



NTSB National Transportation Safety Board

Investigating Fatigue Factors in NTSB Accident Investigations

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National Transportation Safety Board

Control Room Management Forum

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Outline

- NTSB recommendations on controller fatigue
- Fatigue risk factors
- NTSB Human Fatigue Investigation Methodology

Fork Shoals, SC, 6/26/96



- Fork Shoals: Establish industry guidelines for work schedules that minimize fatigue
- DOT report: Establish hours of service regulations that provide predictable schedules and consider circadian rhythms and human sleep requirements

NTSB SCADA Study

- 2005 Study that looked at accidents, surveys, interviews and system reviews
- Most controllers reported fatigue-related problems with their shifts



- Recommendation to PHMSA to include fatigue information on accident reporting form

PHMSA Actions

- Published 2005 Advisory Bulletin on countermeasures to prevent human fatigue in the control room
- Issued 2008 NPRM that addressed scheduling and investigations
- Drafted revisions to accident report that address controller fatigue



Making a Fatigue Determination?



" We're not sure yet, but we think he may have been asleep at the wheel."

Method

- Reviewed NTSB major accidents after 1990 with fatigue as probable cause or contributing factor
- Coded **fatigue indicators** listed in “Analysis” section
- Recorded **evidence sources** for each fatigue indicator



Fatigue Indicators

- Recent work/rest history
- General work/rest history
- Time on task/time awake
- Appearance/behavior
- Organizational factors
- Task factors
- Circadian factors
- History of fatigue
- Medical issues
- Performance errors
- Self report



Evidence Sources

- Time of day
- Operator interview
- Interviews with others
- Records
- Data/voice/video recordings
- Wreckage/reconstruction
- Medical tests

Burnt Cabins, PA June 20, 1998





Burnt Cabins, PA June 20, 1998

Fatigue Indicators

- Recent work/rest history
- Circadian factors
- Trouble sleeping
- History of drowsy driving
- Drifting prior to accident
- Shallow departure, no braking/counter-steering
- Sedating drug

Evidence Sources

- Work schedule records
- Time of day
- Medical records
- Passenger witnesses
- On-the-road witnesses
- Wreckage
- Family interviews
- Toxicological testing



Clarkston, MI November 15, 2001



Clarkston, MI November 15, 2001

Fatigue Indicators

- No braking in response to signal or during 2 minutes prior to accident
- History of falling asleep while working
- Obstructive sleep apnea
- Highly variable work schedule

