

# EMS Fatigue Risk Management and Project Research – What's New???



Daniel Patterson, PhD, NRP

December 1, 2020

# Outline

- Review Phase 1 – Evidence Based Guideline
  - Take Questions
- Discuss Phase 2 – Experimental Study
  - Take Questions

# The Fatigue in EMS Project



[www.emsfatigue.org](http://www.emsfatigue.org)

NHTSA DTNH2215R00029

# Partnership



NHTSA DTNH2215R00029

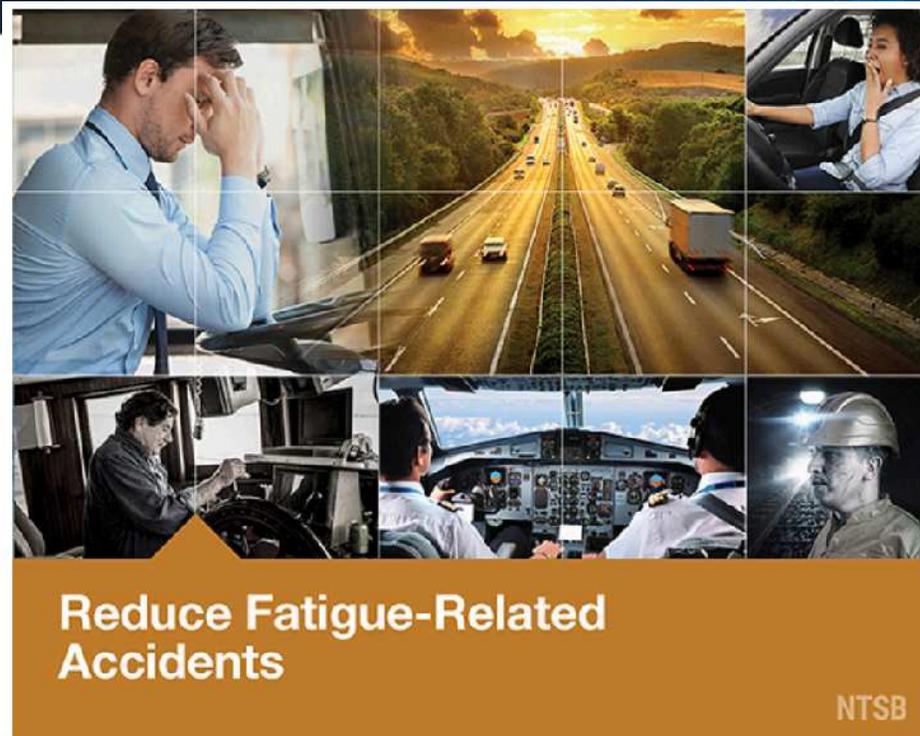
# Fatigue

...a subjective, unpleasant symptom, which incorporates total body feelings ranging from **tiredness** to **exhaustion** creating an unrelenting overall condition which **interferes** with an individual's ability to function to their normal capacity.

# Significance of Fatigue

# FATIGUE

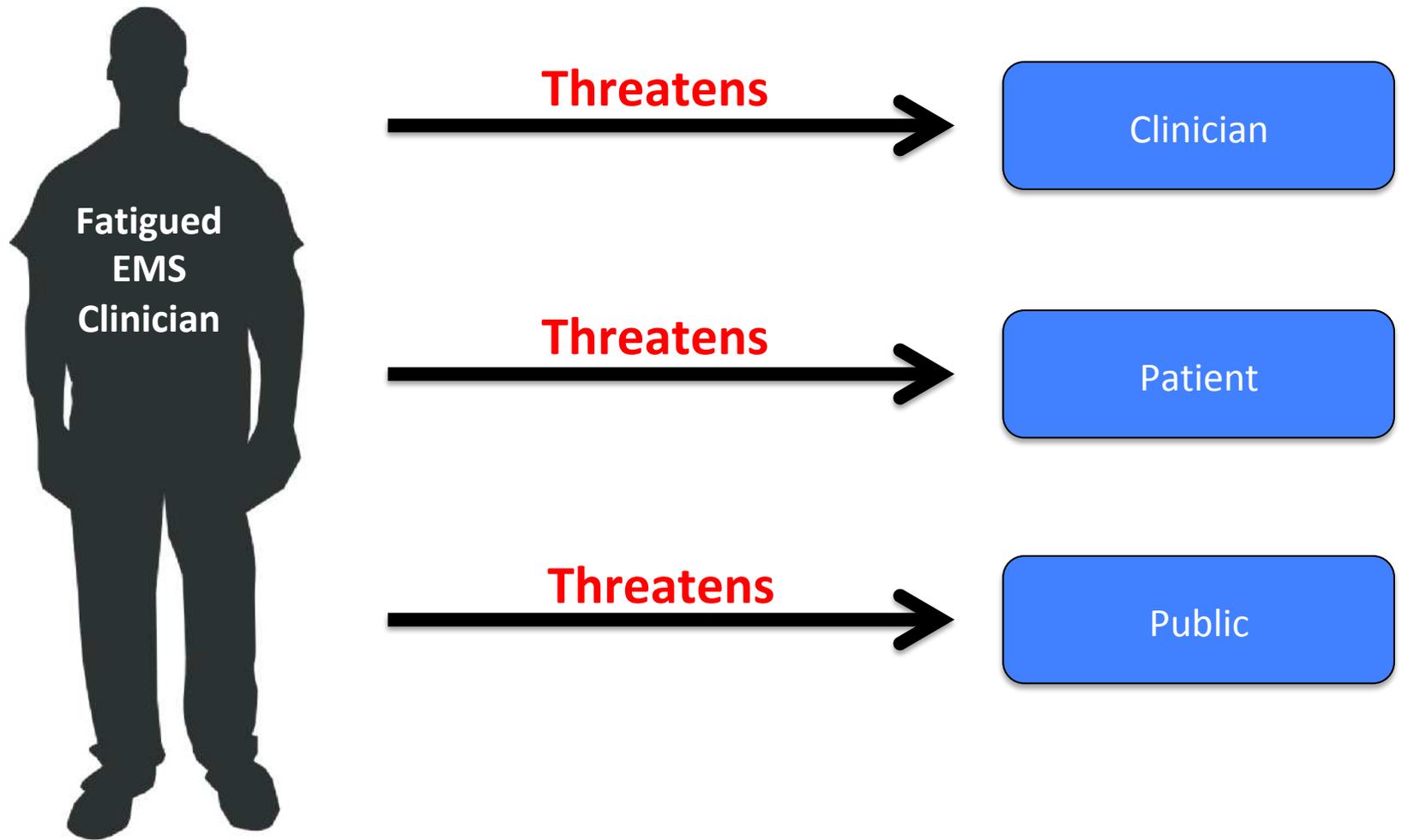
2019-2020 Most Wanted List



# Significance of Fatigue in EMS

- Placeholder for video on fatigue, sleep, etc.

