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Research priorities to reduce risks from work hours and fatigue in the healthcare and social assistance sector

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AUTHOR CONTRIBUTIONS

Claire C. Caruso: lead the development and organization of the manuscript. **All authors**: contributed text, references, attended conference calls, and suggested edits for drafts of the manuscript. **Claire C. Caruso**: organized and led the HCSA Session in the 2019 NIOSH Forum to obtain feedback from 25 participants on an extended abstract describing the draft priorities. Ann E. Rogers and Beverly M. Hittle participated in that session and took notes of the participants' feedback. Patricia A. Patrician recommended the group use a modified Delphi approach for authors to anonymously rank-order the priorities and organized that process. **Claire C. Caruso**: drafted the introduction, methods, limitations, and conclusions. **Claire C. Caruso, Laura K. Barger, Christopher P. Landrigan, and Sharon Tucker**: drafted the burden of work hours and related sleep and fatigue issues. Megan W. Arbour drafted text about advanced practice nurses, midwives, and sleep. Laura K. Barger and **Christopher P. Landrigan**: provided text about resident physicians. **Claire C. Caruso** and **Megan W. Arbour**: drafted the design of work schedules. **Patricia A. Patrician**, **Alison M. Trinkoff**, and **Claire C. Caruso**: drafted the HCSA culture and leadership. **Claire C. Caruso**: drafted education. **Ann M. Berger**, **Ann E. Rogers**, and **Sharon Tucker**: drafted countermeasures for fatigue. **J. Cole Edmonson**: drafted drowsy driving. **Alison M. Trinkoff**: drafted fitness for duty. **Claire C. Caruso**: drafted technologies. **Beverly M. Hittle**: drafted individual differences. **Nancy S. Redeker**: pointed out content to add or address across the manuscript. **Eileen R. Chasens**: provided edits. **Claire C. Caruso**: produced the final manuscript for publication.

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Christopher P. Landrigan, MD, MPH reports personal fees and other from I-PASS Patient Safety Institute, personal fees from Midwest Lighting Institute, personal fees from Missouri Hospital Association/Executive Speakers Bureau, outside the submitted work. In addition, Dr. Landrigan has received monetary awards, honoraria, and travel reimbursement from multiple academic and professional organizations for teaching and consulting on sleep deprivation, physician performance, handoffs, and safety, and has served as an expert witness in cases regarding patient safety and sleep deprivation. The other authors declare no conflicts of interest.

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DISCLAIMER

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Abstract

Background: The services of Healthcare and Social Assistance (HCSA) workers are needed by society around the clock. As a result, these workers are exposed to shift work and long work hours. The combination of demanding work schedules and other hazards in the HCSA work environment increases the health and safety risks to these workers, as well as to their patients/clients and the public.

Methods: This paper has three aims: (1) provide an overview of the burden of shift work, long hours, and related sleep and fatigue problems in this sector; (2) suggest research priorities that would improve these ; and (3) discuss potential positive impacts of addressing these research priorities for the health and safety of workers and the public. The authors used a modified Delphi approach to anonymously rank-order priorities for improving HCSA worker health and safety and public safety. Input was also obtained from attendees at the 2019 National Institute for Occupational Safety and Health (NIOSH) Work Hours, Sleep, and Fatigue Forum.

Results: The highest rated research priorities were developing better designs for work schedules, and improving the HCSA culture and leadership approaches to shift work and long work hours. Additional priorities are identified.

Conclusion: Research in these priority areas has the potential to benefit HCSA workers as well as their patients/clients, employers, and society.

Keywords

circadian rhythms; fatigue; long work hours; nurses; occupational health; physicians; public safety; shift work; sleep health; veterinarians

1 | INTRODUCTION TO THE HEALTHCARE AND SOCIAL ASSISTANCE (HCSA) SECTOR

HCSA is one of the fastest growing sectors in the United States (U.S.) with over 20 million workers.[1,2] This sector includes four subsectors: ambulatory healthcare services, hospitals, nursing and residential care facilities, and social assistance.[3] Workers are in a wide range of occupations including physicians, nurses, dentists, pharmacists, social workers, nurses aids as well as food service, housekeeping, clerks, and other types of workers who work in these organizations.[3] Registered nurses are the largest occupation in this sector and have been studied the most on this topic.[3] Few studies have examined the effects of work hours and

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related fatigue issues in some occupations in this sector. Therefore, this discussion applies mostly to the types of healthcare workers that have research available on this topic.

