



WELCOME



Following the Science: Evidence-based Approaches to Improving Patient & Provider Safety

EMS FOCUS

Today

- ▶ Lights and Siren
 - ▶ Literature review and best practices
 - ▶ Use and usefulness
- ▶ Fatigue in EMS
 - ▶ Systematic review of the evidence
 - ▶ Evidence-based guidelines and recommendations

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Today's Speakers

- ▶ Douglas Kupas, MD, EMT-P, FAEMS, Professor of Emergency Medicine, EMS Medical Director
 - ▶ Geisinger Health
 - ▶ Pennsylvania Department of Health
- ▶ P. Daniel Patterson, PhD, NRP, Assistant Professor of Emergency Medicine
 - ▶ University of Pittsburgh
- ▶ Dave Bryson, EMT, EMS Specialist
 - ▶ NHTSA Office of EMS

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Lights & Siren Use by EMS: Above All, Do No Harm

Douglas F. Kupas, MD, EMT-P, FAEMS

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U. S. Department of Transportation
National Highway Traffic Safety Administration
Office of Emergency Medical Services (EMS)



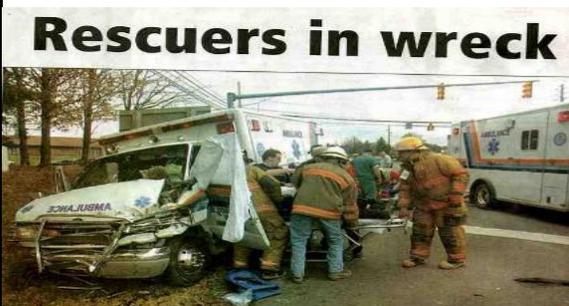
Lights and Siren Use by Emergency Medical Services (EMS): Above All Do No Harm

Douglas F. Kupas, MD, EMT-P, FAEMS, FACEP
Author:
Submitted by Marym Consulting, Inc.
For NHTSA Contract DTH22-14-F-00579



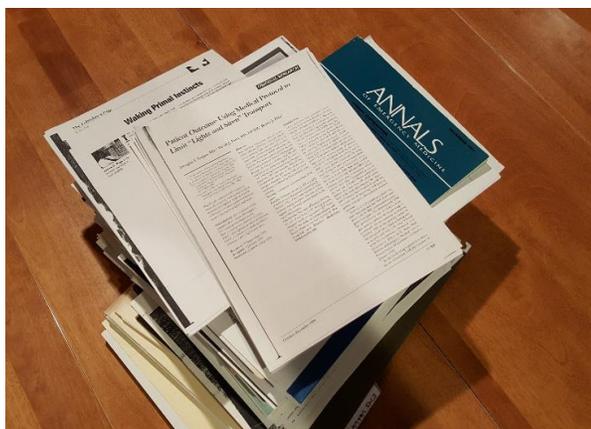
RLS-related EMVCs

- ▶ Most at intersections
- ▶ Increased incidence of injury
- ▶ Nearly all severe injuries unrestrained



Literature Review

- ▶ Literature based (peer and non-peer reviewed)



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Annotated Bibliography

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- ▶ EMS vehicle crash statistics, driving (including driver training), liability, and ethics (55)
- ▶ Effectiveness of warning L&S (and vehicle conspicuity) (33)
- ▶ Time savings with L&S response and transport (24)
- ▶ Traffic signal preemption systems (3)
- ▶ Public perception and expectations related to L&S use (8)

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Annotated Bibliography

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- ▶ Provider safety issues when using L&S (7)
- ▶ Emergency medical dispatch and L&S response (28)
- ▶ Clinical outcomes with L&S (including physiological effects) (23)
- ▶ EMS operations, policies, and guidelines related to L&S use (21)

- ▶ Total references = 202 references / 9 sections

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Reasons for L&S

- ▶ “Saves time”
- ▶ Contract requirements (< 8 minutes)
- ▶ Medical emergency
- ▶ Public expectations
- ▶ Fun/EMS provider retention, “they’ll quit”
- ▶ Insurance requirements

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1. Introduction – primum non nocere