# Fatigue is a threat!



# Three Phased Approach to Address Fatigue in EMS

## Phase 1

Develop an Evidence Based Guideline for Fatigue Risk Management in EMS

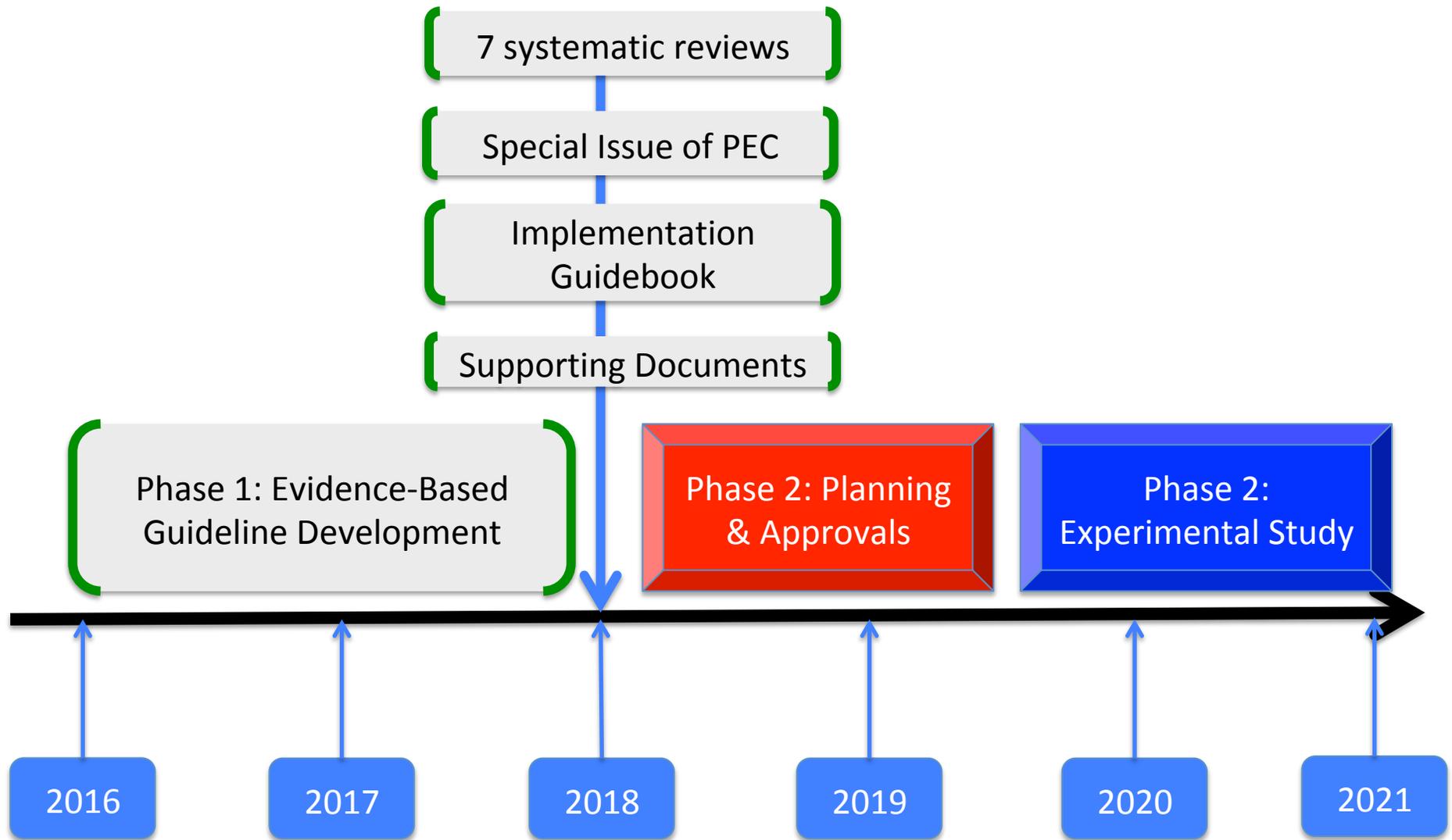
## Phase 2

Experimental Study

## Phase 3

Freely available biomathematical model tool

# Timeline of the Fatigue in EMS Project



# What are Evidence Based Guidelines?

*“...are systematically developed statements designed to help administrators, practitioners, and patients make decisions about appropriate health care for specific circumstances.”*

# A Growing Number of EMS-focused EBGs

## Prehospital Guidelines Consortium

[Home](#) [About Us](#) [Evidence-Based Guidelines](#) [Member Organizations](#) [Committees](#) [Funding Resources](#) [Contact Us](#)

[EBG Resources](#) [COVID-19 Resources](#)



[www.prehospitalguidelines.org](http://www.prehospitalguidelines.org)

# EBGs vs. Consensus

## **Evidence Based Guidelines**

- Labor intensive
- Comprehensive with systematic reviews and meta-analyses
- Standard protocol
- Full transparency

## **Consensus Statements**

- Often short time frame
- Limited review of the literature
- Inconsistent procedures
- Lacks transparency and subject to bias

# Why do we need EBGs?

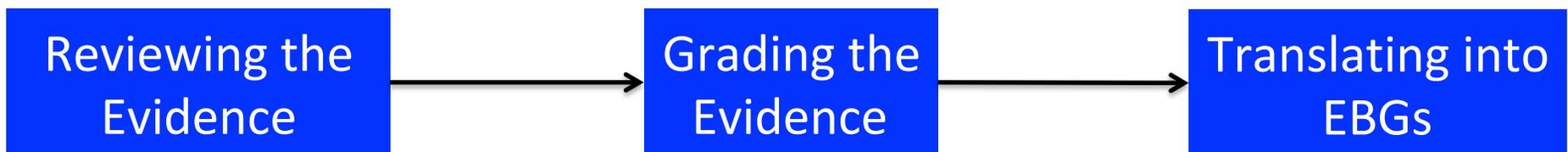
- Potential to reduce practice variation
- Enhance translation of research into practice
- Improve quality and safety