Several characteristics of this sector are unique. About 77% of HCSA workers are women, 17.1% are African American, 14.2% are Hispanic or Latino, and 7.3% are Asian.[4] The percentages of women, African Americans, and Asians in this sector are higher than the general workforce.[4] Many jobs require at least a college degree involving 2–8 years or more of coursework and supervised clinical experience. The majority of HCSA occupations require a state license or certification. The numbers of workers with these requirements are often insufficient to meet demands. This promotes long work hours, which are defined as over 40 h of work per week or over 8 h per shift. Because HCSA services are needed around the clock, these workers often work shift work, which is defined as work hours outside the daytime hours between 7 a.m. and 6 p.m. They can also work at irregular times or on rotating shifts. This paper has three aims: (1) provide an overview of the burden of shift work, long hours, and related sleep and fatigue issues in this sector; (2) suggest research priorities that would improve these issues; and (3) discuss potential positive impacts of addressing these priorities for the health and safety of workers and the public.

2 | BURDEN OF WORK HOURS AND RELATED SLEEP AND FATIGUE ISSUES

Almost 28% of HCSA employees work evenings, nights, rotating shifts, or other nonday schedules to provide vital services around the clock.[5] Many also work over 40 h a week. As a result, these workers are at risk for sleep disturbances, fatigue, and related health problems. In addition, their clients are potentially exposed to safety risks from HCSA worker fatigue. Despite these concerns, few regulations exist regarding work hours to protect the health and well-being of HCSA workers as well as their patients and clients.

2.1 | Weekly excessive work hours

Almost 17% in HCSA work 48 or more hours a week, and almost 6% work 60 or more hours.[5] The Accreditation Council for Graduate Medical Education (ACGME) which accredits all graduate medical training programs in the United States permits over 100,000 resident physicians to work 80 h per week, including shifts of 24 h or more.[6]

2.2 | Long shifts

In addition to high numbers of work hours per week, long work shifts of 12 and 16 h are also recognized as excessive and dangerous for staff and their patient/clients. In 2014–2015, over 79% of new graduate nurses worked 12-h shifts.[7] Shift work and long work hours are associated with shorter sleep duration, poorer sleep quality, and sleepiness on the job.[8] Additionally, patient care errors and increased infection rates have been associated with nurses working long shifts.[9,10] However, a 2020 study reported over 83% of nurses preferred 12-h shifts and 36-h work weeks.[11] They perceived these gave them better work-life balance and promoted better patient care. In a qualitative study, nurses reported 12-h shifts allowed more time at home for appointments, reduced childcare expenses, and less time for the commute.[12]

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2.3 | Risks for workers from shift work and long work hours

Work during the evening and night and excessive daily or weekly work hours increase the workers' risks for turnover, defined as the "process whereby nursing staff leave or transfer within the hospital environment" (p. 65).[13] Turnover has many contributing factors including state of the economy, organizational characteristics (e.g., leadership), individual variables, and integrative variables such as satisfaction. Turnover also may be impacted by shift work and health. A recent study found that a host of health problems among night shift nurses significantly increased turnover intention, but when clustering the health problems, the neuropsychological cluster—sleep disturbance, fatigue, and depression—significantly increased turnover intention.[14]

Several health concerns are reported among HCSA staff who work nonstandard hours. Sleep deficiency is common in HCSA: 52% of night shift healthcare workers reported sleeping 6 h or fewer per day,[15] which is substantially less than the 7–9 h recommended for adults.[16,17] A meta-analysis of 53 studies of nurses reported 61% had poor sleep quality measured by the Pittsburgh Sleep Quality Index.[18] In a study of nurse midwives, call schedules longer than 12 h increased sleepiness during work.[19]

2.4 | Other hazards in the HCSA work environment

HCSA workers are also exposed to many other workplace hazards: excessive physical, social, emotional, and cognitive demands over which they have little control, fast-paced work, hazardous chemicals and drugs, infectious agents, and workplace violence.[20] Many HCSA workers care for very sick and dying clients or those with complex physical and/or emotional needs. Although the work is meaningful and often emotionally rewarding, these jobs are often mentally and physically exhausting. Long shifts prolong workers' daily exposures to these hazards and limit time to recover. Long work hours increase the risk for musculoskeletal disorders.[21] Longer exposure to these other hazards may increase the risk for other adverse health outcomes discussed below.