- ▶ L&S use is a medical intervention



DEA# GB000000 Lic. # ME 0000000

NAME _____ AGE _____
ADDRESS _____ DATE _____

R Lights and Siren
Sig: Dispense one L&S
transport,
Use only when indicated

(SIGNATURE) _____

LABEL
REFILL 0 1 2 3 4 5 PRN

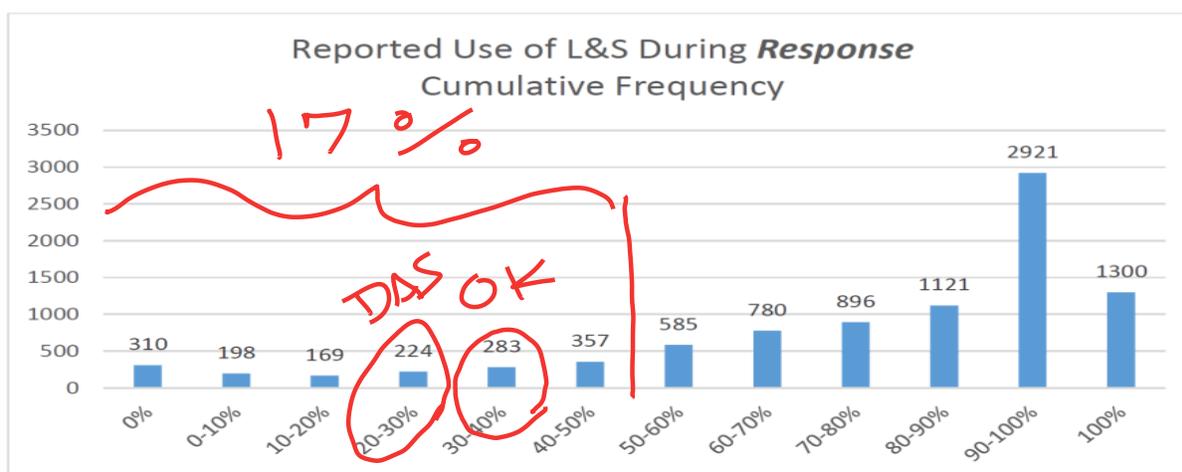
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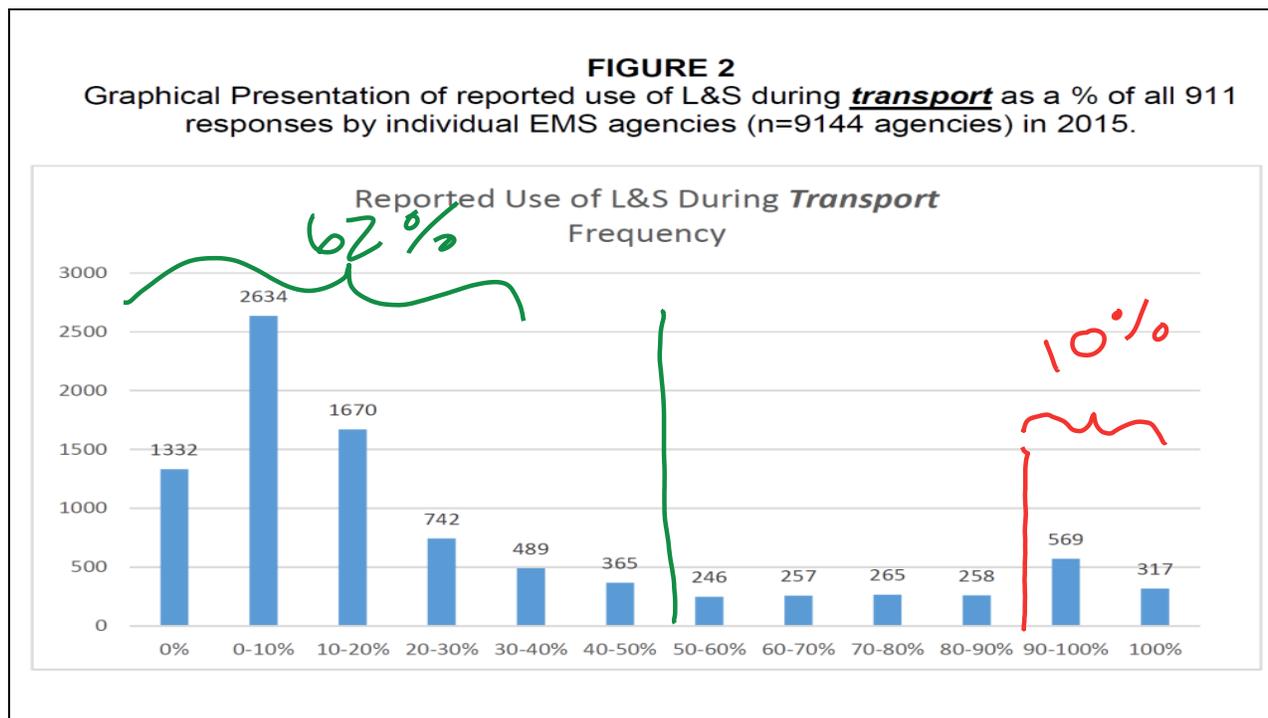
2. Current Use of L&S in U.S.

- ▶ 15.7 million 911 responses with transport
 - ▶ Response: 76.5% used L&S
 - ▶ No change from 2010 to 2015
 - ▶ Transport: 22.7% used L&S (73.3% did not)
 - ▶ 10.9 decrease in use since 2010
 - ▶ Varies 10.3% by urbanicity
 - ▶ Varies by 20.8% across U.S. Census divisions
 - ▶ 58% L&S transport in PA in 1991

FIGURE 1

Graphical presentation of reported use of L&S during **response** as a % of all 911 responses by individual EMS agencies (n=9144 agencies) in 2015.





3. Review of State Laws Regarding L&S Use by EMS

- ▶ Uniform Vehicle Code
 - ▶ Proceed through a red traffic signal, stop light/sign
 - ▶ **Some states require full stop - Recommended**
 - ▶ Drive wrong way opposing traffic
 - ▶ Exceed posted speed limit
 - ▶ **Some states limit speed – Recommended**
 - ▶ Park where otherwise not legal

4. Discussion



- ▶ Use and usefulness of emergency warning lights and vehicle conspicuity
- ▶ Use and usefulness of sirens
- ▶ Time saved with L&S
- ▶ Association between L&S driving and crash risk
- ▶ Traffic signal preemption devices
- ▶ Hazards of L&S use for EMS providers
- ▶ EMS and L&S response
- ▶ Clinical considerations related to L&S use during transport
- ▶ Public perceptions and expectations for L&S use
- ▶ Recommendations for EMS vehicle operations policies

Discussion – Use and usefulness of emergency warning lights and vehicle conspicuity



- ▶ Warning Lights
- ▶ Retroreflective Material
- ▶ Vehicle Color



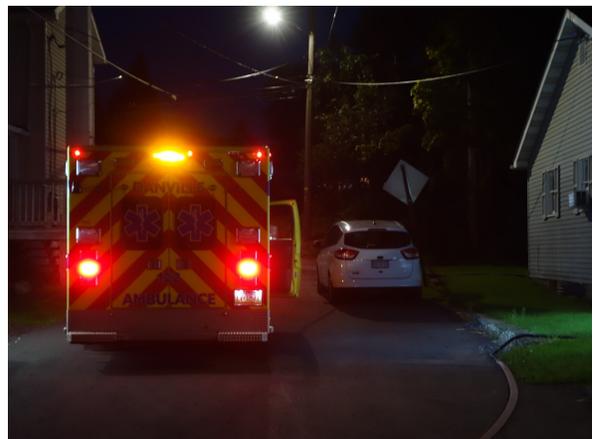
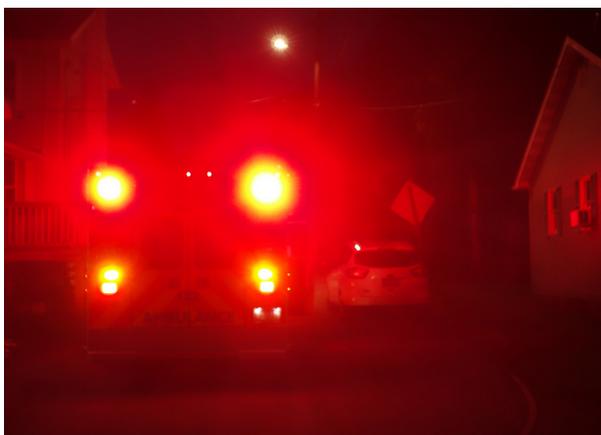
Retroreflective Material