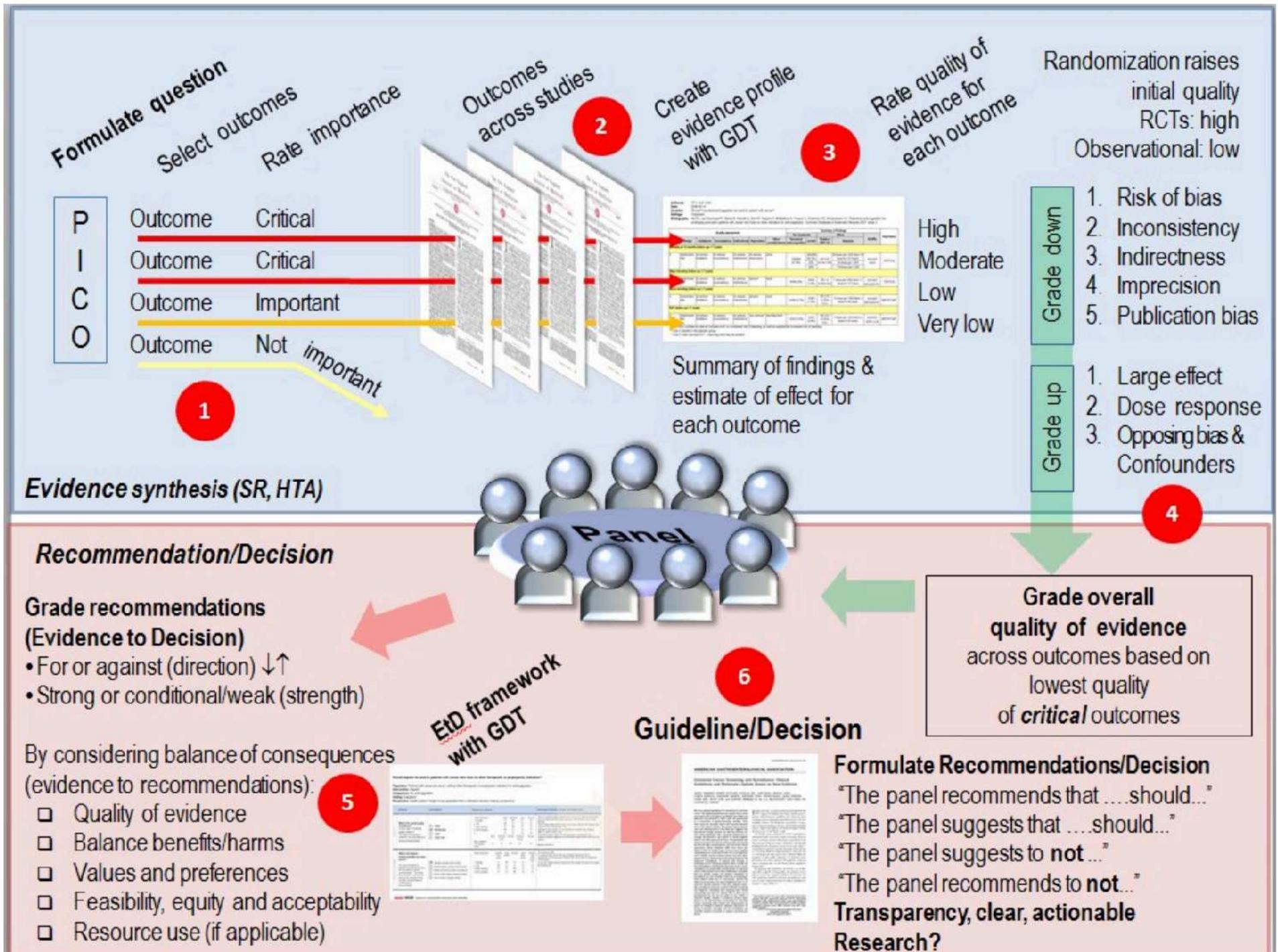
# The Process

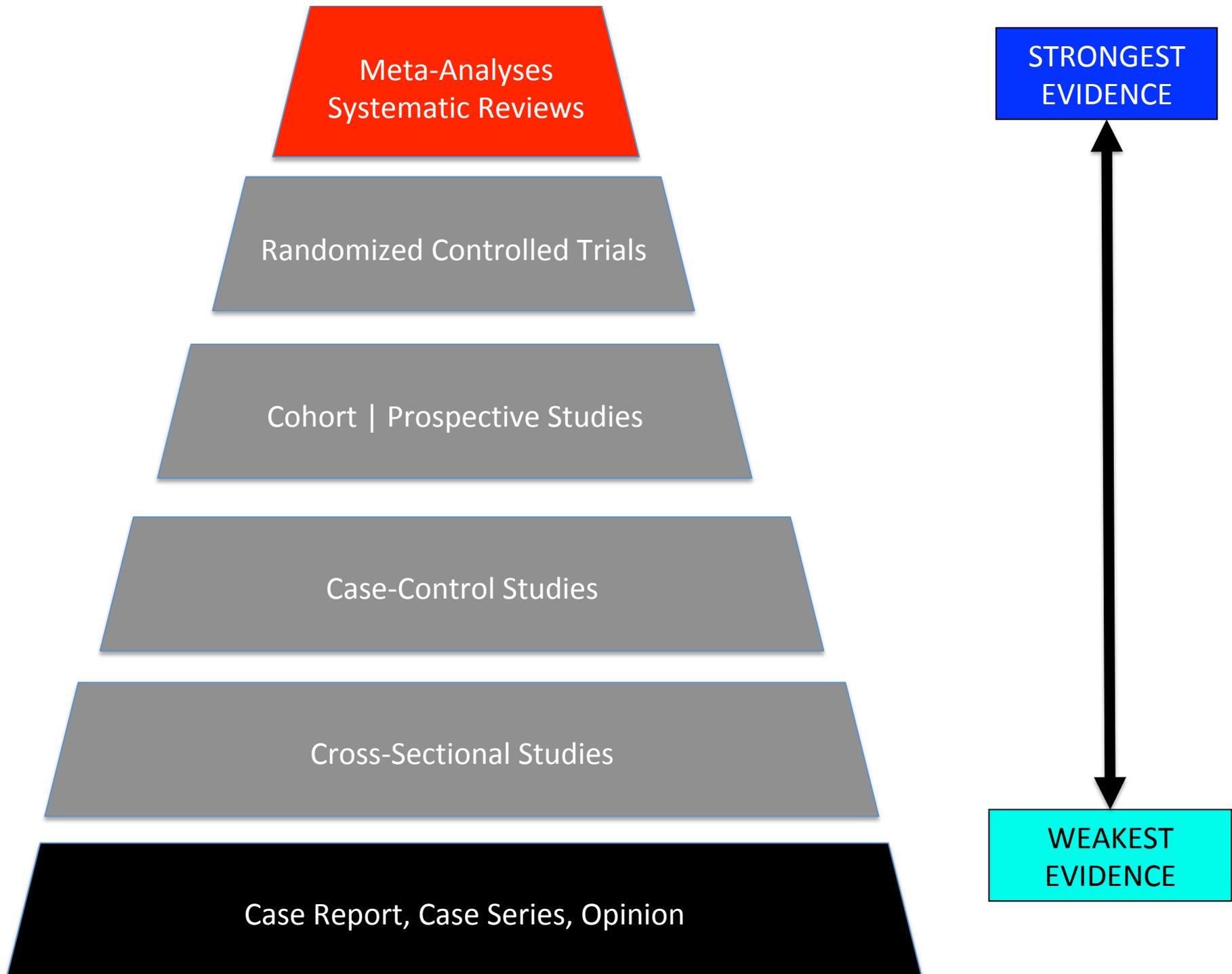


Grading of Recommendations Assessment, Development, and Evaluation

[www.gradeworkinggroup.org](http://www.gradeworkinggroup.org)







# 7 Systematic Reviews

1. Identify reliable and valid instruments to assess fatigue.
2. Determine the impact of shorter versus longer shift durations on health, safety, and performance outcomes.
3. Determine the impact of caffeine on safety and performance outcomes.
4. Determine the impact of on-duty naps on safety and performance outcomes.