2.5 | HCSA workers higher rates of health problems

Compared to workers in other sectors, HCSA sector workers have significantly higher prevalence of job stress, depression, anxiety, fatigue, burnout, and substance abuse.[22] Suicide rates among nurses, physicians, and veterinarians are higher than men or women in the general population,[23–25] and appear higher in nurses than physicians in recent times.[26] Oregon Workers Compensation data showed that hospital workers on evening and night shifts were at higher risk for severe occupational injuries than day shift workers.[27] Occupational Safety and Health Administration (OSHA) data indicate that this sector has the highest number and rate of work-related nonfatal injuries and illnesses requiring 3 or more days off from work.[28,29] Shift work, long work hours, and inadequate sleep quantity and quality are likely critical contributors to these adverse health outcomes.[9,30,31]

2.6 | Risks to patients, clients, and the public

Healthcare worker fatigue negatively affects client/patient safety in healthcare settings and public safety on the roads when tired workers commute.[32–35] One explanation is the cognitive decline that occurs from sleep deprivation and fatigue. After working 12-h shifts,

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night shift nurses exhibited decreased cognitive functioning and performance over three consecutive work shifts, compared to day shift nurses.[36] Cognitive decline can lead to medical errors, a significant concern as medical errors were estimated to be the third leading cause of death in the United States in 2013.[37] A systematic review reported increased error rates among nurses working more than 12 consecutive hours.[9] Shifts of 24 or more hours were associated with increased medication errors and adverse events among medical interns.[38,39] Other research found increased infection rates and reduced pain control among patients when nurses worked shifts exceeding 12 h.[10] Performance declines from shift work also were linked to increased risk for motor vehicle crashes, endangering workers and others on the road.[35,40]

2.7 | Few regulations for HCSA

Few U.S. regulations and laws target the work hours of HCSA workers. No federal U.S. government work hour regulations exist for this sector. About one-third of U.S. states have laws that ban or limit mandatory overtime in nurses.[41] Potentially applicable is the general duty clause of the Occupational Safety and Health Act that states the employers shall provide a workplace free from recognized hazards that are likely to cause death or serious physical harm to employees.[42] OSHA enforcement data[43] are publicly accessible, and as of June 2021, the database had no cases concerning HCSA work hours.

In 2003, the ACGME instituted the first rules for limiting work hours for resident physicians across the United States.[44] These allowed 80 h of work per week and multiple long shifts per week lasting up to 30 consecutive hours. Following a review of the safety of this policy by the National Academy of Medicine (called the Institute of Medicine until 2015), the ACGME in 2011 limited first-year residents to shifts of 16 consecutive hours, but continued to allow work shifts up to 28 consecutive hours for more senior residents.[45–47] In 2017 after carrying out their 5-year assessment and gathering input from member organizations and others, the ACGME revised the work hour rules and increased the work-hour limit of first-year resident physicians to 28 consecutive hours and 80–88 h per week.[6,48] Despite risks associated with work shifts of 24 or more consecutive hours,[49,50] rules for resident physicians reverted back to the longer schedules. ACGME accesses their accreditation standards and processes at least every 5 years so these requirements will be reviewed and reconsidered in the future.

3 | METHODS TO IDENTIFY RESEARCH PRIORITIES

Mixed methods were used to generate research priorities for improving work schedules and reducing fatigue in the HCSA sector. The methods described below include input from 13 authors with expertise on the topic, input from 25 experts during the NIOSH Forum, and targeted reviews of the literature on the nine priority areas. Most of the research on the work schedule topic in the HCSA Sector has been conducted in registered nurses and physicians. A few recent studies examined pharmacists and home health workers. Little research was found for other occupations in this sector by using these terms in PubMed.gov: work schedule; work schedule tolerance; shift work; night shift; long work hours.

