



Training and Certification of Work Schedule Managers May Improve Shift Scheduling Practices

SUMMARY

The Federal Railroad Administration (FRA) Human Factors Research and Development (R&D) Program sponsored the implementation of a strategic job analysis to investigate the job of work schedule managers (WSMs) across a diverse range of industries that employ shiftworkers at around-the-clock operations. Currently, no such position exists in the Dictionary of Occupational Titles or Occupational Information Network (O*NET). A WSM is broadly defined as a person responsible for managing, maintaining, and monitoring the work schedules of shiftworkers across multiple shifts in an organization. The management of shiftwork schedules can vary in complexity across industries and even between divisions in a single organization, depending on the design of the schedule, the number of employees, and the daily schedule maintenance requirements to meet operational needs. The current investigation sought to identify a common set of knowledge and skills needed by WSMs to ensure effective practices in schedule design and maintenance.

Interviews with subject matter experts (SMEs) suggest that as WSMs develop and manage work schedules, more emphasis should be placed on mitigating the health and safety risks associated with shiftwork. In addition, most job incumbents (JIs) interviewed did not have the breadth of knowledge needed to fully understand the health and safety effects of poorly designed work schedules. Some JIs expressed a desire to receive more training to better equip their employees with tools and information to manage shiftwork lifestyles. Although most JIs agreed about the importance and significance of their duties and responsibilities as a WSM, it was often an ancillary job. The primary form of training available to WSMs was on-the-job, with scheduling skills most commonly learned through trial and error.

Results of this study suggest that disseminating shiftwork research findings and scheduling experiences via formalized training programs can improve JIs' knowledge of effective practices for schedule design and maintenance, thereby minimizing the health and safety risks of shiftwork. This will enhance JIs' skills in assessing the need for and the implementation of schedule changes to better balance productivity and safety without sacrificing the needs of the employees.

Table 1. List of KSAOs Identified as Evidencing Significant Gaps, Grouped by Level of Importance

	Knowledge	Skills	Abilities	Other Characteristics
Critically Important and Trainable	<ul style="list-style-type: none"> ▪ Various designs used to schedule 24/7 work (e.g., fast/slow, forward/backward rotations) ▪ The impact work hours have on health, safety, and performance ▪ Staffing analysis 	<ul style="list-style-type: none"> ▪ Recognizing the warning signs of potential fatigue, health, and safety issues 	<ul style="list-style-type: none"> ▪ Identify and manage risks 	<ul style="list-style-type: none"> ▪ Passion for safety and health
Very Important and Trainable, but Intergroup Disparities	<ul style="list-style-type: none"> ▪ The physiology of sleep as related to performance ▪ Tools and technologies available for scheduling ▪ Program evaluation 	<ul style="list-style-type: none"> ▪ Troubleshooting schedule systems 	<ul style="list-style-type: none"> ▪ Balance conflicting demands 	
Moderately Important and Trainable	<ul style="list-style-type: none"> ▪ Employee training programs specific to shiftwork ▪ Basic ergonomics and human factors 	<ul style="list-style-type: none"> ▪ Using analytical/statistical applications 	<ul style="list-style-type: none"> ▪ Self-evaluate to gauge success 	<ul style="list-style-type: none"> ▪ Well-connected with a community of schedulers



BACKGROUND

Over 21 million wage and salary workers, or almost 18 percent of the U.S. workforce, currently work other-than-day work schedules (McMenamin, 2007). Research has shown that poor schedule design can have negative implications for worker performance, safety, and health, and as a result cost U.S. businesses approximately \$206 billion per year (Broughton & Ogilvie, 1992; Kerin & Aguirre, 2005; Tepas, 2001). Yet the vast majority of supervisors and managers who perform shiftwork scheduling and management have no formal training in the human factors of sleep, the health and safety impacts of shiftwork, or the array of methods and formulas for designing and managing low stress-high productivity work schedules and shift rotations (Kryger, Roth, & Dement, 2000). Despite this, and the fact that millions of people in the United States work some form of shiftwork, no position description currently exists for that of WSM in the Dictionary of Occupational Titles or Occupational Information Network (O*NET). Moreover, the consultants and academicians responsible for training WSMs are relatively few. When it comes to shiftwork schedule management, the apparent gap between research and practice needs to be documented and addressed by the industry.

As part of its efforts to investigate new approaches to work scheduling and fatigue management, the Federal Railroad Administration's (FRA) Office of Railroad Policy and Development sponsored this preliminary assessment to identify the need for advanced training in shiftwork schedule management and certifications for scheduling managers. Although there may be substantial differences in the mechanisms associated with managing work schedule operations in general, and fatigue in particular, the nature of the problems is very similar across occupational classifications. Therefore, this phase of research sought to document the job tasks and knowledge, skills, abilities, and other characteristics (KSAOs) common to WSMs across a broad array of industries that operate multiple and/or around-the-clock work shifts.