Emergency Warning Lights Requesting the Right of Way



Emergency Warning Lights Blocking the Right of Way



Emergency Warning Lights Blocking the Right of Way



Discussion – Use and usefulness of sirens

Rural

(55 mph, closed window, radio on)

	straight	crossroad
Electronic wail	33 ft.	14 ft.
Electronic yelp	32	12
Electronic hi-lo	24	<12
Mechanical wail	33	<12



Discussion – Time saved with L&S (response)

TABLE M
Mean response time interval differences related to L&S use
(from seven studies as shown)

Author	Year of Study	Community/Geographical Location	Time Saved (in minutes)	Notes
Dhindsa	1994	Washington, DC	3.6	Poster Abstract
Zachariah	1994	Suburban Texas	1.7	Poster Abstract
Ho	1998	Minneapolis, MN	3.0	
Brown	2000	Syracuse, NY	1.8	
Ho	2001	Becker County, MN (rural)	3.6	
Williams	2005	Anne Arundel County, MD	2.2	Fire Department Report
Yeh	2011	San Francisco, CA	1.9	Response to Stroke Symptoms

Discussion – Time saved with L&S (transport)

TABLE N
Mean transport time interval differences related to L&S use
(from eight studies as shown)

Author	Year of Study	Community/Geographical Location	Time Saved (in minutes)	Notes
Dhindsa	1994	Washington, DC	3.0	Poster Abstract
Hunt	1995	Greenville, NC	0.7	
O'Brien	1999	Jefferson County, KY	3.8	
Brown	2000	Syracuse, NY	1.8	
Williams	2005	Anne Arundel County, MD	2.4	Up to 10.2 minutes for areas farther from hospital
Marques-Baptista	2010	New Brunswick, NJ	2.6	Reviewed critical interventions at hospital
Fleischman	2013	Multnomah County, OR	3.1	GPS/Google maps
Dami	2014	Vaud, Switzerland	1.8	No difference at night, 16.6% L&S transport rate

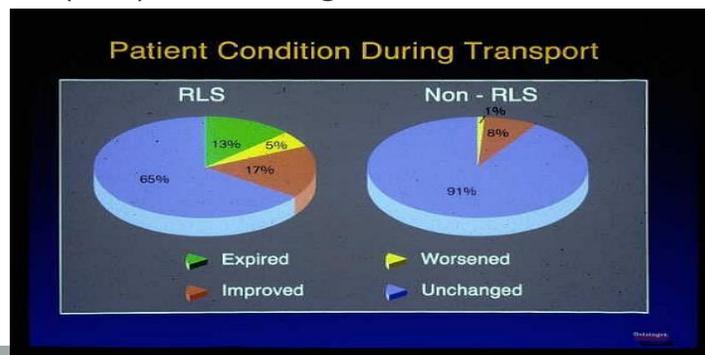
Discussion – Hazards of L&S use for EMS providers

- ▶ Accelerated hearing loss
- ▶ Off-balance injuries in patient compartment



Discussion – Clinical considerations related to L&S use during transport

- ▶ Kupas DF, Dula DJ, Pino BJ. PDM. 1994
 - ▶ 130/162 (8%) Emergent
 - ▶ 1495/1625 (92%) Nonemergent





Parks LL. Are speeding, open sirens and red light-breaking by ambulances necessary. J Fla Med Assoc. 1953; 40(1):20-22.

- ▶ Jackson Mem. Hosp – 808 patients
 - ▶ 67.1% not admitted
 - ▶ “87.8% of patients arriving by ambulance need not have been rushed to the hospital.”
- ▶ Duval Med. Center – 378 patients
 - ▶ “Conservatively 15% of admitted patients and 4.2% of all patients are true emergencies.”
- ▶ 1951 – 25 ambulance crashes in FL
 - ▶ 1 fatality, 14 injuries

Discussion

Public perceptions and expectations for L&S use

“Competence is more often shown by quiet deliberateness than by noisy bravado.”



E. Marie Wilson
Conn. EMS Patient Survey
1980

Connecticut EMS Patient Survey 1980

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- ▶ Public's Reasons for EMS Uneasiness
 - ▶ Sirens and noise
 - ▶ Getting a lot of attention
 - ▶ Abilities of crew
 - ▶ Dealing with strangers

Discussion: Recommendations for EMS vehicle operations policies

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- ▶ L&S use is a medical intervention
- ▶ Performance Parameter Benchmarks
 - ▶ L&S Response < 50% of 911 responses
 - ▶ L&S Transport < 5% of 911 responses
 - ▶ L&S transport could be a sentinel QI event
- ▶ EMSVO training, continuing education, policies
- ▶ Requesting vs. blocking “right of way”
- ▶ EMD
- ▶ Medical direction
- ▶ EMS seatbelt use / vehicle design





Developing
Evidence Based
Fatigue Risk Management
Guidelines
for Emergency Medical Services



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Evidence-based Guidelines For Fatigue Risk Management in Emergency Medical Services

Daniel Patterson, PhD, NRP

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Tired EMS Workers a Prescription for Danger on the Roads, Experts Say

