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Social Rhythm Stability and Psychological Well-Being Among Shift Workers

Dr. Eva L. Bakker

Associate Professor, Leiden University, Netherlands

Abstract

Shift work is indispensable in healthcare, transportation, manufacturing, security, hospitality, emergency services, and other sectors that require continuous operation. Its occupational necessity, however, frequently requires workers to sleep, eat, work, socialize, and recover at times that conflict with endogenous circadian organization and conventional social schedules. The present study examines social rhythm stability as a potentially modifiable behavioral factor associated with psychological well-being among shift workers. Social rhythm stability refers to the degree of regularity with which recurring daily activities—including sleep, waking, meals, work transitions, exercise, and interpersonal contact—occur across successive days. Earlier social-rhythm research established methods for quantifying regularity in daily routines, while later evidence showed that greater social rhythmicity is associated with fewer depressive and anxiety symptoms and healthier sleep-related behavior.

Because no original participant dataset was supplied, the study employs a simulation-based quantitative design involving 520 synthetic shift-worker cases. Social rhythm stability, sleep regularity, psychological well-being, and psychological distress were modeled as related but non-identical constructs. The simulated analysis produced a positive association between social rhythm stability and psychological well-being, with a simulated correlation of r = 0.74. Mean psychological well-being increased from 54.16 among workers in the lowest rhythm-stability category to 81.14 in the very-high-stability category, while the modeled prevalence of elevated psychological distress declined from 64.6% to 16.9%. These values are methodological simulations rather than population estimates.

The findings support a framework in which psychological risk among shift workers is influenced not only by whether employees work outside conventional daytime hours but also by the degree of instability surrounding their daily behavioral timing. Previous reviews have associated shift work with disturbed sleep, depressed mood, anxiety, impaired cognition, and reduced quality of life, whereas irregular and unpredictable schedules appear especially relevant to psychological health. The paper concludes that organizational interventions should consider schedule predictability, chronotype compatibility, protected recovery periods, sleep timing, meal regularity, and opportunities for stable social participation. Social rhythm stability should not be treated as a substitute for adequate staffing or humane scheduling; rather, it represents one behavioral pathway through which better-designed shift systems may support psychological well-being.

Keywords: social rhythm stability; shift work; psychological well-being; circadian rhythm; sleep regularity; mental health; social jetlag; occupational health

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1. Introduction

Shift work allows modern societies to provide essential services continuously, yet it places substantial demands on workers whose occupational schedules extend beyond conventional daytime hours. Night duties, rotating rosters, early-morning shifts, split schedules, and rapidly changing work periods can alter the timing of sleep, meals, family interaction, physical activity, and social engagement. These changes matter because human biological systems are organized around circadian rhythms that coordinate sleep–wake behavior, hormonal activity, metabolism, alertness, and mood across approximately twenty-four hours. James and colleagues described shift work as a condition capable of producing both sleep displacement and circadian misalignment, while Kecklund and Axelsson emphasized that insufficient sleep and irregular work timing contribute to a broad occupational health burden.

Psychological consequences are particularly important because they can extend beyond temporary fatigue. Zhao and colleagues' systematic review and meta-analysis found that the relationship between shift work and mental health varied according to schedule type, with especially relevant evidence for irregular and unpredictable forms of shift work. Torquati and colleagues' longitudinal meta-analysis likewise identified an increased risk of poor mental health among shift workers, while Lee and colleagues reported an association between night-shift work and depression across observational studies. Brown and colleagues subsequently concluded that shift work is associated with sleep disturbance, depressed mood, anxiety, cognitive difficulties, substance-related concerns, and reduced quality of life, although the magnitude and expression of these outcomes differ across workers and occupational settings.

One reason for this variability may be that shift work is often treated as a single exposure even though workers experience very different degrees of behavioral regularity. Two employees may both work nights while having markedly different lifestyles. One may follow a relatively stable sequence of sleeping, eating, exercise, family contact, and recovery; another may alternate repeatedly between early, late, and overnight work, with irregular meals and constantly changing sleep periods. Social-rhythm theory provides a useful framework for distinguishing these experiences. Monk and colleagues developed the Social Rhythm Metric to quantify regularity in recurring daily activities, demonstrating that measurable patterns of social timing can be followed over extended periods. Frank and colleagues later showed that psychological interventions could increase lifestyle regularity, reinforcing the broader idea that daily rhythms are behaviorally meaningful and potentially modifiable.