# 7 Systematic Reviews

5. Determine impact of sleep health/fatigue education and training on health, safety, and performance outcomes.
6. Determine the impact of changes in task load / workload on health, safety, and performance outcomes.
7. Determine the impact of using fatigue biomathetical models on health, safety, and performance outcomes.

# Results of the 7 Systematic Reviews

Research Question	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

# Five Recommendations

1. Use (reliable/valid) fatigue / sleepiness survey instruments to measure and monitor fatigue.
2. EMS personnel work shifts shorter than 24 hours in duration.
3. EMS personnel have access to caffeine as a fatigue countermeasure.
4. EMS personnel have the opportunity to nap while on duty.
5. EMS personnel receive education and training to mitigate fatigue and fatigue-related risks.

# The 2018 Guideline for Fatigue Risk Management in EMS

Evidence-Based Guidelines for Fatigue Risk Management in EMS: Formulating Research Questions and Selecting Outcomes	
P. Daniel Patterson PhD, NRP, J. Stephen CCFP, Michael S. Runyon MD, MPH, Laura PhD, NRP, Charity G. Moore PhD, Kathy R MPA, Allison Infinger MSPH, Patricia M. V Christian Martin-Gill MD	<b>Fatigue Risk Management in High-Risk Environments: A Call to Action</b>
	Deborah A. P. Hersman & Emily A. Whitcomb
Evidence-Based Guidelines for Fatigue Risk Management in Emergency Medical Services: A Step in the Right Direction Toward Better Sleep Health	
Daniel J. Buysse	<b>Absence and Need for Fatigue Risk Management in Emergency Medical Services</b>
	P. Daniel Patterson & Christian Martin-Gill
Systematic Review Methodology for the Fatigue in Emergency Medical Services Project	
P. Daniel Patterson, J. Stephen Higgins, Patricia M. Weiss, Eddy Christian Martin-Gill	<b>Reliability and Validity of Survey Instruments to Measure Work-Related Fatigue in the Emergency Medical Services Setting: A Systematic Review</b>
Shorter Versus Longer Shift Durations to Mitigate Fatigue and Fatigue-Related Risks in Emergency Medical Services Personnel and Related Shift Workers: A Systematic Review	P. Daniel Patterson, Matthew D. Weaver, Anthony Fabio, Ellen M. Teasley, n L. Renn, Brett P. Curtis, Margaret E. Matthews, Andrew J. Kroemer, Huang Xun, Zhadyra Bizhanova, Patricia M. Weiss, Denisse J. Sequeira, k J. Coppler, Eddy S. Lang & J. Stephen Higgins
P. Daniel Patterson, Michael S. Runyon, J. Stephen Higgins, M Weaver, Ellen M. Teasley, Andrew J. Kroemer, Margaret E. M Curtis, Katharyn L. Flickinger, Xiaoshuang Xun, Zhadyra Bizhanova, Patricia M. Weiss, Joseph P. Condle, Megan L. Renn, Denisse J. Sequeira, Eddy S. Lang & Christian Martin-Gill	<b>Systematic Review and Meta-analysis of the Effects of Caffeine in Fatigued Shift Workers: Implications for Emergency Medical Services Personnel</b>
	Jennifer L. Temple, David Hostler, Christian Martin-Gill, Charity G. Moore, Patricia M. Weiss, Denisse J. Sequeira, Joseph P. Condle, Eddy S. Lang, J. Higgins & P. Daniel Patterson
Effects of Napping During Shift Work on Sleepiness and Performance in Emergency Medical Services Personnel and Similar Shift Workers: A Systematic Review and Meta-Analysis	
Christian Martin-Gill, Laura K. Barger, Charity G. Moore, J. Stephen Higgins, Ellen M. Teasley, Patricia M. Weiss, Joseph P. Condle, Katharyn L. Flickinger, Patrick J. Coppler, Denisse J. Sequeira, Ayushi A. Divecha, Margaret E. Matthews, Eddy S. Lang & P. Daniel Patterson	<b>Effect of Fatigue Training on Safety, Fatigue, and Sleep in Emergency Medical Services Personnel and Other Shift Workers: A Systematic Review and Meta-Analysis</b>
	Laura K. Barger, Michael S. Runyon, Megan L. Renn, Charity G. Moore, Patricia M. Weiss, Joseph P. Condle, Katharyn L. Flickinger, Ayushi A. Divecha, Patrick J. Coppler, Denisse J. Sequeira, Eddy S. Lang, J. Stephen Higgins & P. Daniel Patterson

## IMPLEMENTATION GUIDEBOOK

2018 FATIGUE RISK MANAGEMENT  
GUIDELINES FOR EMERGENCY  
MEDICAL SERVICES

October 2018

By:

P. Daniel Patterson, PhD, NRP  
University of Pittsburgh

Kathy Robinson, RN, EMT-P  
National Association of State EMS Officials

With Support From:

National Highway Traffic Safety Administration  
Contract Number: DTNH2215R00029











# Reminder

## The purpose of EBGs

- Reduce practice variation
- Translate research into practice
- Improve quality and safety

## EBGs are...

A synthesis of the best available evidence to help guide decision making. They are NOT rules, laws, edicts, or ordinances.