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The 13 authors have extensive knowledge and research experience on HCSA work hours, sleep, and fatigue topic. Over 11 months, they participated in monthly conference calls to identify and discuss research priorities to improve HCSA work hours and related sleep issues. They identified nine research priorities and, using a modified Delphi approach, anonymously rank-ordered the priorities from "1" for the highest priority to "10" for the lowest priority for improving HCSA worker health and safety and public safety. The average across the participants was used for the group score for each priority area. During subsequent conference calls, authors shared the reasons for their rank ordering. Then, they carried out a second anonymous rank-ordering. The Initial Author Poll in Table 1 shows the average ranking across the authors. After this, they created an extended abstract with the priorities. This was given to participants at the *2019 National Institute for Occupational Safety and Health (NIOSH) Work Hours, Sleep, and Fatigue Forum*[51] to facilitate the discussion and obtain their input on the priorities.

Twenty-five participants attended the HCSA session at the Forum, including labor representatives, international work hour and fatigue experts, a representative from the American Academy of Sleep Medicine, members of academia, and NIOSH scientists. The two-hour session began with a short presentation about the HCSA sector including the burden of work hours and fatigue, other work hazards, and the high rates of health problems in this sector. The nine proposed research priorities were presented, and session leaders distributed hard copies of these with spaces for attendees to add comments. An open discussion followed, and at the end, participants were asked to individually rank-order the research priorities based on the discussion and their own expertise. Participants had the option of adding a new priority and were given 2 months after the Forum to submit their comments to NIOSH. Nineteen participants provided their ranked priorities (Table 1, middle column) and written comments. Four of the 19 participants added a few additional priorities, but these were not mentioned by other participants. Forum participant rankings were calculated and compared with the authors. The authors discussed the Forum participants' feedback and further refined the research priorities (Table 1, right column, Final Author Poll). Authors divided into small groups. Each group carried out a targeted literature search on one of the final priorities using a search method of their choosing.

4 | RESEARCH PRIORITIES

Based on Table 1, forum participant priorities showed some overlap with the authors' priorities. Many of the participants' insights and suggestions given during the Forum are incorporated in the discussion below and are marked with an *.

4.1 | Design of work schedules

The highest ranked priority was to develop better ways to schedule HCSA workers to allow them to provide services more safely around the clock and improve their ability to maintain their own health, safety, and well-being. Critically needed are best practices for scheduling services during emergencies that cause surges in patient workload. Research is needed to determine ways to promote better worker and patient outcomes when long work hours cannot be avoided during unexpected emergencies. Also, research can investigate ways to

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move HCSA to reduce use of long shifts. Workable solutions may depend on the job. For example, Arbour et al. developed strategies for nurse midwives to improve sleep including modifying the work schedule, developing strategies to increase sleep, and reorganizing the work.[52] Reducing long work hours for resident physicians has been particularly challenging although outcomes improved in resident physicians working 16-h shifts compared to 24 h or longer.[53] Long hours combine with other job demands to influence outcomes,[54] so more information on the impact of work hours in other HCSA workers is needed.*

Evidence is growing that night shift work with persistent circadian disruption is a probable carcinogen and is linked to the development of type 2 diabetes and cardiovascular disease.[55–59] Therefore, research is needed to design work schedules that allow evening and night shift workers to better align their circadian rhythms with their work hours. At a minimum, work schedules should allow workers enough time off between shifts to obtain the recommended daily amount of sleep and sufficient time off for personal tasks.* For example, Garde et al.[60] recommended night shifts have at least 11 h off between shifts and be limited to three consecutive 9-h shifts. Gurubhagavatula et al.[61] published guiding principles for determining shift length: this could be tested for applicability in HCSA. Studies of the interaction of staffing levels, work demands, and work schedules could inform best practices.* Landrigan et al. reported that the number of intensive care unit patients per resident physician influenced patient safety.[62] This and other evidence suggest that schedules may need to be tailored to account for inadequate staffing, skill-mix, patient acuity, work intensity, task demands, and crisis situations.*