OBJECTIVES

The objectives of this research project were to investigate and identify the gaps between the job tasks and KSAOs that WSMs should have and what they currently have. To accomplish this task, a strategic job analysis was implemented to compare subject matter experts' (SMEs') knowledge of effective practices in work scheduling with job

incumbents' (JIs') reports of current practices in their job scheduling duties.

METHODS

A strategic job analysis is a forward-looking process that utilizes the principles and methodologies of traditional job analysis to extrapolate the future knowledge and skills needed by workers in a particular job. The goal of this strategic job analysis was to assess gaps between current and future knowledge and skill requirements to advance effective practices in shiftwork schedule management. Data were collected from JIs to assess current knowledge and skills and compared with SMEs' assessments of future knowledge and skill needs for WSMs.

SME Interviews and Panel Discussion. In Phase 1, future-oriented job task and KSAO information were solicited from 17 SMEs with high-level knowledge of shift scheduling best practices and extensive experience implementing schedule changes in organizations. Ten industry experts were interviewed in a panel discussion format, and each brought at least 10 years of experience consulting for organizations that operate around-the-clock. In addition, seven academic experts participated in one-on-one telephone interviews. They were chosen based on track records of publishing and presenting research related to the health and safety of shiftworkers. In total, 6 job tasks, 14 types of knowledge, 14 skills, 12 abilities, and 12 other characteristics were identified as critical for WSMs.

Jl Interviews. In Phase 2, current job task and KSAO information were solicited from JIs in various types of industries that operate around-the-clock. Individual in-person interviews were conducted with 16 JIs from 11 different organizations. The JIs worked in the fields of transportation, public utilities, health care, hospitality, public safety, and manufacturing.

The research team used a mixed methods approach to conduct an overall evaluation of the gaps that should be addressed to optimize the job performance of WSMs. Quantitative ratings and qualitative differences among tasks and characteristics were considered. Each job task was given one of three labels: minimal gaps, moderate gaps, or significant gaps. The KSAOs were divided into one of four tiers based on ratings of importance (higher tiered KSAOs were rated as more important) and then categorized into one of the three gap levels mentioned previously.



RESULTS

Results suggest that the most significant gaps in job tasks concern addressing the particular demands of shiftwork. In addition to managing work schedules, WSMs should have responsibility for monitoring performance and safety to determine potential shift-related safety risks. WSMs should also be equipped to serve as an internal health and safety resource for their organization; they can assist employees and management with understanding the challenges of shiftwork and shift scheduling. Current WSMs may not have the knowledge or the tools to carry out these activities.

Critical (tier 1) KSAOs demonstrating significant gaps can be divided into two categories: i) knowledge concerning the inputs needed to design work schedules and ii) characteristics needed to understand and manage the health and safety risks associated with shiftwork. Although SMEs and JIs agreed that these KSAOs were very important, most of the JIs we interviewed did not demonstrate the level of scheduling design, or health and safety knowledge that SMEs indicated should be required. However, there were a couple of exceptions. Two of the JIs interviewed reported having specialized training. Training beyond that acquired on-the-job assisted both of these scheduling managers in carrying out their job responsibilities, albeit in different ways. Yet training is neither standardized nor easily accessible to all scheduling managers at this time.

DISCUSSION

The gap analysis of job tasks and KSAOs revealed a common theme: additional training is needed, not only to aid WSMs in understanding how to better evaluate and design work schedules to improve operational efficiency, such as conducting staffing analysis, but also to aid WSMs in understanding how the design of shiftwork schedules can affect employee health, safety, and performance. The incumbents interviewed were fully capable of maintaining work schedules and making minor changes to scheduling to account for absenteeism, turnover, or overtime needs. However, they may not be qualified to identify problems in the schedule design and/or make changes to the system to address those problems. SMEs reflected that schedulers and their employing organizations appear to be underestimating the importance of proper schedule design.

Nonetheless, caution should be used when extrapolating these results to the entire population of employees with work scheduling job duties. Only a

small number of shiftwork managers were interviewed for this study. In addition, there were relatively few statistically significant differences between empirical ratings of importance. Conclusions are based on holistic observations of the quantitative and qualitative data collected and should be used to provide guidance for future studies and training development efforts. Additional research is necessary to identify training and certification needs in specific occupations, especially considering the identified need for substantial industry-specific knowledge in shiftwork schedule management.

Another consideration when moving forward with a WSM training and certification program is that different levels of training need to be developed to target varying levels of skill development. SMEs indicated that scheduling expertise varies based on industry, type of operation, and the size of an organization. Variations in expertise were also evident across JI interviews. Shiftwork schedule management training is needed at all levels, from first-line supervisors to the next generation of shiftwork consultants. Addressing the training need at different levels requires different kinds of programs, ranging from short-term seminars to graduate-level training.