Evidence Sources

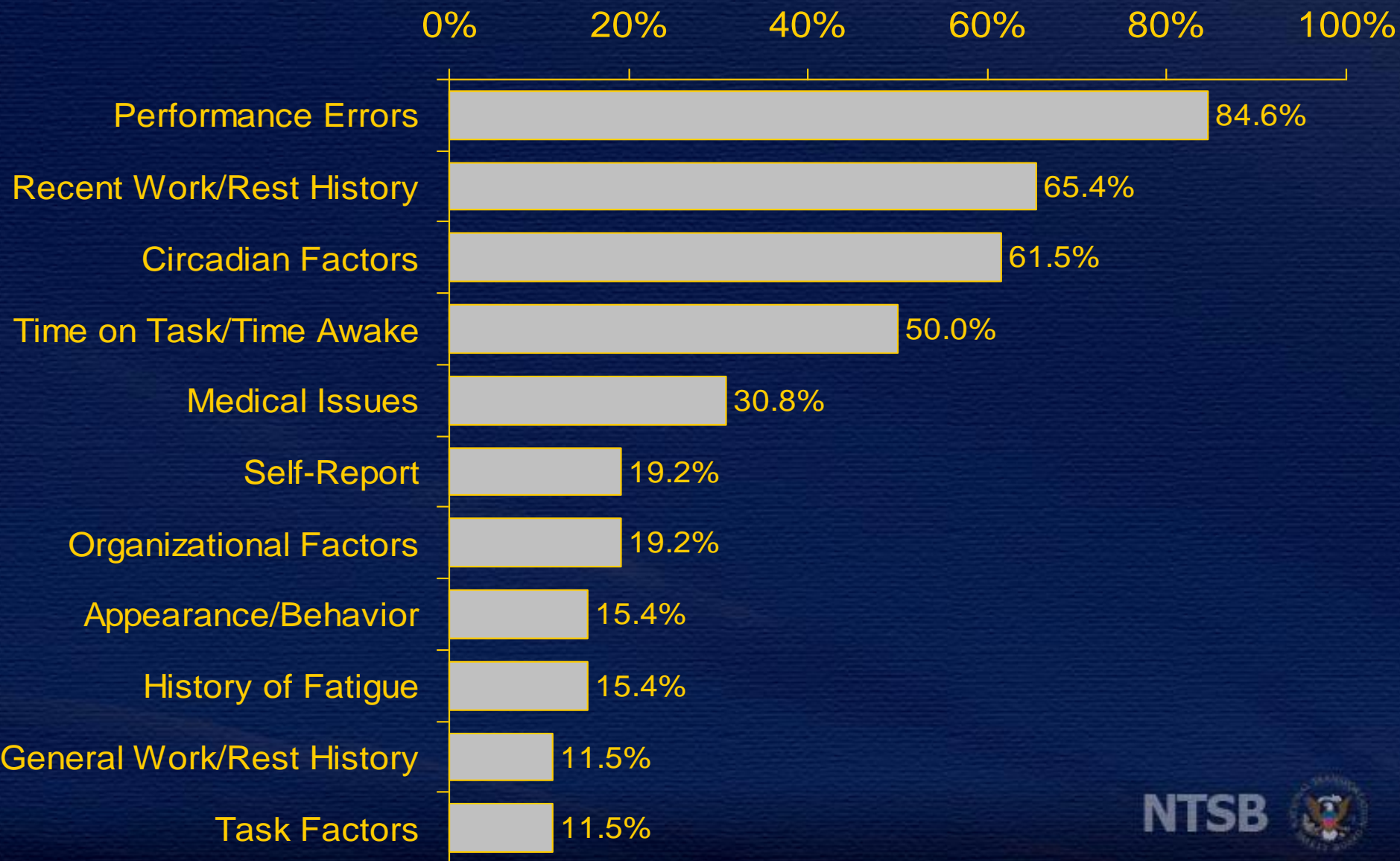
- Data recorder
- Coworker interviews
- Medical records
- Work schedule records