The relevance of this framework to shift work is strengthened by research linking behavioral regularity, sleep, and mental health. Sabet, Dautovich, and Dzierzewski found that greater social rhythmicity was associated with fewer depressive and anxiety symptoms and that healthier sleep-related behaviors and cognitions partly explained this association. Shift workers are especially vulnerable to disruption of these rhythms because work timing may force sleep and activity into periods that conflict with chronotype and endogenous circadian preferences. Juda, Vetter, and Roenneberg demonstrated that chronotype modifies sleep duration, sleep quality, and social jetlag across different shift schedules, while Vetter and colleagues showed that adjusting schedules according to chronotype can improve sleep and reduce circadian disruption.

The present paper therefore shifts attention from shift-work exposure alone to social rhythm stability within shift-work conditions. The central proposition is that greater regularity in sleep timing, meals, work transitions, physical activity, and social interaction may provide a degree of temporal

organization even when employees cannot maintain conventional daytime schedules. The direct intersection of social-rhythm stability and psychological well-being among heterogeneous shift-worker populations remains less developed than the separate literatures on shift work, circadian disruption, and social rhythmicity; this is an inference from the existing evidence base rather than a claim that no prior research exists. The current simulation consequently develops a testable framework for examining whether rhythm stability is positively associated with psychological well-being and whether sleep regularity represents one plausible pathway through which that relationship may operate.

2. Objectives of the Study

2.1 To Examine Social Rhythm Stability Among Shift Workers

The first objective is to conceptualize social rhythm stability as the regularity of recurring daily activities among employees working outside conventional daytime schedules. The study considers consistent timing of sleep, waking, meals, physical activity, work transitions, recovery periods, and social interaction. The underlying proposition draws on the Social Rhythm Metric tradition, which treats recurring behavioral timing as measurable rather than merely anecdotal.

2.2 To Assess the Association Between Social Rhythm Stability and Psychological Well-Being

The second objective is to examine whether shift workers represented by more stable social rhythms demonstrate higher simulated psychological well-being and lower psychological distress. This proposition is consistent with evidence that stronger social rhythmicity is associated with fewer depressive and anxiety symptoms and with research linking shift-work-related sleep disturbance to adverse mental-health outcomes.

2.3 To Evaluate Sleep Regularity as an Explanatory Pathway

The third objective is to evaluate sleep regularity as a plausible mechanism linking stable social rhythms with psychological well-being. Sleep timing and consistency have been increasingly recognized as important dimensions of health in addition to sleep duration, while shift-work research demonstrates that circadian alignment and chronotype influence sleep quality and adaptation.

3. Review of Literature

3.1 Social Rhythms, Daily Regularity, and Mental Health

The social-rhythm perspective developed from the recognition that human biological rhythms are influenced not only by environmental light but also by recurring social and behavioral events. Waking, leaving for work, eating meals, interacting with other people, exercising, and going to bed can function as repeated temporal markers within everyday life. Monk, Kupfer, Frank, and Ritenour demonstrated that such regularity could be systematically measured using the Social Rhythm Metric across a twelve-week period. The importance of this approach lies in its treatment of routine as a temporal property rather than simply a list of healthy or unhealthy behaviors.

Clinical research subsequently strengthened the argument that lifestyle regularity can have psychological relevance. Frank and colleagues examined interpersonal and social rhythm therapy and showed that lifestyle regularity could be increased through structured intervention. Although this

research originated in the context of mood disorders rather than occupational shift work, it established an important principle: recurrent behavioral timing is modifiable and may interact with emotional stability. Evidence from a broader adult population further supports the relationship between social rhythms and mental health. Sabet, Dautovich, and Dzierzewski analyzed 3,284 adults and found that greater social rhythmicity was directly associated with fewer depressive and anxiety symptoms. Their analysis also indicated that healthier sleep behaviors and sleep-related thoughts mediated part of the association. This finding is particularly relevant to shift workers because work schedules can destabilize both social timing and sleep at the same time.

The implication is not that routine automatically produces psychological well-being. Highly regular schedules can still be exhausting or socially restrictive. Rather, social rhythm stability may reduce the number and magnitude of timing shifts that workers must repeatedly negotiate. Stable temporal cues may make sleep preparation, eating, exercise, family coordination, and recovery more predictable, reducing one layer of behavioral uncertainty within an already demanding occupational environment.