By TOM LLAMAS, GERRY WAGSCHAL, CONOR FERGUSON, BRIAN BRODER, HAE YOUNG YOO and SARAH MESSER
Jul 3, 2015, 7:44 AM ET

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... and van on U.S. 101 sends six to hospital - Oregon
... a paramedic tending a patient in the back around 3:15 a.m. when an

... d an ambulance on U.S. 101 north of Seaside sent six to the hospital,
... h a paramedic tending a patient in the back around 3:15 a.m. when an Oregon State Police Senior Trooper Dom Dyer said that the ambulance
... nton, tried to avoid the van by steering to the right, but the vehicles

... jandra Palacios, 17, both
... left rear seat and had
... not injured. They were
... on-life threatening injuries

Fatigue a factor in ambulance accident in Canada

Patient dead, three crew injured after ambulance crash - Roswell, New Mexico

One man died and three medical workers were injured Wednesday after their ambulance crashed. State police said the accident happened on U.S. Highway 285 north of Roswell as the ambulance was traveling

South Dakota Ambulance Flips After Driver Falls Asleep

EMSWORLD.COM NEWS
CREATED: MARCH 6, 2013

The EMT in the rear compartment treating the patient was ejected when the unit rolled.

State Coroner: fatigue a factor in administering wrong drug

- In 2007 Coroner Peter White reported that while attempting to resuscitate a 78 year-old male cardiac patient a paramedic accidentally administered morphine instead of adrenaline.
- The Coroner said fatigue was a factor. "I am satisfied that both officers were affected by fatigue at the time of these incidents and that resulting error was always a possibility in such circumstances."
- A positive outcome was unlikely but "the possibility that resuscitation may have been more effective given appropriate treatment cannot be excluded."



Second ambulance crash in three days

Rachel McCubbin, WCSH 2:16 PM EDT July 14, 2017



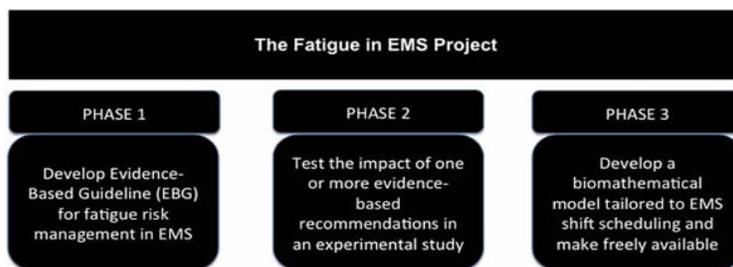
BOWDOINHAM, Maine (NEWS CENTER) -- A nurse was injured when a Delta Ambulance swerved into a median, went airborne, and struck a guardrail early Friday morning, according to Maine State Police.

The NHTSA Fatigue in EMS Project

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- ▶ Aim I: To develop evidence-based guidelines for fatigue risk management in Emergency Medical Services



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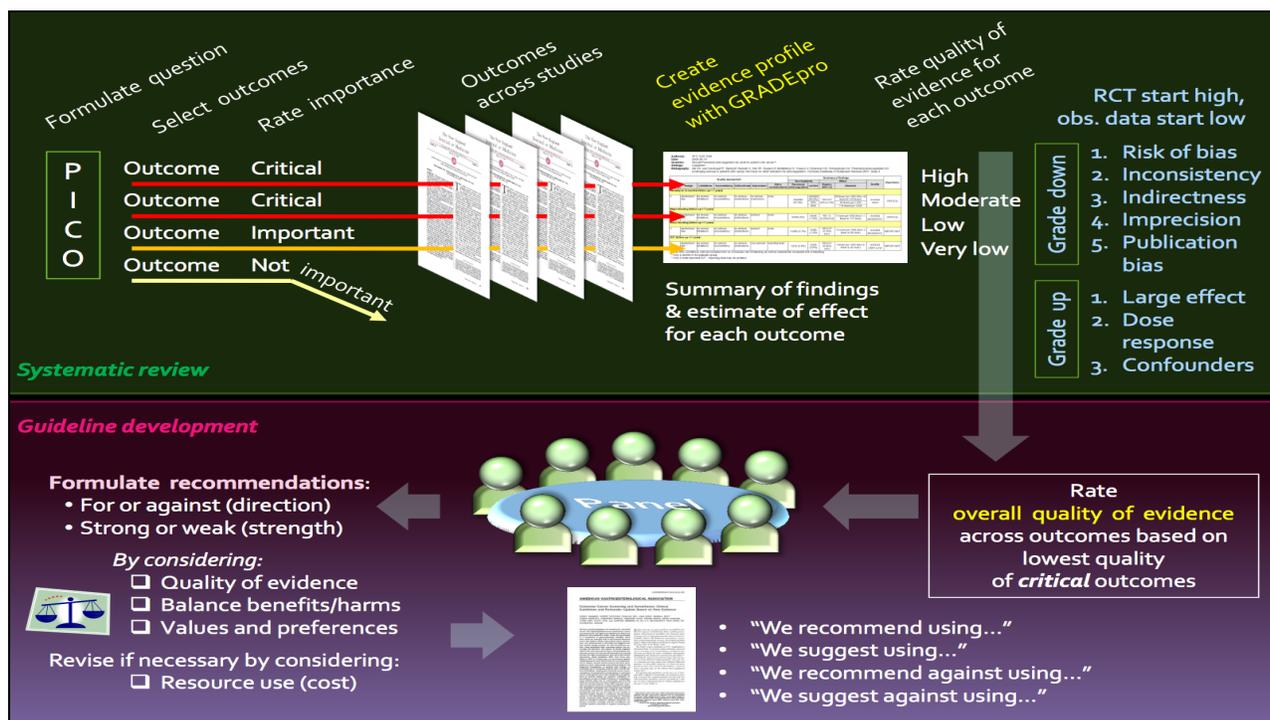
Methods