CONCLUSIONS

Overall, SMEs expressed enthusiasm for the development of a certification program and confirmed the need for greater levels of expertise in shiftwork scheduling. Many also expressed interest in assisting with the development of training curricula. JIs were helpful and cooperative, and confirmed that shiftwork scheduling is often not a streamlined process. Training, technology, schedule designs, and even “rules of thumb” differ greatly within and between organizations. The outcomes of this project suggest that training work schedule managers involves finding a balance between company needs and occupational health and safety concerns, as well as helping managers navigate that balancing act. In conclusion, this strategic gap analysis identified a need for the formalization, training, and certification of WSMs whose primary job duties and responsibilities are to maintain, design, implement and evaluate operational work schedules. In addition, supplemental yet formalized education and training programs are needed for managers and supervisors of shiftwork operations.



FUTURE DIRECTION AND ACTIVITIES

The future of this project relies on cross-governmental support to fund broad-based implementation and application of a WSM credential across all operations that employ shiftworkers for around-the-clock staffing.

Next steps in this project are to begin development of model curriculum for WSM credentialing and design a program development plan for the creation of a certification program.

REFERENCES

Broughton, R. J. & Ogilvie, R. D. (Eds.) (1992). *Sleep, Arousal and Performance: Problems and Promises*. Boston, MA: Birkhauser.

Gertler, J. and Nash, David. (2004). *Optimizing Staffing Levels and Schedules for Railroad Dispatching Centers* (Report No. DOT/FRA/ORD-04-01). Washington, DC: Federal Railroad Administration.

Kerin, A. & Aguirre, A. (2005). Improving health, safety, and profits in extend hours operations (shiftwork). *Industrial Health*, 43, 201-208.

Kryger, M., Roth T., & Dement, W. (Eds.) (2000). *Principles and Practices of Sleep Medicine* (3rd ed.). Philadelphia, PA: W. B. Saunders Co.

Morrow, S. L., Stentz, T., Nash, D. E., Walsh, B. M., Badiie, M., Plano Clark, V., Barnes-Farrell, J., & Impara, J. (2010). *Shiftwork schedule management gap analysis: Assessing the future training needs of shiftwork schedule managers using a strategic job analysis approach*. (Report No. DOT/FRA/ORD-10-05). Washington, DC: Federal Railroad Administration.

http://www.fra.dot.gov/downloads/Research/Work_Schedule_Manager_Gap_Analysis.pdf

McMenamin, T. (2007). A time to work: recent trends in shift work and flexible schedules. *Monthly Labor Review*, 130(12), 3-15.

Tepas, D. I. (2001). Shiftwork and sleep. In W. Karwowski (Ed.) *International Encyclopedia of Ergonomics and Human Factors*. London: Taylor & Francis, pp. 1355-1358.

ACKNOWLEDGMENTS

This study would not have been possible without the efforts and cooperation of a diverse research team: Dr. Janet Barnes-Farrell and Mr. Ben Walsh at the University of Connecticut, Dr. Terry Stentz, Dr. Vicki Plano Clark, and Ms. Manijeh Badiie at the University of Nebraska-Lincoln, Dr. Heidi Howarth, Dr. Stephen Popkin, and Ms. Tara DiDomenico at the Volpe National Transportation Systems Center, and consultants Mr. David Nash and Dr. James Impara. The author would also like to thank the consultants, researchers, organizations, and employees that volunteered their time to participate in the data collection efforts. This work is being performed under an interagency agreement between the Human Factors Program in FRA's Office of Railroad Policy and Development and the John A. Volpe National Transportation Center's Human Factors Research and System Applications Center of Innovation, with support from the University of Connecticut's Industrial Psychology Applications Center and the University of Nebraska-Lincoln.

CONTACT

Michael Coplen, M.A.
Senior Evaluator, Manager, Culture and Safety
Performance, Human Factors Program
Federal Railroad Administration
Office of Railroad Policy and Development
1200 New Jersey Ave. SE – Mail Stop 20
Washington, DC 20590
(202) 493-6346
Michael.Coplen@dot.gov

Stephanie Morrow, Ph.D.
Human Factors Research and System Applications
Research and Innovative Technology Administration
Volpe National Transportation Systems Center
1200 New Jersey Ave. SE
Washington, DC 20590
(202) 493-1344
Stephanie.Morrow@dot.gov

KEYWORDS

gap analysis, needs assessment, job analysis, rail, shiftwork, fatigue, human factors, training, certification, credentialing, work scheduling, knowledge, skills, abilities, job tasks, fitness for duty, personnel, staffing, work time

Notice and Disclaimer: This document is disseminated under the sponsorship of the United States Department of Transportation in the interest of information exchange. Any opinions, findings and conclusions, or recommendations expressed in this material do not necessarily reflect the views or policies of the United States Government, nor does mention of trade names, commercial products, or organizations imply endorsement by the United States Government. The United States Government assumes no liability for the content or use of the material contained in this document.