3.2 Shift Work, Circadian Misalignment, and Sleep Disruption

Circadian misalignment is one of the principal mechanisms through which shift work can affect health. Walker, Walton, DeVries, and Nelson reviewed evidence linking circadian-rhythm disruption with mental health and highlighted night-shift work as an important human model of circadian disturbance. Chellappa similarly argued that circadian misalignment provides a biological basis for increased mood vulnerability during shift work. These studies indicate that psychological outcomes should not be interpreted solely through the amount of work performed; the biological timing of that work is also consequential.

Chronotype adds further complexity because individuals vary in preferred timing for sleep and activity. Juda, Vetter, and Roenneberg studied 238 shift workers and showed that chronotype influenced sleep duration, sleep quality, and social jetlag under different morning, evening, and night schedules. Vetter, Fischer, Matera, and Roenneberg later implemented a chronotype-adjusted shift schedule and reported improvements in sleep and reductions in circadian disruption. These findings undermine the assumption that a single roster design will affect all workers identically.

Sleep consistency itself also deserves attention. Chaput and colleagues' systematic review examined sleep timing and sleep consistency as distinct health-relevant dimensions, reinforcing the view that healthy sleep cannot be assessed through duration alone. For shift workers, regular sleep cannot always mean sleeping at the same conventional nighttime hour. A more realistic occupational definition concerns whether workers can maintain reasonably predictable sleep windows relative to their work sequence and whether schedule changes allow sufficient time for circadian and behavioral adjustment.

Holzinger, Mayer, and Klösch focused directly on irregular work shifts and argued that desynchronization of biological and social rhythms contributes to psychological health difficulties. Their work is particularly relevant to the present study because it links the occupational schedule with both biological and social dimensions of rhythmic organization.

3.3 Shift Work and Psychological Well-Being

Mental-health evidence concerning shift work is substantial but not completely uniform. Zhao and colleagues' systematic review concluded that associations differ according to how shift work is defined and that irregular or unpredictable work patterns deserve particular attention. This heterogeneity is theoretically important: broad comparisons between “shift workers” and “day workers” may conceal meaningful differences in rotation speed, predictability, night-work frequency, recovery periods, and behavioral regularity.

Torquati and colleagues synthesized longitudinal evidence and reported increased risk of poor mental health among shift workers, particularly depressive symptoms. Lee and colleagues' meta-analysis similarly found that night-shift work was associated with an increased risk of depression, although heterogeneity across included observational studies was substantial. These results support occupational concern while also cautioning against deterministic interpretations.

Booker and colleagues provided a more focused analysis among nurses and found that shift-work disorder was strongly associated with depression and anxiety. Brown and colleagues' updated review reached a broader conclusion that shift work can affect sleep, mood, anxiety, cognition, substance use, and quality of life, with sleep disturbance frequently underlying psychological consequences. Together, this literature suggests that a useful next step is to identify modifiable characteristics within shift-work environments rather than treating all risk as an unavoidable consequence of nonstandard employment.

4. Research Methodology

4.1 Research Design and Conceptual Model

The study uses a simulation-based explanatory quantitative design. No employees were recruited, no questionnaire was administered, and no workplace records were accessed. Simulation was selected to avoid presenting invented participant data as completed empirical research while allowing the proposed relationships to be expressed in a reproducible analytical form.

The model contains social rhythm stability as the principal explanatory construct and psychological well-being as the principal outcome. Sleep regularity is treated as a theoretically plausible intermediary variable. Psychological distress is included as a supplementary negative outcome. The conceptual direction is informed by earlier evidence connecting social rhythmicity with depression and anxiety, together with shift-work literature emphasizing sleep and circadian disruption.

A synthetic analytical sample of 520 shift-worker cases was generated. Cases were distributed into four rhythm-stability categories using quartile-based classification: low, moderate, high, and very high. Each category contained 130 simulated observations.

4.2 Operationalization of Variables

Social rhythm stability was represented by an index ranging from 0 to 100. Higher scores indicate greater consistency in recurring behavioral timing. The construct was informed conceptually by the Social Rhythm Metric tradition but is not presented as a directly administered version of that clinical instrument.

Psychological well-being was represented by a composite simulation index ranging from 0 to 100, where higher values indicate more favorable emotional functioning, perceived psychological

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balance, and lower disruption from stress. Sleep regularity was represented by a corresponding 0–100 index reflecting the consistency of sleep onset, waking, and recovery timing.