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- ▶ We completed seven systematic reviews guided by seven research questions (PMID-27858581)
- ▶ Reviewed literature from 1980 to September 2016
- ▶ Used the Grading of Recommendations, Assessment, Development and Evaluation methodology

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Results

Systematic Review	Literature Screened/Reviewed
1	1,257
2	21,670
3	1,401
4	4,656
5	3,817
6	2,777
7	3,394
TOTAL	38,972

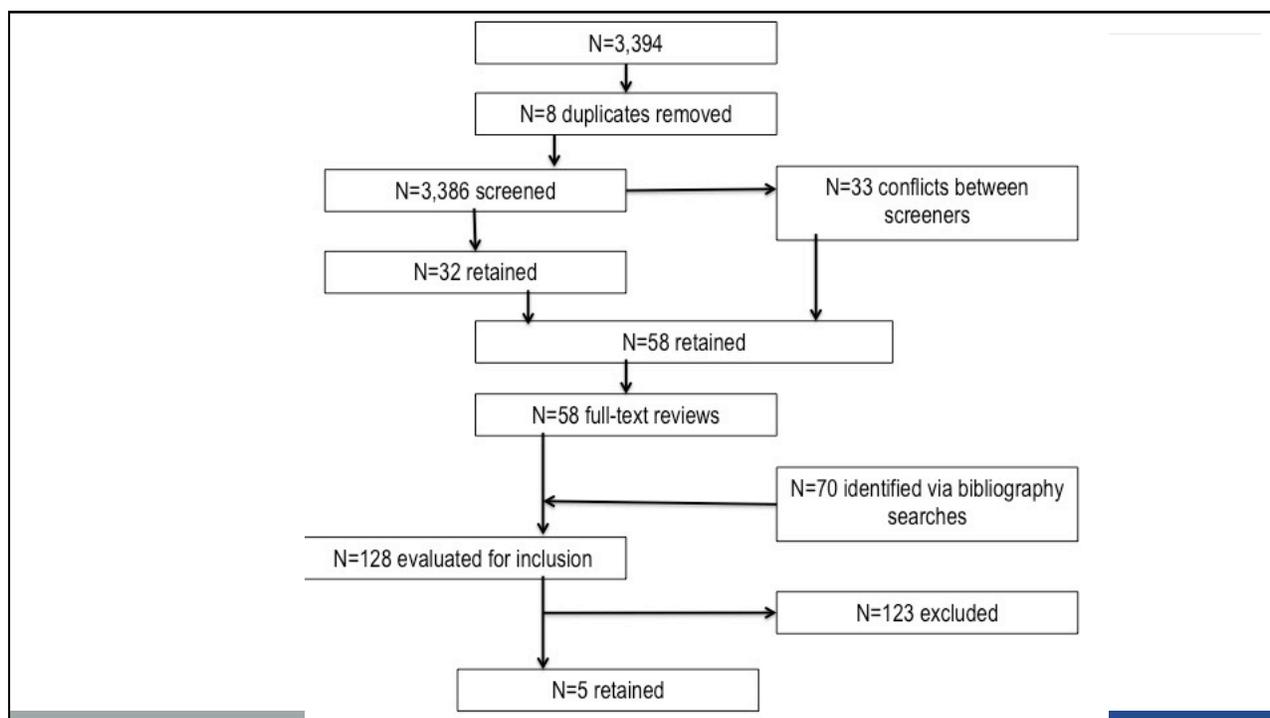
Systematic Review #7

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- ▶ In EMS personnel, do task load interventions mitigate fatigue, mitigate fatigue-related risks, and/or improve sleep?
- ▶ PROSPERO 2016:CRD42016040114

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Systematic Review #7

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- ▶ No recommendation: The confidence in effect estimates is insufficient to make a recommendation at this time.

(GRADE Handbook 6.1.4)

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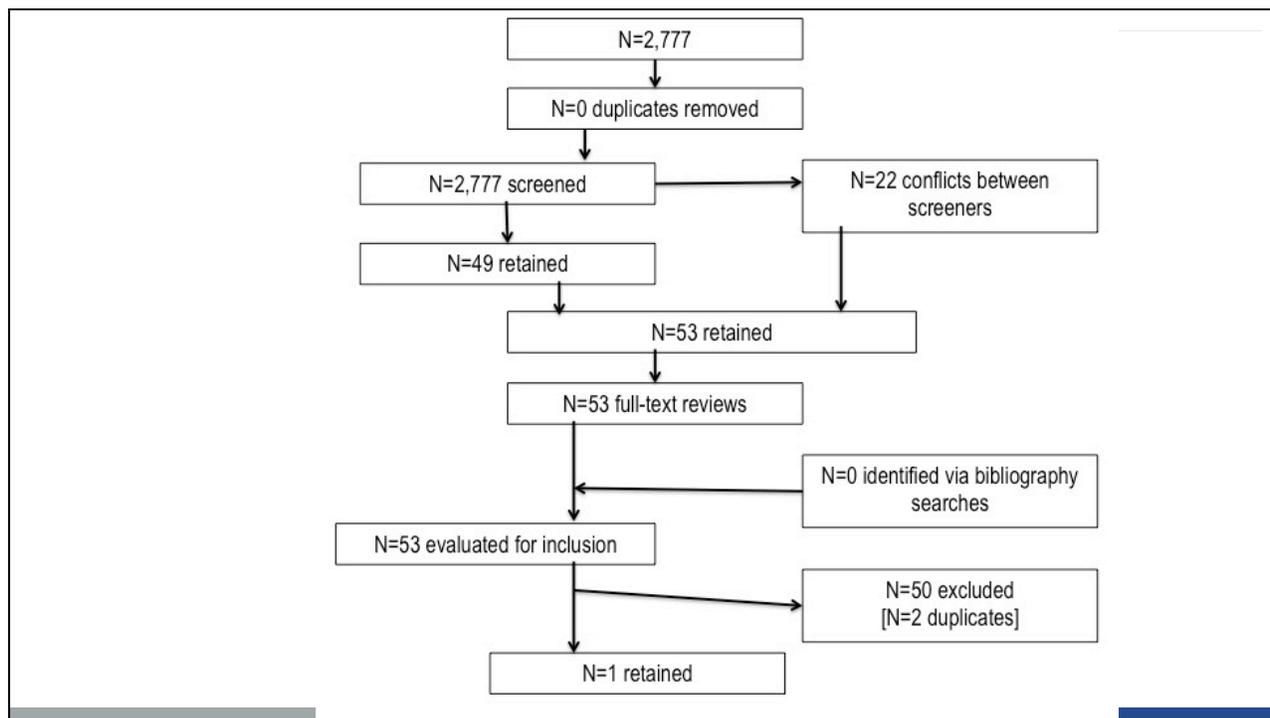
Systematic Review #6

