duration and efficiency improved compared to rest days
  - Increase in percentage of drivers reporting more than six hours of sleep before their shift
- More drivers defined as "night drivers" (unexpected) but proportion of night driving hours unchanged

SLEEP DURATION DURING MAIN SLEEP PERIOD (ACTIGRAPHY)



SLEEP EFFICIENCY DURING TIME IN BED



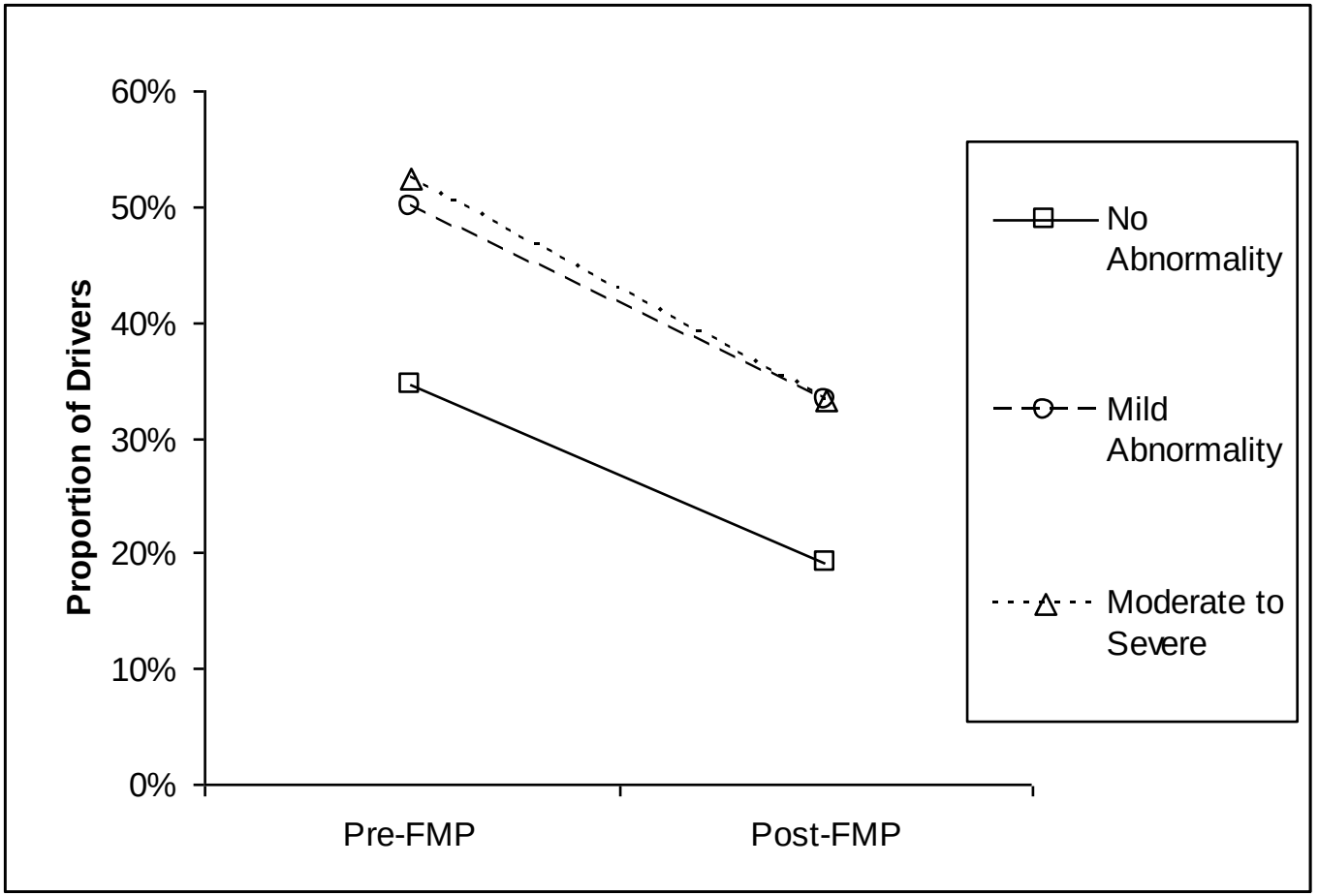
HYPOTHESIS 2

⇛ FMP will reduce subjective fatigue, improve psychomotor performance, and reduce critical events (near accidents) during duty days

⇛ Post-FMP versus pre-FMP: duty days

- Fatigue: less reported (trend)
- Critical events
  - Proportion of drivers reporting reduced from 46% to 29%
  - Events/km driven reduced by 40%
- PVT: increase in minor lapses at end of the day (unexpected)

PERCENTAGE OF DRIVERS REPORTING 1 OR MORE CRITICAL EVENTS



HYPOTHESIS 3

⇛ Sleep disorder screening and treatment is feasible and will reduce fatigue and improve sleep for affected drivers

⇛ Post-FMP versus pre-FMP
(reminder: 71% were diagnosed with sleep apnea based on home recorders and physician visits)