Table 1: Operational Framework of the Simulation Model

Construct	Operational Definition	Scale	Analytical Role
Social Rhythm Stability	Regularity in the timing of sleep, waking, meals, activity, work transitions, and social contact	0–100	Primary predictor
Sleep Regularity	Consistency of sleep and wake timing across work and recovery periods	0–100	Explanatory pathway
Psychological Well-Being	Composite representation of positive psychological functioning and emotional stability	0–100	Primary outcome
Psychological Distress	Simulated probability of elevated depressive, anxious, or stress-related symptoms	Binary probability	Supplementary outcome
Shift-Schedule Predictability	Degree to which upcoming work periods can be anticipated and planned	1–5	Contextual variable
Chronotype Compatibility	Approximate correspondence between work timing and preferred biological timing	1–5	Potential moderator

4.3 Simulation and Analytical Procedure

The simulation generated individual variability rather than assigning fixed outcomes to each rhythm category. Social rhythm stability was first generated across a broad continuous distribution. Sleep regularity was then modeled as positively but imperfectly associated with rhythm stability. Psychological well-being was modeled as a function of both social rhythm stability and sleep regularity plus unexplained individual variation. This structure reflects the theoretical assumption that regularity may matter without determining mental-health outcomes.

Descriptive statistics were calculated for four social-rhythm categories. Pearson-style correlation was used as a descriptive representation of the simulated continuous association between social rhythm stability and psychological well-being.

5. Analysis

5.1 Psychological Well-Being Across Social-Rhythm Stability Levels

The simulated results reveal a consistent gradient across the four social-rhythm categories. Workers represented in the lowest-stability quartile had a mean Social Rhythm Stability Index of 37.57 and a

mean Psychological Well-Being Index of 54.16. At the opposite end, the very-high-stability group had a mean rhythm score of 81.30 and a mean psychological well-being score of 81.14.

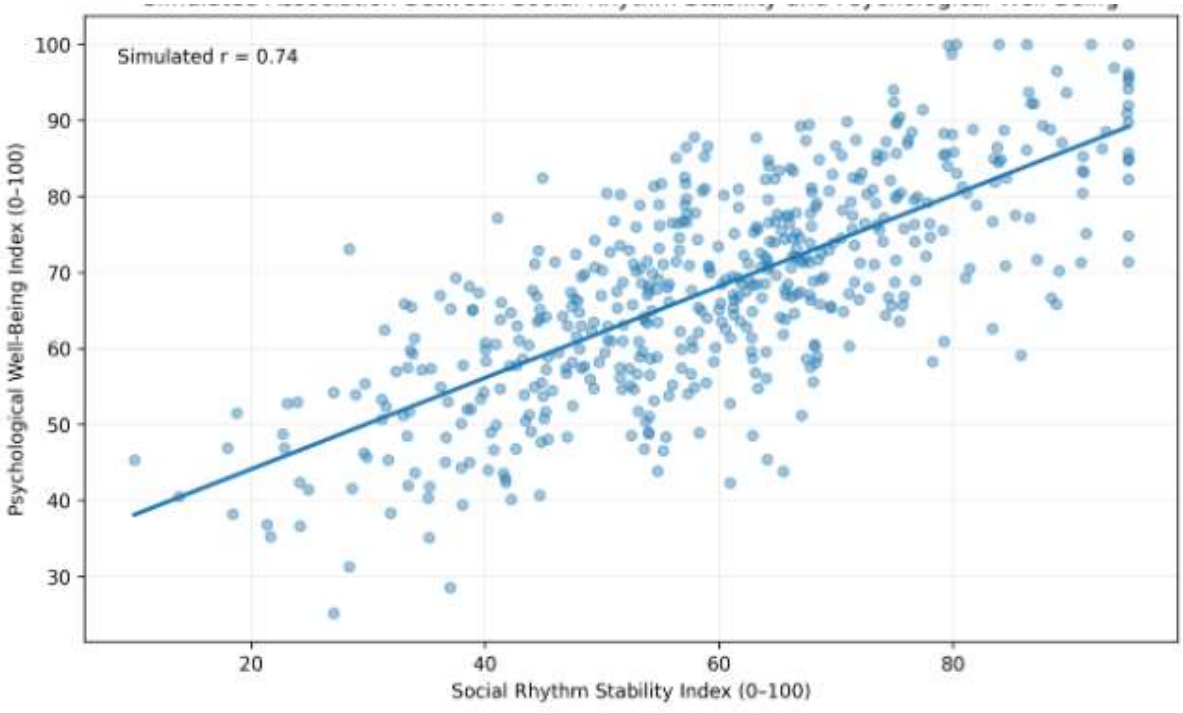
Table 2: Simulated Social Rhythm Stability, Sleep Regularity, and Psychological Outcomes