**36 years of  
research**

**1980-2016**

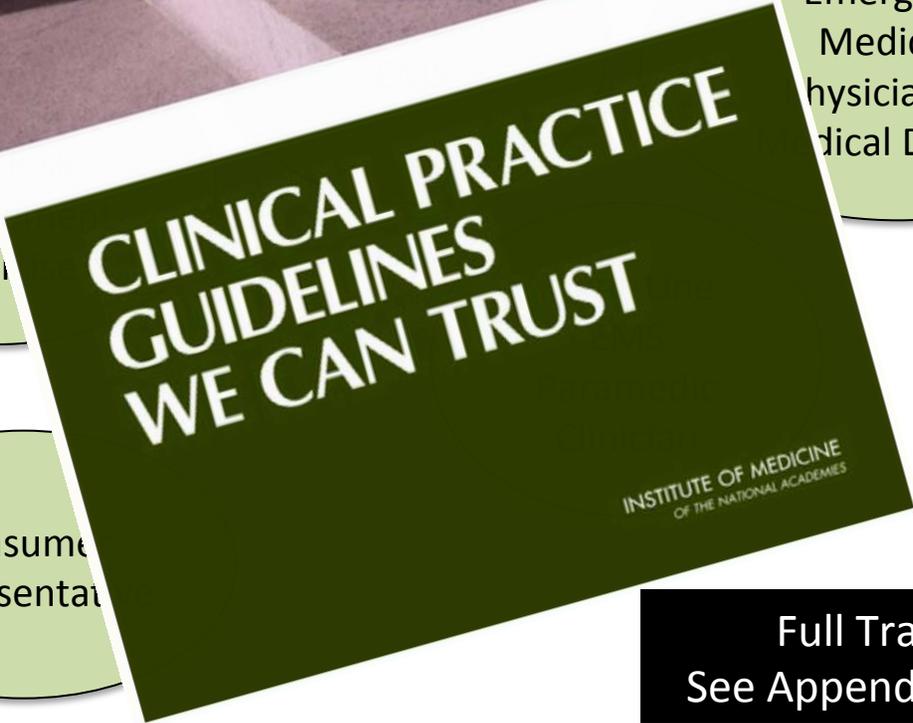
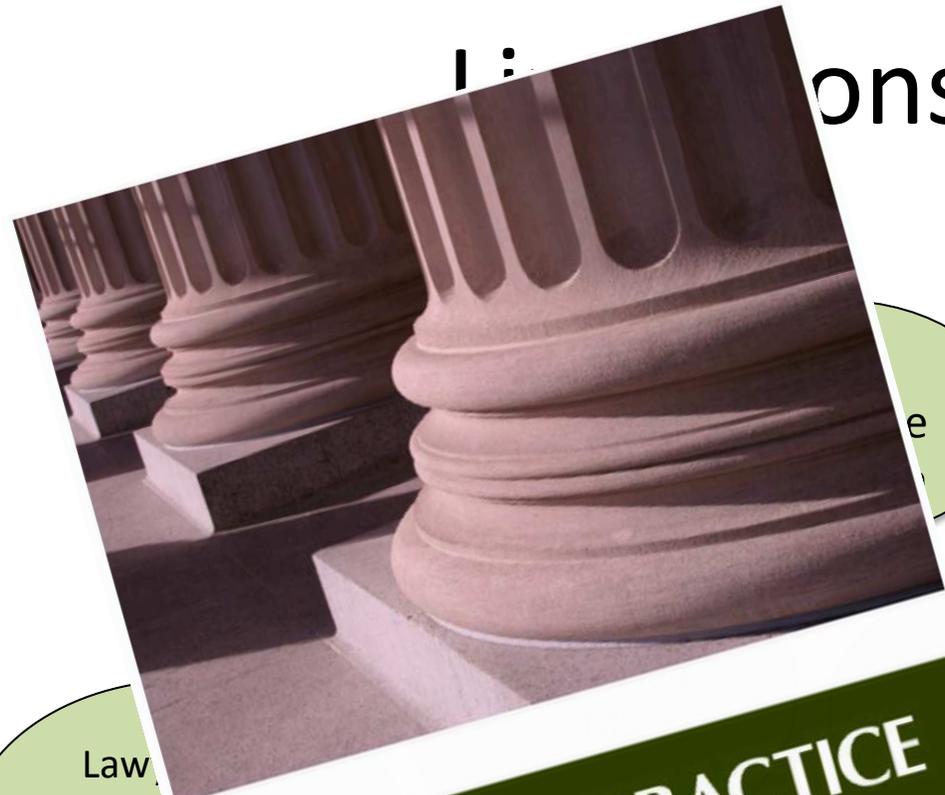
**> 38,000 pieces of  
literature**

# Despite the Rigor: EBGs do have limitations

Evidence is often limited or lacking

Research Question	Literature Screened / Reviewed [1980-2016]	Total Studies Retained
1	1,257	34
2	21,670	100
3	1,401	8
4	4,656	13
5	3,817	18
6	2,777	1
7	3,394	5

# Conditions of EBGs



Law  
EM  
Manag  
Exper

Consum  
Representat

e

Emergency  
Medicine  
Physician Air-  
Medical Director

Meets the IOM  
recommendation of  
diversity in...

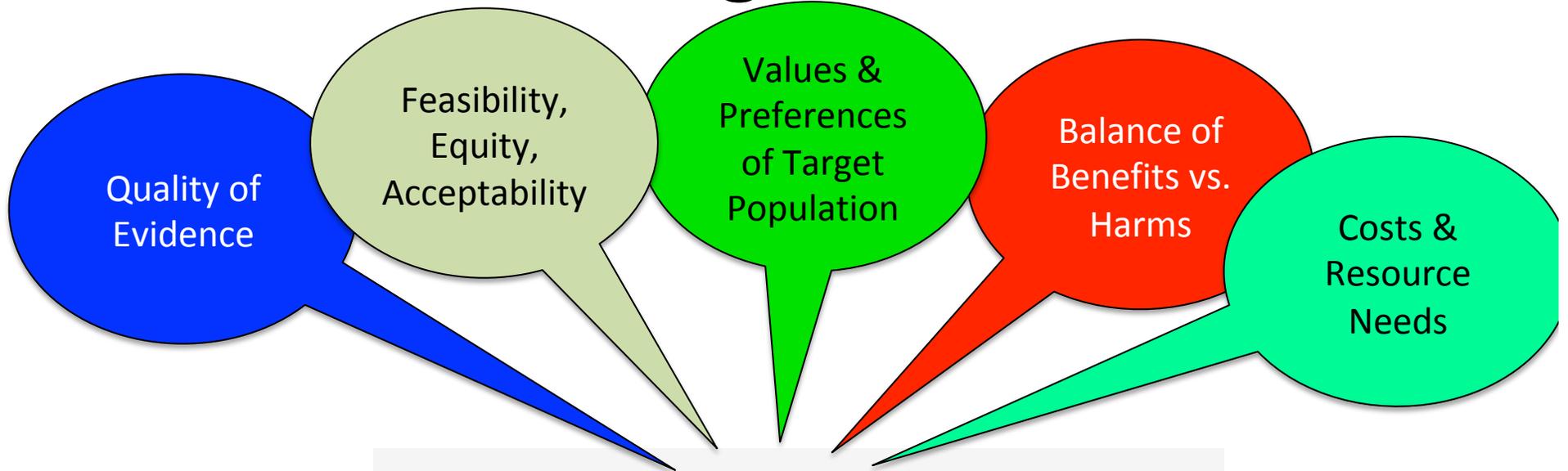
Experience  
Director

Expertise  
State Medical

Content Knowledge

Full Transparency (PMID-29324069):  
See Appendix A for panel member disclosures

# Judgment



See Appendix B of PMID-29324069 – Evidence to Decision Framework

Transparent documentation of judgment

# Concern, misinformation, and the reality of this EBG

## Concern / Misinformation

- EMS can't work long duration shifts
- There is a mandate to not work certain shifts
- The aim is to eliminate shifts

## The Reality

- Does not say any of this
- Guidelines are not mandates
- Many on the expert panel utilize 24 hour shifts today
- Long duration shifts are necessary in public safety
- Should be no surprise that evidence shows long duration shifts are fatiguing
- If long duration shifts utilized, it is recommended that other strategies be adopted

# Let's dissect recommendation #2 regarding shift duration

N=21,674

N=480 full text articles

N=100 compared  
different shift durations

N=38 compared  
8hr vs. 12hr shifts

N=38 compared  
multiple durations

N=24 compared two  
shift durations:  
(n=15 ~24hr vs. <24 hrs)