- Critical events
  - Severe RDI group more likely to report a critical event pre FMP
  - Severe RDI group showed greater reduction in critical events post FMP than other RDI groups
- PVT performance
  - On rest days, CPAP Adherent group had better PVT performance
- Sleep time:
  - No CPAP group & No Abnormality RDI group reported more sleep time in a 24-hr period
  - no difference in the other CPAP or RDI groups

HYPOTHESIS 4

⇛ FMP will improve corporate measures & fatigue management practices in the company (Alertness Management Strategies Evaluation):

⇛ Post-FMP versus pre-FMP

- Fatigue Management practices
  - improvements in education, alertness strategies, healthy sleep, organizational
  - More night drivers but same night driving overall
- Corporate Measures: reduced crashes and infractions, trend to reduced sick days at Québec site

CONCLUSIONS:
PRE VS POST FMP

- For drivers on duty days, FMP lead to more sleep during the main sleep period, improved sleep quality, less reported fatigue, fewer reported critical events but more PVT minor lapses
- Drivers with more severe sleep apnea (RDI) reported more critical events pre FMP and had greater reductions post vs pre FMP
- For drivers diagnosed with sleep apnea and who were adherent to CPAP, FMP lead to better PVT performance (reaction time, minor lapses) on rest days
- Drivers in No CPAP group & No Abnormality RDI group reported more sleep time in a 24-hr period; no difference in the other CPAP or RDI groups
- For companies, FMP lead to improved knowledge, perceived effort and experience regarding fatigue management and – in Quebec only, reduction in crashes & convictions and trend to reduced sick days