Social Rhythm Stability	Simulated Cases	Mean Rhythm Stability	Mean Sleep Regularity	Mean Psychological Well-Being	Elevated Distress
Low	130	37.57	52.75	54.16	64.6%
Moderate	130	54.36	64.09	65.96	34.6%
High	130	65.36	70.71	70.47	21.5%
Very High	130	81.30	82.43	81.14	16.9%

The 26.98-point difference in mean well-being between the lowest and highest rhythm-stability groups is accompanied by a comparable improvement in sleep regularity. Elevated distress also declines progressively across the categories. The directional pattern is compatible with existing research showing associations between stronger social rhythmicity and fewer depressive and anxiety symptoms, although the simulated magnitudes should not be compared directly with real-world estimates.

5.2 Continuous Association Between Social Rhythm Stability and Psychological Well-Being

Graph 1: Simulated Association Between Social Rhythm Stability and Psychological Well-Being



The scatter distribution produces a simulated correlation of r = 0.74, indicating a strong positive modeled relationship. The dispersion around the fitted trend line is equally important. Workers with similar rhythm-stability values do not receive identical well-being values because psychological functioning is influenced by numerous occupational, social, biological, and personal conditions. The simulation therefore represents social-rhythm stability as a probabilistic contributor rather than a deterministic explanation.

Key Finding: Within the simulation, greater stability in recurring daily activities is consistently associated with higher psychological well-being, but substantial individual variability remains at every level of rhythm stability.

5.3 Sleep Regularity as a Plausible Pathway

Sleep regularity increases from 52.75 in the low-rhythm group to 82.43 in the very-high-rhythm group. This parallel increase supports the proposed interpretation that social-rhythm stability may influence psychological well-being partly by creating more predictable opportunities for sleep and recovery.

The interpretation is consistent with Sabet, Dautovich, and Dzierzewski's finding that sleep-related behaviors and thoughts partly mediated the relationship between social rhythms and depressive and anxiety symptoms. It is also compatible with Chaput and colleagues' systematic review emphasizing sleep timing and consistency as health-relevant characteristics and with shift-worker research showing that chronotype and schedule alignment affect sleep quality and circadian disruption.

The simulation does not establish formal empirical mediation. Its purpose is to identify sleep regularity as one pathway that deserves explicit measurement in future shift-worker studies.

6. Discussion

6.1 Social Rhythm Stability as a Protective Occupational Resource

The results support the theoretical proposition that social rhythm stability may represent a meaningful occupational resource for workers whose employment prevents conventional daytime routines. This distinction matters because complete circadian stability may be unrealistic for many occupations.

Nurses, physicians, security personnel, emergency responders, factory employees, transport workers, and hospitality staff cannot always avoid night or rotating work. The more practical question is whether their nonstandard schedules can still permit a sufficient degree of behavioral predictability.

The wider shift-work literature supports this interpretation. Zhao and colleagues found that mental-health outcomes vary according to the nature of shift exposure, with irregular and unpredictable schedules carrying particular relevance. Holzinger, Mayer, and Klösch similarly emphasized the psychological problems associated with irregular shifts and the desynchronization of biological and social rhythms. These findings suggest that schedule design should be evaluated not only according to the number of night duties but also according to how frequently workers must reorganize their entire daily timing.

A stable rhythm does not necessarily mean rigid repetition. For a permanent night worker, regularity might involve a consistent post-shift sleep window, predictable meals, planned exercise, and recurring family contact. For rotating workers, stability may involve predictable roster cycles, sufficient notice, gradual rather than erratic rotation, and protected recovery periods. The occupational objective is therefore not perfect sameness but manageable temporal organization.

6.2 Circadian Alignment, Sleep, and Individual Differences

The simulated pattern also reinforces the importance of separating social-rhythm stability from biological circadian alignment. A schedule can be socially predictable yet biologically difficult. An employee who works the same night schedule every week may have more behavioral regularity than an irregular rotating worker, but the night schedule can still conflict with circadian physiology.