4.2 | Workplace culture of safety and leadership

The second and third highest priorities are closely related and discussed together. Improving HCSA culture of safety could influence leadership approaches to work hours* and, in turn, leadership can influence their workplace's culture of safety. Yet, limited research is available on this topic. Steege et al. recently reported that HCSA managers gave little attention to the impact of shift work, long work hours, and fatigue on workers' safety and health and on patient/client safety.*[63,64] This could be due to a lack of knowledge about the evidence-based practices for their operations. In addition, leaders may need to see the business case for reducing these risks, as they may not recognize or appreciate the personnel and financial costs or benefits of risk reduction strategies.* Also, research could develop and test strategies to promote sufficient sleep quantity and quality in workers and examine that effect on organizational costs and patient/client safety.[65]

Research is needed on the best ways to improve leadership approaches. * Theories of behavioral change such as Ajzen's Theory of Planned Behavior and the Total Worker Health® approach to worker safety, health and well-being could provide theoretical frameworks.[66,67] Research on these topics could help better understand leadership's perspective*: (1) attitudes about work hours, sleep, and fatigue and their perceived accountability for workplace systems that promote workers' sleep and alertness; (2) perceived ease or difficulty in applying evidence-based strategies; (3) anticipated barriers* such as resistance to alternate shift lengths; and (4) beliefs about what their organizations and stakeholders want them to do.

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Researchers could bring multiple stakeholders together to explore strategies to emphasize sleep health and a culture of safety, and how to organize operations for this purpose.* This aligns with a key area of the 2021 Future of Nursing Consensus Study Report: Supporting the Health and Well-Being of Nurses.[68] The report states this is critical for the nursing profession's ability to meet the challenges in the next decade. The Institute for Healthcare Improvement's plan for patient safety also recommends efforts to promote the safety of the healthcare workforce and improvements in the culture, leadership, and governance regarding safety.[69] Research could examine and test ways to incorporate practice and policy recommendations from HCSA professional and accreditation organizations, HCSA payors including health insurers, and The Joint Commission.*[70–74] Researchers could test ways to incentivize promotion of a healthier and more alert workforce and better patient outcomes.*

4.3 | Education for workers and managers

Workers and managers often lack education about work hours, sleep, and fatigue because these are not usually included in professional education or on-the-job training. Research could examine HCSA workers' knowledge about their personal risks for illness and injuries from long hours and shift work.* Educational programs are needed to help workers understand these risks, along with practical strategies they can use to reduce risks.* Three recent reviews of education interventions concluded that these led to at least modest improvements in sleep duration and quality and decreased sleepiness during work.[75–77] These positive effects were more consistently reported in day shift workers. Studies examined education programs for police and resident physicians who were working long, irregular shifts which included nighttime hours.[78,79] Education alone did not lead to improvements in their sleep, likely because organizational changes also were needed to increase the time available for sleep. Research is needed to develop and test educational interventions and implementation strategies that lead to behavior change, and dissemination strategies.* Educational programs and materials should be provided in multiple languages for HCSA workers who are not fluent in English.*

4.4 | Fatigue countermeasures

Further development of fatigue countermeasures is needed as well as implementation strategies that are acceptable to workers and leaders.* Fatigue countermeasures include naps before and during work, breaks during work shifts, exercise, timing of appropriate color and intensity of light exposure, and optimal stimulant use, such as caffeine.[80] A mixed-methods systematic review examining naps concluded that napping during night shift benefits nurses' health and performance.[81] However, researchers reported challenges to use of naps that need to be addressed: (1) management concerns about sleep inertia, insufficient staffing, lack of napping spaces, and negative view of healthcare workers sleeping on the job; (2) healthcare workers' guilt about being a burden during naps and/or perceptions of patient abandonment; and (3) long periods of sleepiness after the nap. Research to address cultural beliefs about napping at work would be useful.[82–84] In addition, research could develop best practices for using naps during normal times and during catastrophic events.