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- ▶ In EMS personnel, does implementation of model-based fatigue risk management mitigate fatigue, mitigate fatigue-related risks, and/or improve sleep?
- ▶ PROSPERO 2016:CRD42016040112

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Systematic Review #6

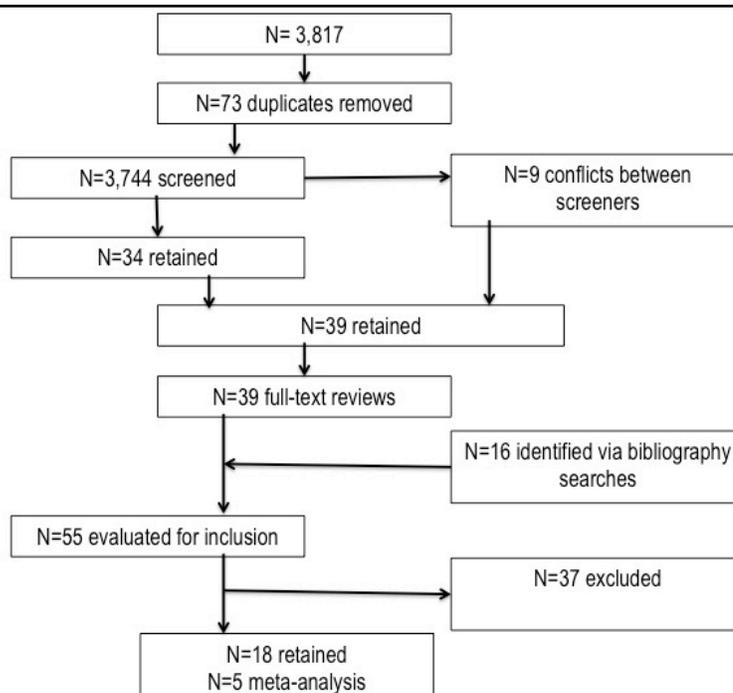
- ▶ No recommendation: The confidence in effect estimates is insufficient to make a recommendation at this time.

(GRADE Handbook 6.1.4)

Systematic Review #5

- ▶ In EMS personnel, does fatigue training and education mitigate fatigue, mitigate fatigue-related risks, and/or improve sleep?
- ▶ PROSPERO 2016:CRD42016040110

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Systematic Review #5

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- ▶ We recommend that EMS personnel receive education and training to mitigate fatigue and fatigue-related risks (weak recommendation in favor, low certainty in evidence).

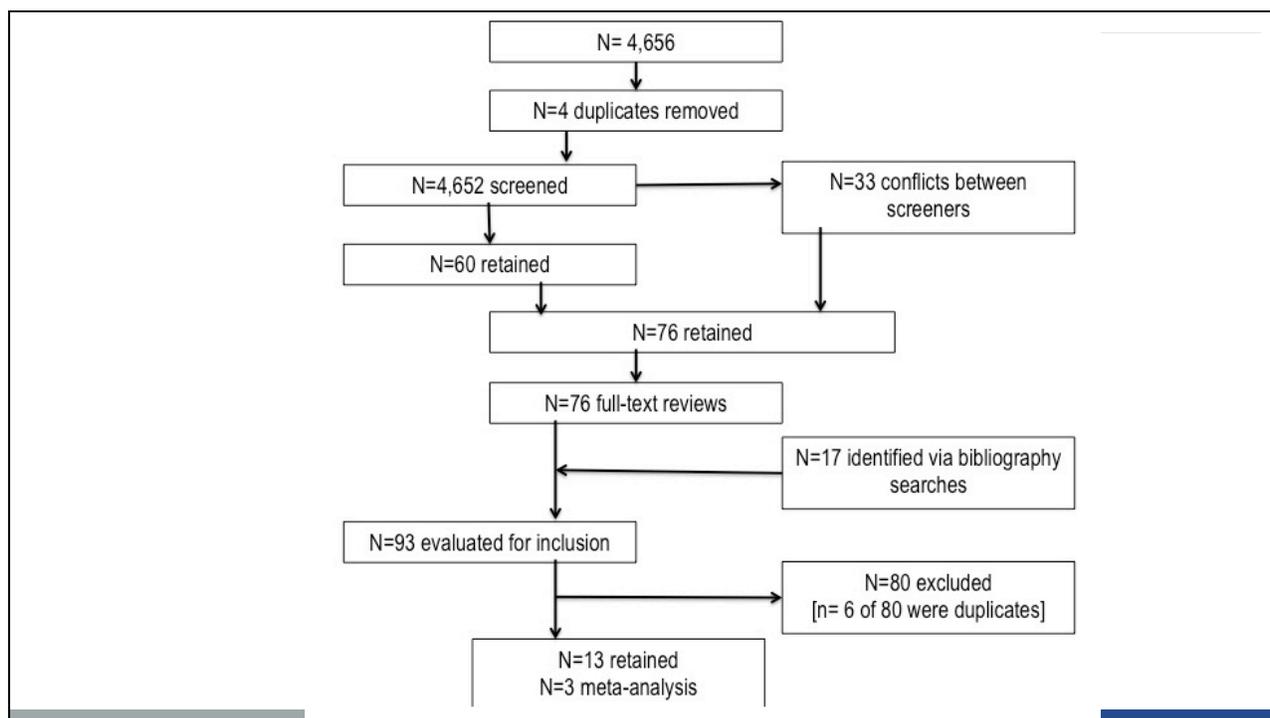
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Systematic Review #4