# A closer look at the evidence

Shift hours	Author, Year	Study Design	Patient Safety <sup>%</sup>	Personnel Safety	Personnel Performance <sup>#</sup>	Acute Fatigue <sup>*</sup>	Sleep and Sleep Quality	Retention / Turnover <sup>§</sup>	Long-Term Health <sup>§</sup>	Burnout / Stress	Cost to System
6 vs. 30	Zheng, 2006	Cross-over trial	--	--	--	--	Favorable	--	Favorable	--	--
8.5 vs. 24	Ernst, 2014	Randomized cross-over	--	--	Favorable	Mixed/Inconclusive	--	--	--	Favorable	--
8 vs. 24	Patterson, 2016	Case report	--	--	--	Favorable	No Impact	--	--	--	--
	Fialho, 2006	Prospective	--	--	--	--	--	--	Favorable	--	--
	Karanovic, 2009	Case-control	--	--	Favorable	--	--	--	--	--	--
9 vs. 32	Leonard, 1998	Randomized case-cross-over	--	--	Favorable	Favorable	--	--	--	Favorable	--
12 vs. 24	Yi, 2013	Quasi-Experimental	--	--	Unfavorable	No Impact	No Impact	--	--	--	--
	Boudreaux, 1998	Quasi-Experimental	--	--	--	--	--	Favorable	--	Mixed/Inconclusive	--
	Allen, 2001	Retrospective record review	No Impact	--	--	--	--	--	--	--	--
	Guyette, 2013	Prospective cohort	--	--	No Impact	--	No Impact	--	--	--	--
	Manacci, 1999	Prospective cohort	--	--	Favorable	No Impact	No Impact	--	--	No Impact	--
	Zuzewicz, 2000	Prospective cohort	--	--	--	--	--	--	--	Mixed/Inconclusive	--
14 vs. 24	Dutheil, 2012	Cross-over trial	--	--	--	Mixed/Inconclusive	Favorable	--	Favorable	Favorable	--
14 vs. 28	Talusan, 2014	Prospective cohort	--	Mixed/Inconclusive	--	Mixed/Inconclusive	Mixed/Inconclusive	--	--	--	--
<24 vs. ≥24	Barger, 2005	Prospective cohort	--	Favorable	--	--	--	--	--	--	--

# What exactly is recommended?

## EVIDENCE-BASED GUIDELINES FOR FATIGUE RISK MANAGEMENT IN EMERGENCY MEDICAL SERVICES

P. Daniel Patterson, PhD, NRP, J. Stephen Higgins, PhD, Hans P. A. Van Dongen, PhD,  
Daniel J. Buysse, MD, Ronald W. Thackery, JD, Douglas F. Kupas, MD, David S. Becker, MA,  
EMT-P, Bradley E. Dean, MA, NRP, George H. Lindbeck, MD, Francis X. Guyette, MD, MPH,  
Josef H. Penner, MBA, John M. Violanti, PhD, Eddy S. Lang, MDCM, CCFP (EM),  
Christian Martin-Gill, MD, MPH

- The decision on shift duration **should NOT** be based on the evidence alone.
- It may not be practical, cost-effective, or safe to eliminate extended shifts.
- If long duration shifts must be utilized, ensure adequate staffing and use of other fatigue mitigation strategies.

# EBGs are NOT rules or law

Rigorous and transparent  
assessment of the **Best Available  
Evidence**

Help guide decision making;  
**DO NOT** dictate it

EBGs are NOT “Magic Bullets” for  
problems

Need updating every \_\_ years

# The Reality: Shift Work in EMS is Here to Stay!

Fatigue cannot be fully eliminated

It must be managed



**There is no gold standard  
fatigue risk management  
program in EMS**

Shift Scheduling

Access to  
Caffeine

ent

Create a combination of  
strategies (tools) that works  
best for you and your agency.

Other

Fatigue Risk  
Management  
Program

# Why is this EBG significant?

No other resource like this



# 2020 Critical Appraisal of EBGs

## Appr

- Scope/Pu
- Stakehol
- Rigor of I
- Clarity
- Applicab
- Editorial

Boulanger et al. (66), had the highest average domain score of 89.2%. The Canadian Stroke Best Practice Recommendations, and their updates, are funded in their entirety by the Heart and Stroke Foundation, Canada. This is a well-funded, long-standing, national organization that advocates for stroke awareness and management across all levels of care. This organization possesses the resources to gather and support a large group of interdisciplinary experts, and the guideline development group used a rigorous framework adapted from the Practice Guidelines Evaluation and Adaptation Cycle (91). The second highest scoring guideline, with an average domain score of 88.8%, is the Evidence-Based Guidelines for Fatigue Risk Management in Emergency Medical Services by Patterson et al (7). Similarly, this guideline had robust funding from the U.S. Department of Transportation, National Highway Traffic Safety Administration and used GRADE methodology for evidence evaluation.

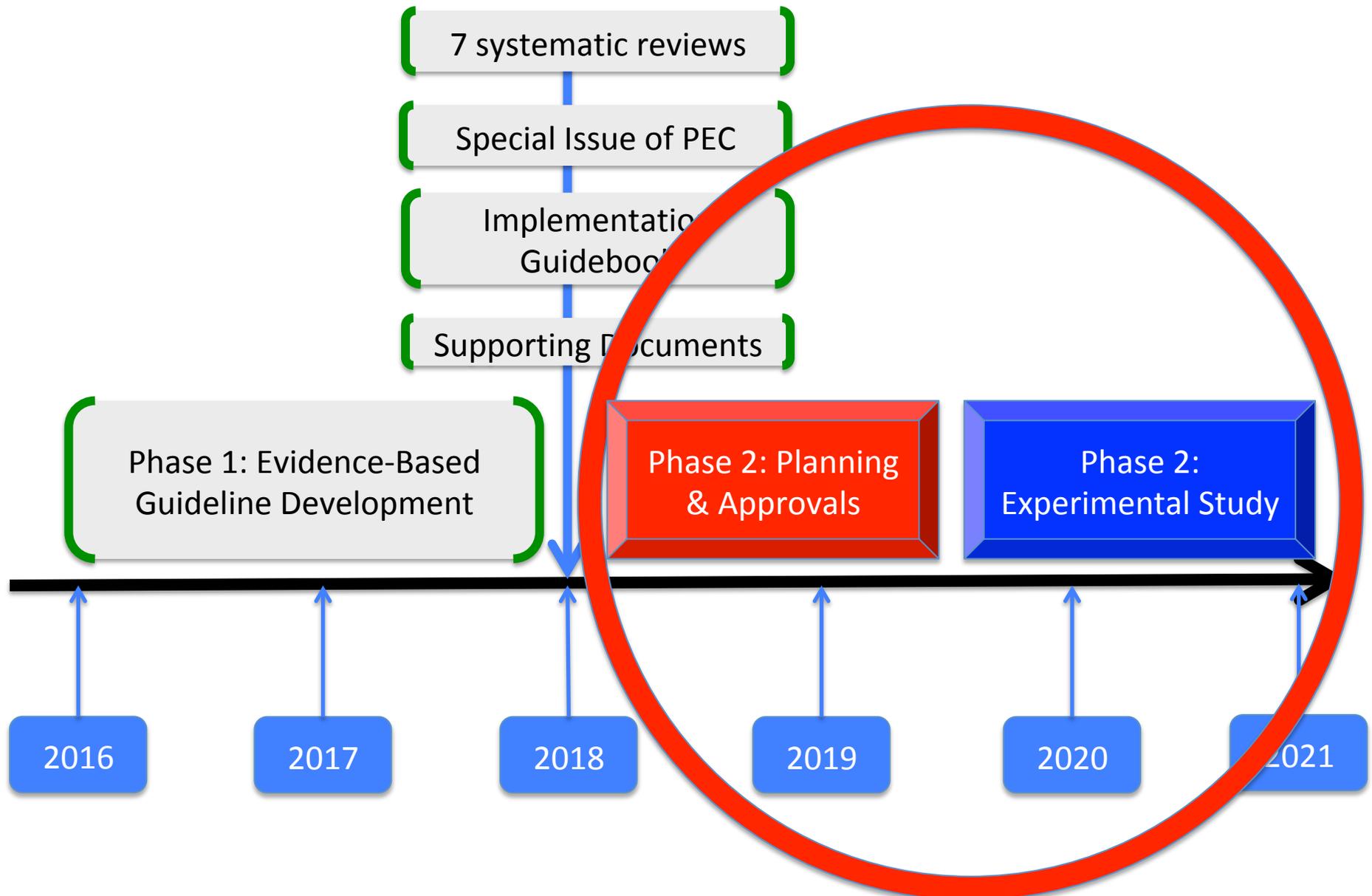
gs...

