



Sleepiness and Shift Worker Fitness to Drive: A Systematic Literature Review

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Introduction

- 15-28% of North Americans are employed in shift work on rotating or overnight shifts (Bureau of Labour Statistics, 2005; Williams 2008).
- Primary concerns of this population include chronic insufficient sleep and sleepiness associated with impaired physical and cognitive abilities, and a disproportionate burden of road traffic injuries and fatalities (Åkerstedt, 1988; Stutts et al., 2003).
- Shift workers may commute or drive as a function of their employment; yet, determinants of fitness-to-drive (FTD) have not been established in this at-risk population.

Objectives

- 1) What is the class of evidence in the determinants underlying FTD and DP outcomes in shift workers with insufficient sleep?
- 2) What is the degree of confidence in the determinants underlying FTD and DP outcomes in shift workers with insufficient sleep?
- 3) What recommendations can be made for clinical practice, research, and policy as a result of this evidence?

Methods

A Protocol was published at PROSPERO (Knott, et al., 2018a, 2018b).

Locate & Select Studies

A comprehensive search strategy was developed in consultation with a Western University Research Librarian. Search terms included:

- Insufficient Sleep OR related synonyms; AND
- Driving OR related synonyms; AND
- Shift work OR related synonyms.

Collect Data

- In pairs, authors (n=4) independently completed data extraction using Systematic Process for Investigating and Describing Evidence-based Research (Classen, Winter, Awadzi, et al., 2008).

Appraise Critically

- Reviewers independently critically appraised studies following the American Academy of Neurology (AAN) guidelines (2017) to determine the level of evidence from Level I (highest) to Level IV (lowest).

Analyze and Interpret Results

- Determine the degree of confidence in the evidence using AAN (2017) guidelines from Level A (highest) to Level U (insufficient).