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- ▶ In EMS personnel, does the use of sleep or rest strategies and/or interventions mitigate fatigue, mitigate fatigue-related risks, and/or improve sleep?
- ▶ PROSPERO 2016:CRD42016040107

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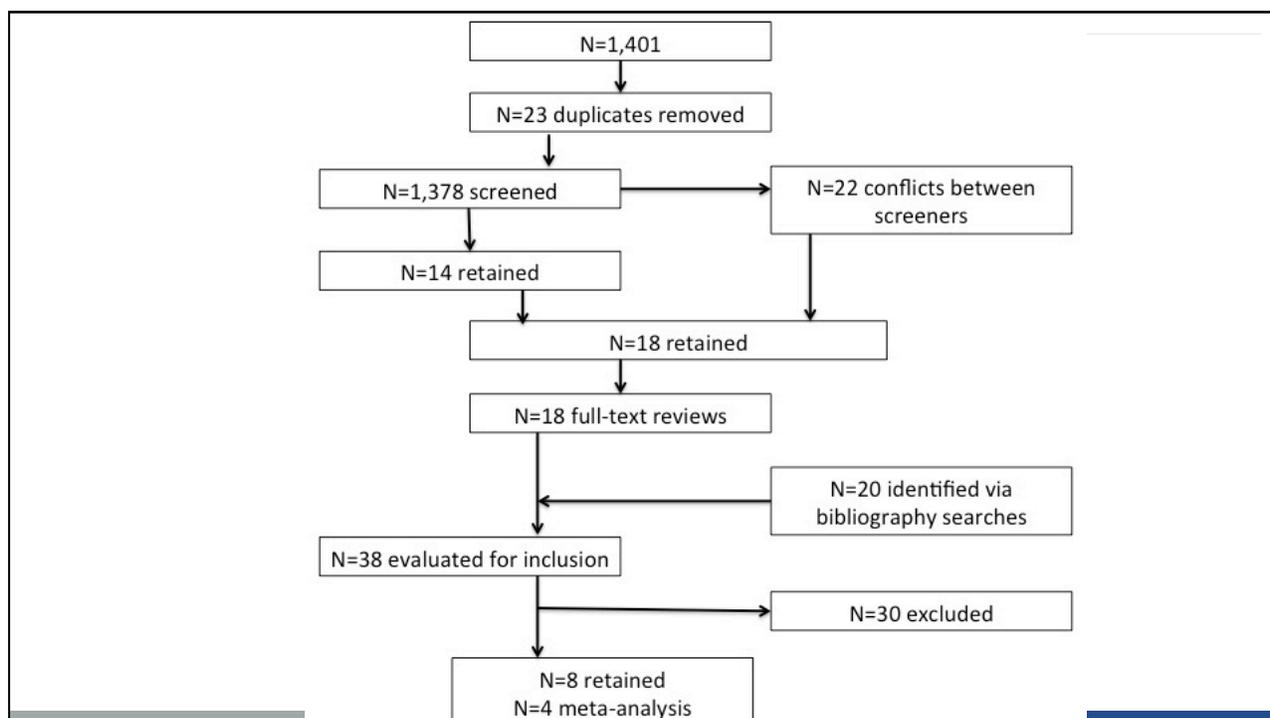
Systematic Review #4

- ▶ We recommend that EMS personnel have the opportunity to nap while on duty to mitigate fatigue (weak recommendation in favor, very low certainty in effect).

Systematic Review #3

- ▶ In EMS personnel, does the worker's use of fatigue countermeasures mitigate fatigue, fatigue-related risks, and/or improve sleep?
- ▶ PROSPERO 2016:CRD420106040101

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Systematic Review #3

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- ▶ We recommend that EMS workers have access to caffeine as a fatigue countermeasure (weak recommendation in favor, low certainty in effect).

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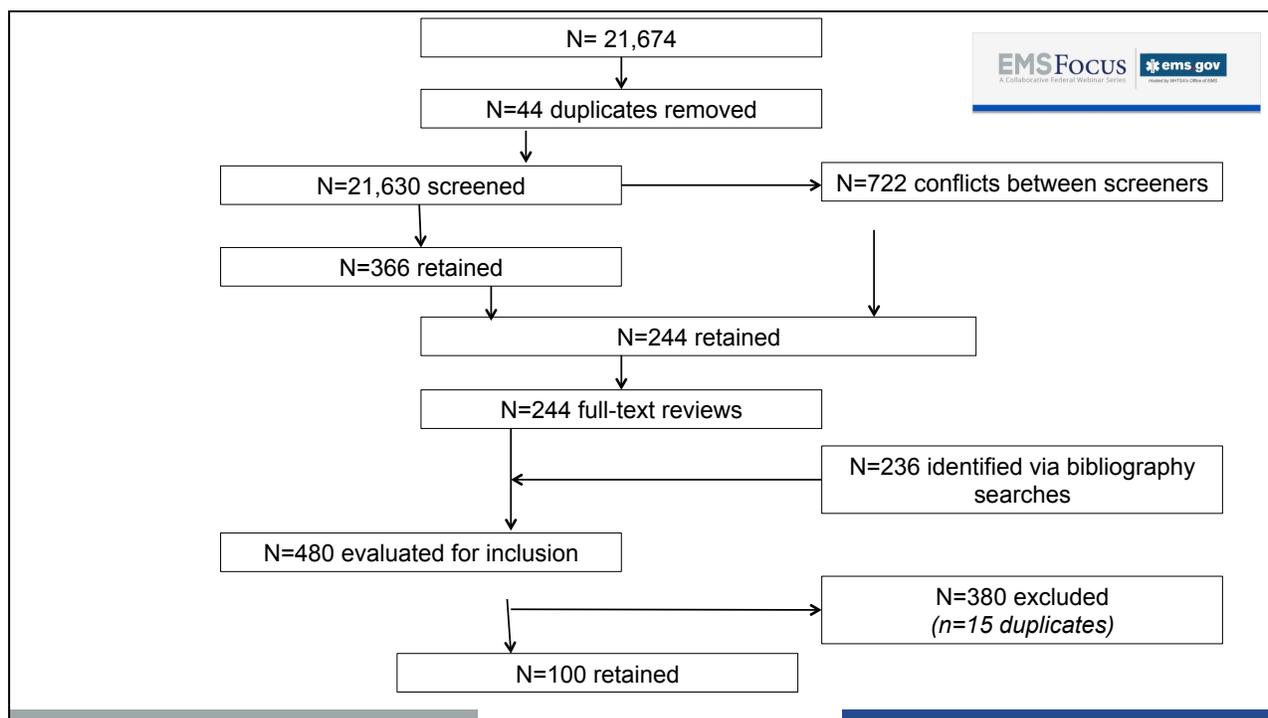
Systematic Review #2