ly focused

Turner et al., 2020  
PMID-32286899

Questions about Phase 1 ?

# Update on Phase 2



# Testing Impact of Recommendation #5

EMS personnel receive education and training to mitigate fatigue and fatigue-related risks.

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## **EFFECT OF FATIGUE TRAINING ON SAFETY, FATIGUE, AND SLEEP IN EMERGENCY MEDICAL SERVICES PERSONNEL AND OTHER SHIFT WORKERS: A SYSTEMATIC REVIEW AND META-ANALYSIS**

Laura K. Barger, PhD, Michael S. Runyon, MD, MPH, Megan L. Renn, BS,  
Charity G. Moore, PhD, Patricia M. Weiss, MLIS, Joseph P. Condle, MS,  
Katharyn L. Flickinger, MS, Ayushi A. Divecha, MPT, Patrick J. Coppler, MSPAS, PA-C ,  
Denisse J. Sequeira, BS, Eddy S. Lang, MDCM, CCFP (EM), J. Stephen Higgins, PhD,  
P. Daniel Patterson, PhD, NRP

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# Developed Program Tailored to EMS

18 months  
to develop

## Fatigue Risk Management in the Workplace

*ACOEM Presidential Task Force on Fatigue Risk Management:  
Steven E. Lerman, MD, MPH, Evamaria Eskin, MD, MPH,  
David J. Flower, MBBS, MD, Eugenia C. George, MD,  
Benjamin Gerson, MD, Natalie Hartenbaum, MD, MPH,  
Steven R. Hursh, PhD, and Martin Moore-Ede, MD, PhD*

## 10 Brief Education Modules

Hazards of Fatigue

Work-Related Stress

Sleep Disorders

Sleep Physiology

Diet & Exercise

Fatigue Recognition

Sleep Health

Adequate Sleep

Alertness Strategies

Fatigue Managed NOT Eliminated

# 10 Education Modules

- Placeholder for video on modules

# Approved Con-Ed Credits



Approved for  
2.25 hours of  
continuing  
education credits



# Comments from Participants

Great course! would do it again...looking forward to finding out the results!

Well organized course.

Great information

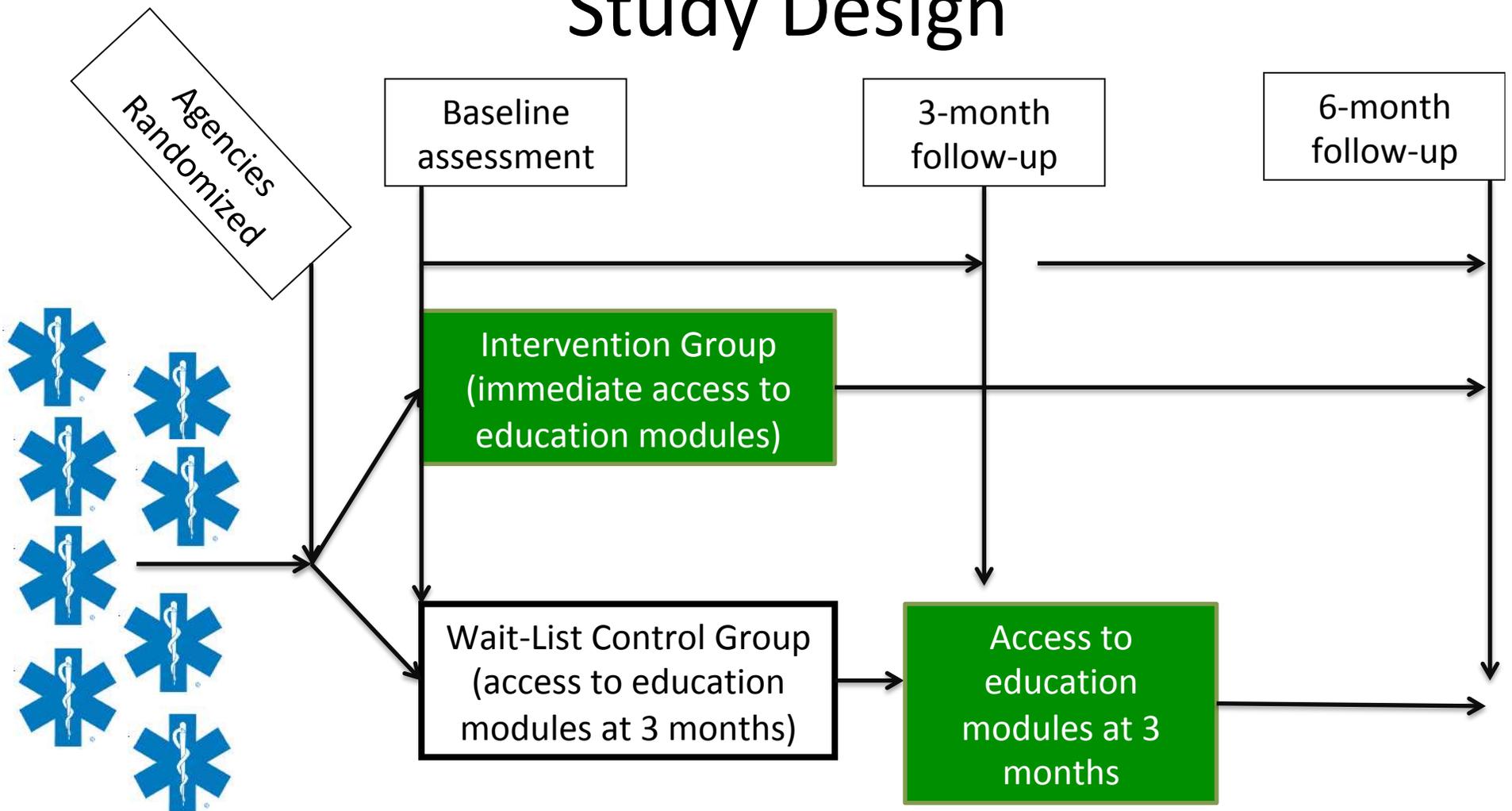
# Comments from Participants

Great job. Excellent material and just the right length to keep my attention while achieving the educational objectives! Kudos.