Results

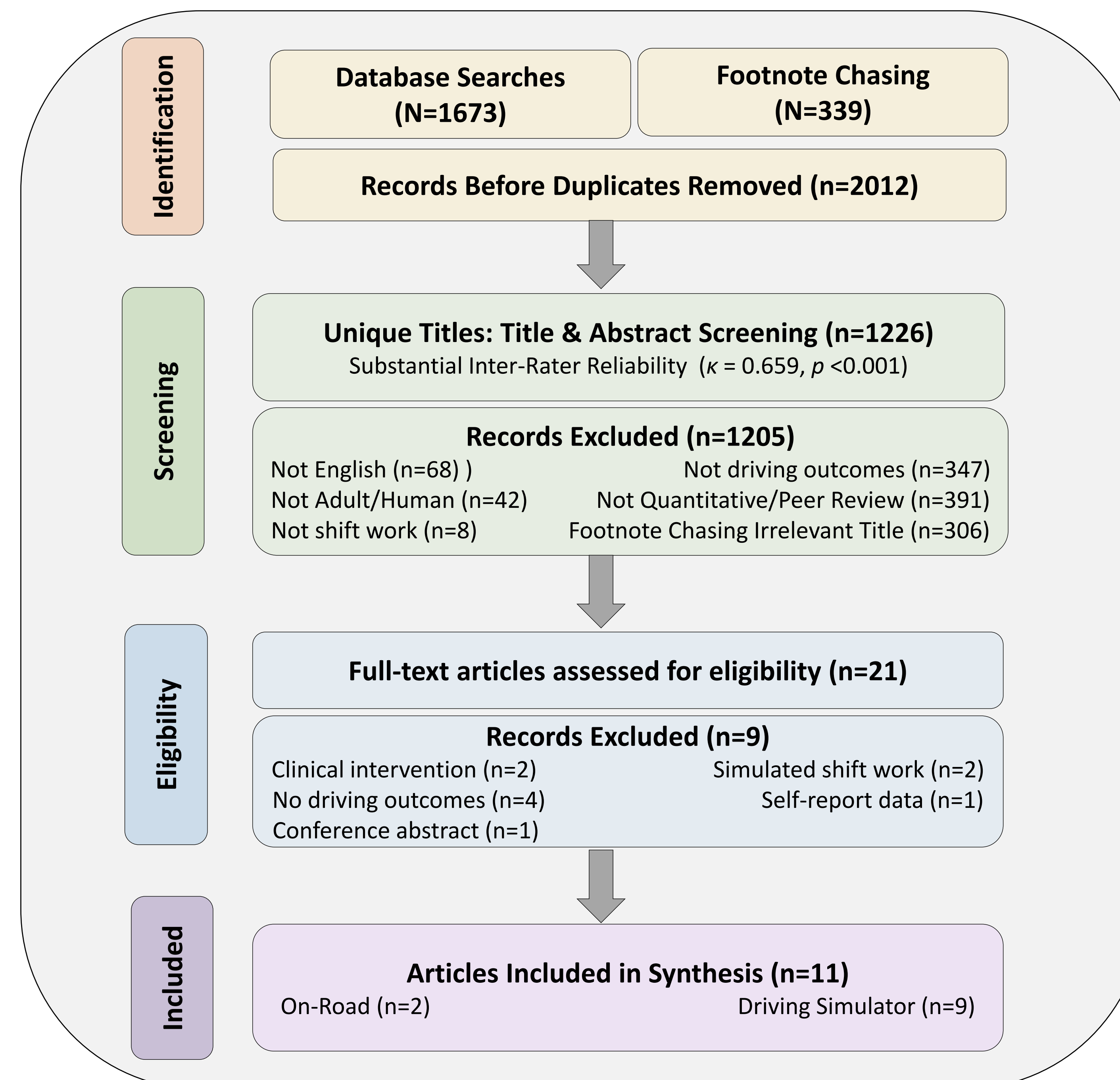


Figure 1. PRISMA Flow Diagram (Moher, Liberati, Tetzlaff, et al., 2009)

Class of Evidence

- On-Road: Two studies assessed as Class III
- Simulator: Eight studies assessed as Class III, one study as Class IV

Level of Confidence

Level B – Likely predicts drivers at risk for adverse driving outcomes

- On-Road: None
- Simulator: Overnight Shifts

Level C – Possibly predicts drivers at risk for adverse driving outcomes

- On-Road: Overnight Shift
- Simulator: Time on task, Subjective Sleepiness ratings via KSS, within-drive

Level U – Insufficient evidence to predict drivers at risk

- On-Road: Time on task, electro-oculography measures
- Simulator: Afternoon shift, Swing shift, 28-hour shift, direction of shift rotation, KSS pre-drive; objective sleepiness (PVT-RT, PVT-lapses); electro-oculography, Sex (male), Physician specialty

Results

Demographics Synthesis

On-Road:

- N=16 (56% female), age 19-65, employment not specified

Simulator:

- N=269 (11% female), age 24-61 (n=58 unreported)
- Employment, police (n=107), physicians (n=106), technician (n=36), mixed/other (n=10)

Methods Synthesis

On-Road: (N=2), conducted in USA, 2016-2017

- Assessed night-shift workers for 2 hours in an instrumented minivan on a closed-course track with no other traffic

Simulator: (N=9), conducted in USA, Sweden, Belgium, 2005-2017

- All studies examined overnight shifts; alternate shifts less frequently
- Workers assessed via 30-120 minute simulated drives in low-demand highway or track environments

Overall:

- All studies used within-subject designs, i.e., worker as own control
- No gold-standard on-road comprehensive driving evaluations (CDE)
- Measures of subjective and objective sleepiness predicted adverse driving outcomes, but were infrequently examined as predictors
- Outcome measures focused on operational driving behavior, i.e., driver interactions with brake, steering wheel
- Tactical behaviors, i.e., negotiating on-road situations such as lane maintenance errors, were rarely examined
- Strategic driving behaviors, i.e., planning or adapting routes, were not examined

Discussion

Practice Recommendations

- Educate shift workers that overnight shift work *likely* predicts adverse driving outcomes
- Extended time on task and increased ratings of subjective sleepiness *possibly* predict adverse driving outcomes

Future Research

- Include larger samples of younger adults <24 years, females, and high-prevalence shift work occupations
- CDE and increased complexity of simulator scenarios to target operational and strategic driving behaviors

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References

- Full Article and references: <https://doi.org/10.1016/j.aap.2019.07.010>