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- ▶ In EMS personnel, do shift-rescheduling interventions mitigate fatigue, mitigate fatigue-related risks, and/or improve sleep?
- ▶ PROSPERO 2016:CRD42016040099

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Systematic Review #2

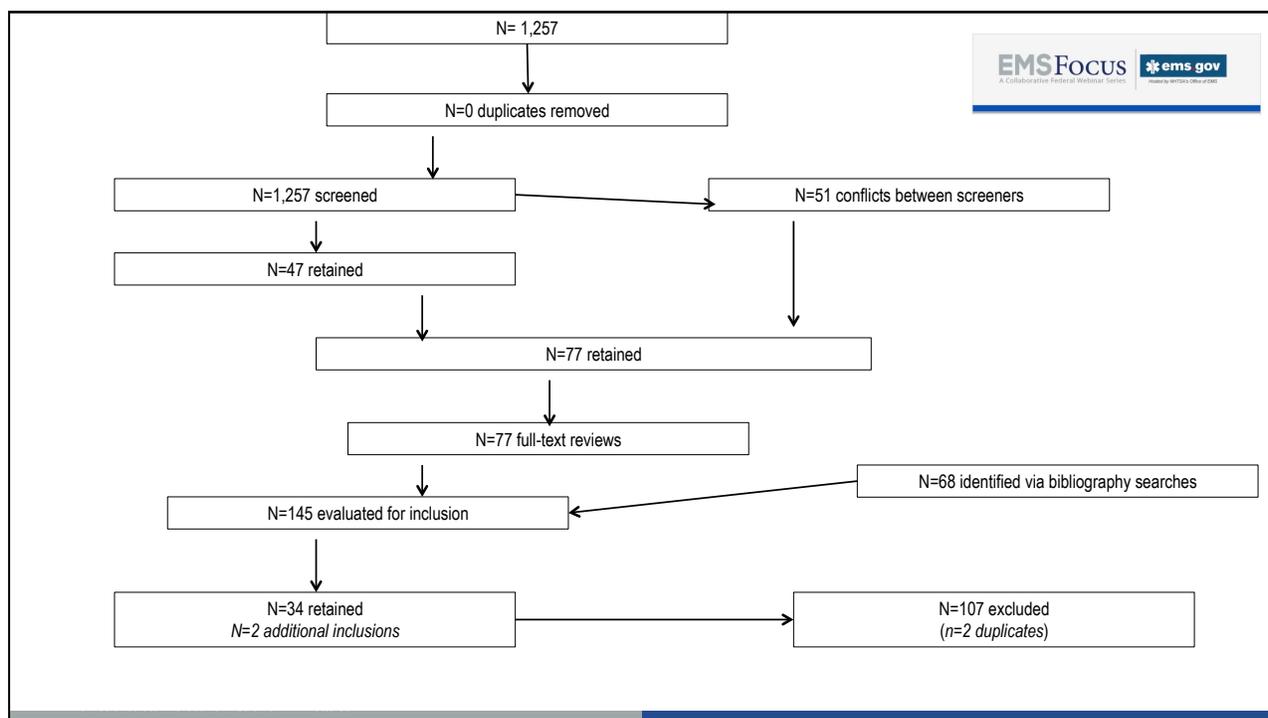
- ▶ We recommend that EMS personnel work shifts shorter than 24 hours in duration (weak recommendation in favor, very low certainty in effect).
 - ▶ The panel does not have a recommendation regarding 8hr vs. 12hr shifts or other shift comparisons that are less than 24 hours.

Systematic Review #1

- ▶ Are there reliable and valid instruments for measuring fatigue among EMS personnel?

- ▶ PROSPERO 2016:CRD42016040097

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Systematic Review #1

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- ▶ We recommend using fatigue/sleepiness survey instruments to measure and monitor fatigue in EMS personnel (strong recommendation, very low certainty in evidence).

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Next Steps

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The Fatigue in EMS Project

PHASE 1

Develop Evidence-Based Guideline (EBG) for fatigue risk management in EMS

PHASE 2

Test the impact of one or more evidence-based recommendations in an experimental study

PHASE 3

Develop a biomathematical model tailored to EMS shift scheduling and make freely available

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Significance of the EMS Fatigue Project

- ▶ **1. Local leaders** have a starting point from which to build a fatigue risk management program – based on evidence.
- ▶ **2. State, regional, national organizations** have a template, frame of reference, a resource to help local agencies.
- ▶ **3. Individual clinicians** have a resource to point to if your organization does not, or is not actively addressing fatigue in the EMS workplace.

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Phase 1 Dissemination

- ▶ Journal publications in PEC
- ▶ Guidebook on Fatigue Management in EMS
- ▶ Presentations
- ▶ I-pager handout
- ▶ Interviews
- ▶ Commentaries/Editorials in trade journals
- ▶ Other

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Q&A