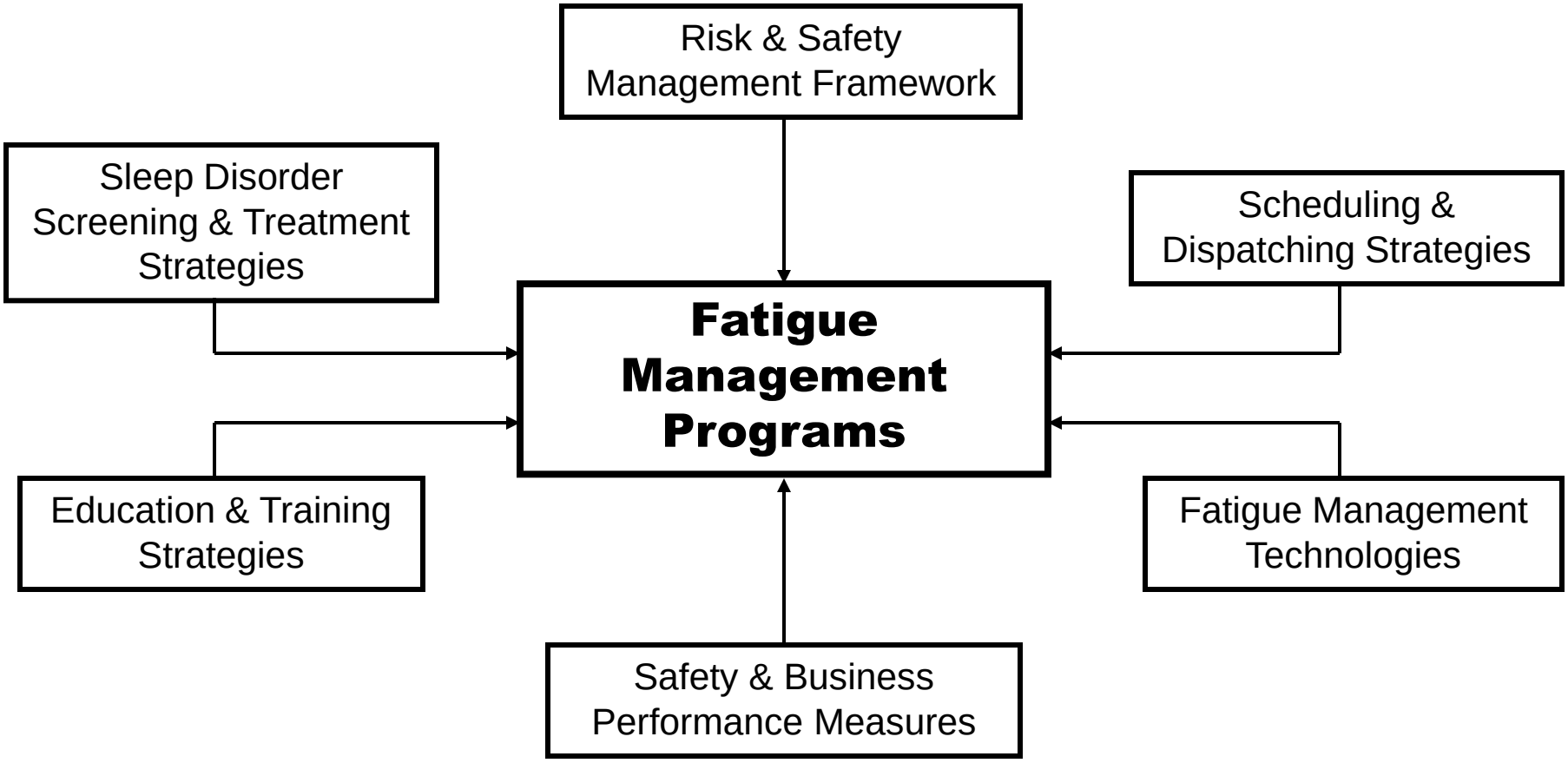
CONCLUSIONS:
FMP APPROACH

- A comprehensive FMP approach at the company and industry level is a promising approach for a long-term reduction in fatigue.
- Such systematic interventions can allow the identification of obstacles and solutions, thereby leading to cultural changes that will allow all players, especially individual drivers, to put in place effective fatigue countermeasures.

MOVING FORWARD WITH FATIGUE MANAGEMENT PROGRAMS

CHALLENGES AND STATE-OF-PRACTICE

FATIGUE MANAGEMENT PROGRAMS: MOVING FORWARD



SLEEP DISORDERS SCREENING: PRACTICAL CHALLENGES

- Driver demands and schedules
- Multiple office visits
- Broad geographic distribution and heterogeneous operations
- Operational constraints
- Flexibility/dedication of the clinical team
- Challenge of follow-up and compliance
- Financial support by insurance companies
- Confidentiality
- Medico-legal issues

SLEEP APNEA SCREENING: RECOMMENDED PRACTICES

- Maximise face-to face follow-up clinical visits and flexibility in the clinical appointments
- Encourage substantial interactions between drivers and peer leadership
- Develop an educational program directed at CPAP adherence and self-management techniques
- Stimulate discussions between the CMV industry, governmental representatives, and insurers regarding the financial coverage of drivers' screening

SLEEP APNEA TREATMENT: MOVING STATE-OF-PRACTICE

- Identify factors that affect adherence to sleep apnea treatment and their impact:
  - Face-to-face interaction with medical staff
  - Group meetings
  - Education
  - Other
- Develop standards for safe treatment and follow-up for CMV drivers
- Develop sleep apnea screening methods that are
  - Adequate to identify high risk drivers
  - Reliable
  - Result in rapid clinical care and high levels of adherence
- Review studies of performance and CPAP treatment in controlled settings to determine specific clinical benefits of detecting and treating sleep apnea
- Examine changes in psychomotor vigilance performance related to FMPs over longer periods, controlled for time of day effects, and for levels of adherence

EDUCATION:
PRACTICAL CHALLENGES

- Driver demands and schedules
- Coordinating mixed group of participants including family members
- Train-the-trainer approach with sufficient availability and knowledge of trainers
- Tailoring the format of education modules/ training sessions to operational constraints
- Corporate support
- Long-term interest, retention, cultural changes

EDUCATION: RECOMMENDED PRACTICES

- Involvement of top management in facilitating the implementation of FMP
- Flexibility of educational sessions
- Development of multiple educational approaches to accommodate all CMV drivers
- Identification of specialized trainers, knowledgeable in scientific and operational matters
- Strategic interventions of scientific experts
- Favour mixed group interactions and a focus group approach
- Establish adult learning principles and learning evaluation tools
- Plan follow-up educational activities to improve long-term retention and favour behavioural changes
- Develop measures to document changes in corporate culture as it pertains to fatigue management

SCHEDULING: PRACTICAL CHALLENGES

- Lack of company written policies on scheduling
- Prioritization of customer services, collective bargaining agreements, and HOS in trip scheduling
- Lack of guidance/training of dispatchers on fatigue-wise scheduling
- Lack of reliable tools/indicators on fatigue-wise scheduling
- Disparity in dispatchers' attitudes
- Limited in-person interaction between dispatchers and drivers
- Limited margins of operations for delivery
- Unexpected trip delays
- Limited number of available drivers (especially in high season)

SCHEDULING: RECOMMENDED PRACTICES

- Consider the drivers' work and rest history in scheduling practices
- Take into account not only the HOS but also the time of day and number of consecutive night shifts
- Promote face-to-face interactions between supervisor, dispatchers, and drivers to identify obstacles to fatigue-wise scheduling
- Educate shippers and receivers on the importance of a well rested driver
- Build-in greater safety margins to accommodate unexpected delays and need for break

SCHEDULING:
MOVING STATE-OF-PRACTICE

Investigation Of
Effective Recovery And Napping Strategies
For Commercial Motor Vehicle Drivers

THE SAFR PROJECT

Scheduling And Fatigue Research

Transport Canada-US Federal Motor Carriers Safety Administration
Collaborative Research Project

INVESTIGATION OF EFFECTIVE RECOVERY AND NAPPING STRATEGIES FOR COMMERCIAL MOTOR VEHICLE DRIVERS

Goal

- Develop a better understanding of the independent combined effects of main sleep periods & supplemental naps on recovery from fatigue in CMV drivers

Output

- Recommendations for “best practices” for managing driver fatigue utilizing:
  - Sufficient recovery sleep
  - Flexible & effective napping strategies

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