Research on countermeasures in resident physicians is needed, given their long work hours. The ACGME periodically carries out a Clinical Learning Environment Review (CLER)

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Program of accredited institutions.[85] The review provides them feedback in several areas including physician well-being, assesses fatigue management, mitigation, and duty hours. In a 2019 review of accreditation visits to 270 small institutions, Co et al.[86] found institutions developed and implemented some fatigue mitigation, mainly by providing sleeping rooms and transportation. But few had "…systematic strategies and solutions that focused on prevention, recognition and effective mitigation of fatigue and burnout."

Some intervention studies combined countermeasures with other workplace strategies. A 2014 integrative review identified system interventions to mitigate fatigue.[87] In addition to napping and breaks during work, the review discussed using circadian rhythm principles for scheduling, reducing praise for working shifts over 12 h, rethinking three 12-h shifts since these promote moonlighting, and providing education on the health and safety risks of demanding work hours, and the need for self-care strategies. Additional system interventions include monitoring staff absentee patterns, limiting involuntary overtime, avoiding calling in unscheduled nurses who need time to recover, promoting positive and supportive environments, and involving staff in unit and organizational councils. The Registered Nurses' Association of Ontario published a best practices guideline in 2011 for preventing and mitigating nurse fatigue.[88] They recommended a similar intervention system, along with adequate funding for education, sufficient staffing levels, and appropriate environment for nurses to rest and take breaks. They also provided recommendations for accreditation bodies and education programs. The Joint Commission similarly recommended fatigue mitigation interventions, emphasizing system strategies and physical infrastructure for naps, including suitable rooms near patient care areas.[74] Based on their assessment, they encouraged eliminating mandatory overtime, monitoring voluntary overtime practices, working with staff to develop flexible staffing strategies, and assessing organizational hand-off processes.

4.5 | Drowsy driving

Another research priority is the increased risk for drowsy driving due to shift work and long work hours.[35,40,89] The 2017–18 American Nurses Association survey found that 33% of night shift nurses reported falling asleep while driving in the past 30 days, compared to 10% of day shift nurses.[90] A 2019 survey by AMN Healthcare found 25% of nurses with more than one job reported that extra work led them to drive while drowsy after their shifts.[91] Resident physicians after 24-h or longer shifts had more than twice the odds of crashing on the commute from work.[89] Workers with the combination of both long commutes and long hours have added risk for drowsy driving. Some facilities report providing sleeping rooms for workers too tired to drive home safely and/or taxi or ride share fares.*[86] Research could assess leading practices in healthcare organizations to prevent drowsy driving and their effectiveness, including prevention strategies, education campaigns, methods to identify workers at risk, workplace policies, and procedures to help tired workers after their work shifts.

4.6 | Fitness for duty

No established fatigue or sleepiness thresholds are routinely used to determine fitness for work or when workers are too tired to practice safely. The threshold for sensing fatigue

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and sleepiness varies across individuals and can become severe before countermeasures are used.* Some tools are available to assess fatigue, such as the Occupational Fatigue Exhaustion/Recovery Scale.[92] This scale was developed and evaluated in Australian nurses and can determine who is least fatigued or help workers realize that they are coming to work fatigued, even after days off.

Several bio-mathematical models (BMMs) have been developed and are often based on laboratory studies or simulations to predict worker fatigue and/or sleepiness. Most use proprietary software and have rarely been formally evaluated. Dawson et al. discusses the limitations of BMMs including their simplistic approach for assessing a highly complex topic: risk connected with sleep-wake behavior. Although some may be attracted to their simplistic approach, Dawson et al.[93] caution the outputs are at best a product of guesswork and calculations. Further development of BMMs is needed as well as guidance about appropriate use to predict safe working time arrangements. In addition, research could develop a model tailored for HCSA which could include the consequences of a medical error and control measures to reduce fatigue-related errors.