Great course. Well put together. Great job. You should try to get it on \_\_\_\_\_ website for others to view. Good job.

Since I enrolled in this ... i have been doing better on my sleep rest cycles, I have been dieting, and i have lost 30 lbs in 8 weeks. I am very thankful for you guys in saving my life and getting me out of a rut I was in and hope to have many years in this field since I love doing this. Thanks so much.

# Study Design



A "Wait-List Control Study Design"

Everyone will get access to the intervention materials

# Eligible Agencies

1. Provide EMS service in U.S.
2. Ground-based (or air/ground mixed).
3. Employ 50 or more paid personnel.
4. Limited restrictions on use of mobile phones.

# Individual Participation

1. Full-time or part-time at eligible agency.
2. 18yrs or older.
3. Certified FF, EMT, etc. at any level.
4. Currently working in shifts.
5. Work at least 1 shift per week.
6. Have a cell/smartphone that can send texts.
7. Willing to participate for 6 months.

# Remuneration?

## Eligible participants will receive

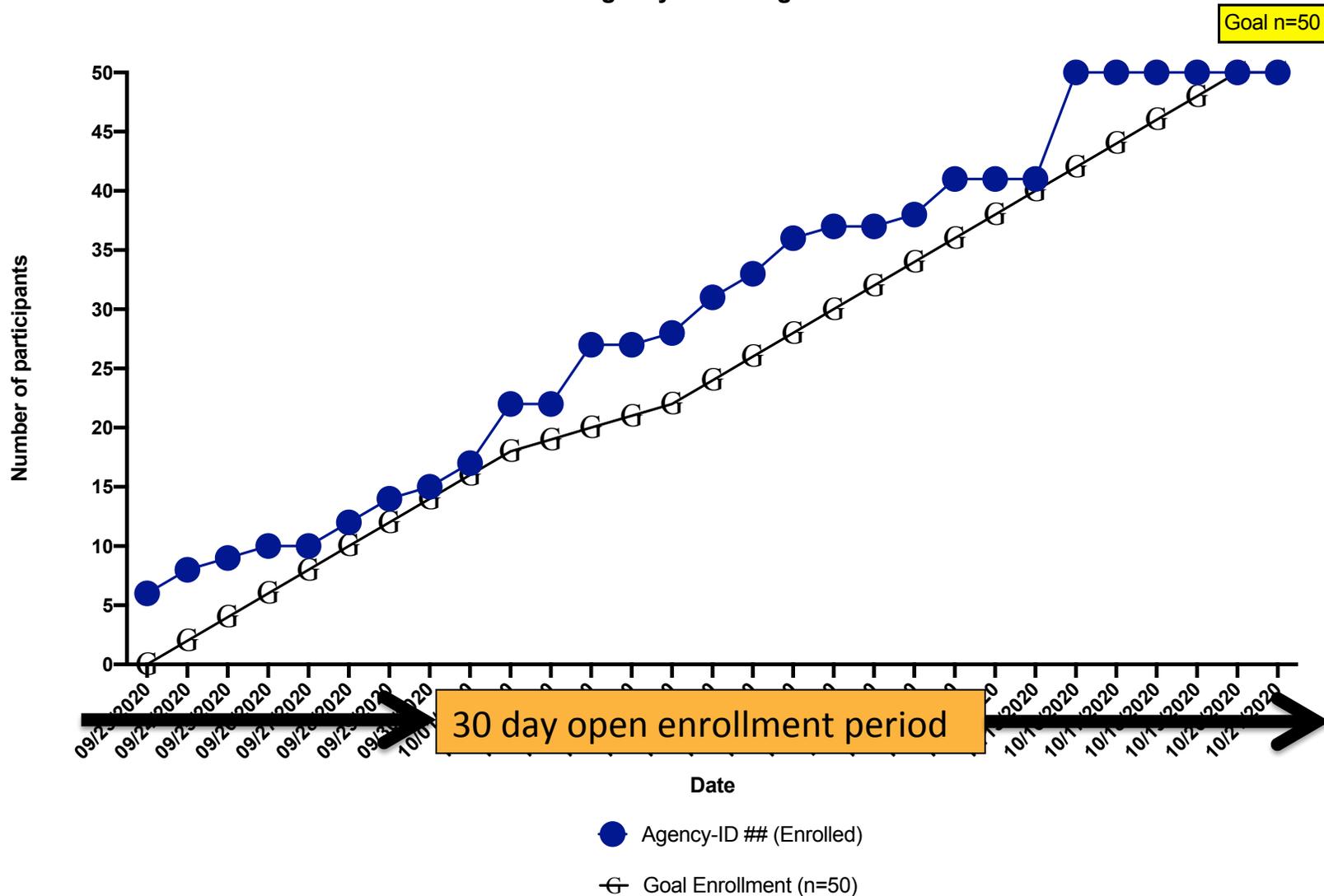
- \$5 dollars at enrollment
- \$5 every month for 6 months
- Total remuneration worth \$35



# Access to Education Modules

Example Graph

Agency ID## Progress



# Update on Phase 3



INSTITUTES FOR  
BEHAVIOR RESOURCES, INC.

*shaping a better world*



Steven R. Hursh, Ph.D.

IBR President and Chief Scientist

## **Biomathematical model**

Model fatigue as it relates to scheduling.

Software program.

Inputs: Scheduling, Rest, Work Hours.

Outputs: Risk of fatigue based on inputs

# How to Participate

1. Need agency leaders to agree to participate.
2. Set a date to start recruitment within agency.
3. Help circulate recruitment info in agency.
4. Promote participation for duration of study.

**DEADLINE for agencies = December 15<sup>th</sup> 2020**

**[www.emssleephealth.pitt.edu](http://www.emssleephealth.pitt.edu)**

# Clarification

- EMS Sleep Health Study
  - [www.emssleephealth.pitt.edu](http://www.emssleephealth.pitt.edu)
- Sleep and Teamwork in EMS Study
  - [www.saftie.pitt.edu](http://www.saftie.pitt.edu)
- EMS Shift Work Project
  - [www.emsshiftwork.org](http://www.emsshiftwork.org)

# Thank You

Please reach out ([pdp3@pitt.edu](mailto:pdp3@pitt.edu))