Chronotype is consequently important. Juda, Vetter, and Roenneberg demonstrated that early and late chronotypes differ in their responses to morning, evening, and night shifts. Vetter and colleagues provided intervention evidence that greater alignment between work timing and chronotype can improve sleep and reduce circadian disruption. These findings imply that organizational scheduling should avoid assuming that identical clock times impose equivalent burdens on every employee.

Sleep appears to connect these processes. Brown and colleagues identified sleep disturbance as a frequent component of shift-work-related psychological difficulty, and Booker and colleagues found strong relationships among shift-work disorder, depression, and anxiety in nurses. A worker exposed simultaneously to unstable social rhythms, chronotype mismatch, insufficient recovery time, and sleep disturbance would therefore be expected to experience a greater cumulative burden than someone exposed to only one of these factors.

6.3 Implications for Shift Scheduling and Worker Well-Being

The study has several organizational implications. First, schedule predictability should be treated as a health-related property of roster design rather than merely an administrative convenience. Workers who know their future shifts can plan sleep, childcare, meals, exercise, transportation, and social interaction with greater consistency. This interpretation is supported by systematic-review evidence indicating that irregular and unpredictable schedules warrant particular attention in relation to mental health.

Second, organizations should consider chronotype-sensitive scheduling where operationally feasible. Vetter and colleagues demonstrated that chronotype-adjusted work scheduling can improve sleep and reduce circadian disruption, providing evidence that work timing can be redesigned rather than viewed as completely fixed. Such approaches may be especially useful in occupations employing large numbers of rotating workers.

Third, worker-focused education should address the stabilization of controllable daily rhythms. Employees may not control when a hospital, manufacturing plant, or transport system operates, but some may be able to stabilize meal timing, recovery routines, exercise periods, light exposure, and pre-sleep behavior around their assigned shifts. Such interventions should be supportive rather than individualizing responsibility. Organizational causes of fatigue—including excessive hours, insufficient recovery, understaffing, rapid rotation, and unpredictable schedules—cannot ethically be transferred to workers through advice about personal routines.

The present simulation also has clear limitations. It cannot estimate real prevalence, causal effects, occupational differences, or intervention effectiveness. Future studies should distinguish permanent nights, forward and backward rotation, irregular/on-call work, compressed schedules, and early-morning shifts. They should also account for age, chronotype, caregiving responsibilities, socioeconomic circumstances, commuting time, workload, and voluntary versus involuntary shift assignment. Objective sleep measures and electronic roster data would considerably strengthen the validity of future evidence.

7. Conclusion

Social rhythm stability provides a useful perspective for understanding psychological well-being among shift workers because it shifts the research question from whether nonstandard work is harmful to which characteristics of nonstandard work make adaptation more or less difficult. Shift workers operate at the intersection of occupational demands, biological timing, sleep pressure, family responsibilities, and social expectations. When these domains change unpredictably from day to day, the resulting burden extends beyond ordinary scheduling inconvenience.

The simulation developed in this study demonstrates a clear theoretical gradient between rhythm stability and psychological well-being. Mean well-being increased from 54.16 in the lowest social-rhythm category to 81.14 in the very-high category, while modeled distress declined substantially. The simulated continuous association reached $r = 0.74$. These values should not be interpreted as empirical estimates; they provide a transparent representation of the relationships that a future longitudinal study could test.

The theoretical interpretation is supported by pre-2022 literature. Social-rhythm research has demonstrated that everyday regularity can be measured and modified, while Sabet and colleagues associated greater social rhythmicity with fewer depressive and anxiety symptoms. Shift-work research has independently established connections among irregular schedules, circadian disruption, disturbed sleep, depression, anxiety, and reduced psychological health. Integrating these traditions suggests that social rhythm stability deserves greater attention as a behavioral and organizational variable in occupational mental-health research.

The practical implication is not that shift workers should simply become more disciplined about their routines. Sustainable well-being requires organizations to create conditions in which stable routines are possible. Predictable rosters, adequate recovery periods, thoughtful rotation, reduced last-minute schedule changes, chronotype-sensitive planning where feasible, and protection of sleep opportunities may allow workers to maintain greater temporal coherence despite nonstandard employment. Social rhythm stability should therefore be understood as a shared outcome of individual adaptation and organizational design rather than solely as a personal lifestyle choice.

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