Results

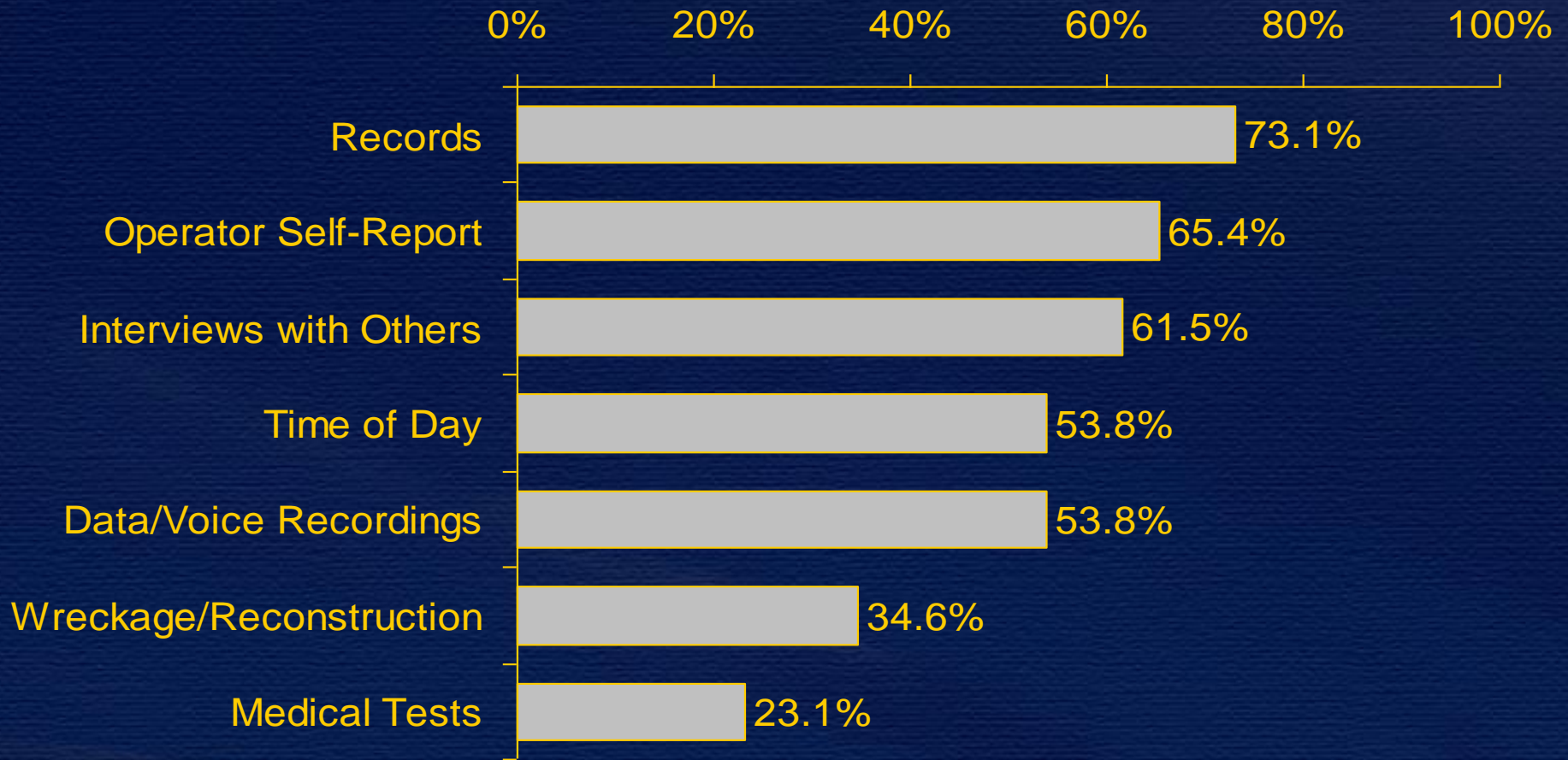
- 26 major accident reports over 13-year period
- Accidents represented all modes
- Average indicators: 5.2
- Average evidence sources: 4.6



Fatigue Indicators



Evidence Sources



		Fatigue Indicators										
		Predisposing Factors								Manifestations		
		Recent Work/Rest History	General Work/Rest History	Time on Task/Time Awake	Circadian Factors	Medical Issues	Organizational Factors	History of Fatigue	Task Factors	Performance Errors	Self-Report	Appearance/Behavior
Evidence Sources	Records	X	X		X	X	X	X				
	Operator Self-Report	X	X	X	X	X	X	X	X		X	
	Interviews with Others	X	X	X		X	X	X	X	X	X	X
	Time of Day			X	X							
	Data/Voice Recordings									X	X	X
	Wreckage/Reconstruction									X		
	Medical Tests					X		X				

NTSB Human Fatigue Investigation Methodology

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NTSB Human Fatigue Investigation Methodology

1. Establish that the operator was in a fatigued state at the time of the accident
2. Determine whether the actions that led to the accident are consistent with fatigue/sleep

Fatigue Risk Factors

- Sleep loss – acute or chronic
- Fragmented/disturbed sleep
- Circadian factors
- Health and drug issues
- Time awake/time on task
- Task factors



Operator Performance

- Overlooking/skipping tasks
- “Tunnel vision”
- Delayed responses or unresponsiveness
- Impaired decision making or inability to adapt to new information
- Self reports of fatigue, yawning or drooping eyes



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