4.7 | Technologies

Technologies are needed to measure and reduce workload, sleepiness, and fatigue.* For example, dictating devices could save time with documentation. Devices could be developed that adjust the intensity and color of ambient light on computer terminals or overhead lighting. These could be tested to evaluate effects on workers alertness and adjustment of their circadian rhythms to night shifts. A critical need is methods to protect workers on night shift from long term disruption of their circadian rhythms and the resulting increased risk for cancer, type 2 diabetes, and cardiovascular disease.[55–59,94]

4.8 | Individual differences

Research is needed on biological, behavioral, psychological, and social factors that put workers at risk for the negative effects of shift work and long hours and protective factors that reduce those risks.[95] For factors that increase risk, strategies are needed to protect vulnerable workers. Since the HCSA workforce is 80% female and has higher percentages of workers from racial and ethnic minority groups, it is important to examine sex differences, gender roles, race, and ethnic differences.* Women in the general population have higher rates of insomnia than men.[96] This vulnerability to insomnia can compound women's difficulties with sleep when working shift work and long work hours which themselves are associated with sleep problems. Another strain for women that reduces their time for sleep and rest is their higher burden of domestic household chores as compared to men.[97] This gender discrepancy also was found in a survey of pediatricians.[98] Female HCSA workers may be also especially affected because of biological differences. Shift work is associated with negative effects on the menstrual cycle, female fertility, and pregnancy outcomes.[99–102] In addition, women's gender role expectations for family caregiving also can decrease the time for sleep.[103,104] Some evidence suggests men may be more shift work tolerant,[105] but it is unclear how much of this is due to differences in biology or gender role.[95] Robust longitudinal studies would be helpful to examine how these differences influence the effects on health and safety.

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The prevalence of poor sleep in HCSA is highest among U.S. Blacks/African-Americans.[106–108] Many U.S. racial and ethnic minority groups are socioeconomically disadvantaged and more likely to experience health disparities, lower wages, food insecurity, longer commutes and limited transportation, which contribute to poor sleep.*[109] Individual tolerance to shift work also can stem from social and economic pressures.*[108] Further research on HCSA workers from diverse backgrounds is needed,* with emphasis on how social and economic environments intersect with work and fatigue.[110,111]

Research could investigate the impact of maternity and paternity leave policies on workers' health and safety. Resident physicians, who have fatiguing work schedules, often have minimal paid maternity or paternity leave and would benefit from supportive return-to-work programs and policies.[112–115] Similar issues exist in veterinary residency programs.[116] It is important to support the needs of working parents, particularly during the post-partum and infancy stage, when working parents may be more sleep-deprived.[117–119]

5 | LIMITATIONS

Most of the studies examining effects of shift work and long work hours in the HCSA Sector have been conducted in nurses and physicians. Little research has examined this topic in other types of healthcare workers and those in social services such as social workers and childcare workers. The demands of those jobs may be different from nursing and medicine. In addition, nursing assistants, radiology technicians, and other types of healthcare technicians might not be covered under the same hospital policies that concern nurses.* Those other types of HCSA workers may be working more demanding schedules with on-call work.* Therefore, how well these research priorities fit other types of workers in the HCSA sector is not known.

6 | CONCLUSIONS AND POTENTIAL IMPACT OF THESE RESEARCH PRIORITIES

Research to reduce risks associated with work hours, poor sleep quality and quantity, and fatigue among HCSA workers will benefit HCSA workers, their patients/clients, employers, and society. Potential benefits from improved sleep and alignment of circadian rhythms with work times include improved workers' moods, better reproductive outcomes, and lower rates of several chronic diseases. Job satisfaction and job tenure also can be impacted by addressing these priorities. Employers can benefit from better job performance, higher quality of services, lower absenteeism, increased staff retention, and lower workers' compensation costs. Society can benefit from better quality of care, lower healthcare costs, and fewer HCSA workers driving while drowsy. If improved policies lead to better recruitment and retention of HCSA workers, society also will benefit by more highly skilled HCSA workers to meet the growing needs of the aging population and the 60% of U.S. adults and 43% of U.S. children with chronic illnesses who need their services.[120,121]

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This paper is part of a series of publications in this issue that were developed to identify research needs around the working hours, sleep, and fatigue topics specific for several industry sectors and vulnerable workers in the United States. Collectively, the papers provide overviews of the current state of research, identify health and safety risks, highlight effective interventions, and suggest future research directions.

DATA AVAILABILITY STATEMENT

No research data is connected to this manuscript.

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TABLE 1

Mean ranked score for research priorities (lower number is a higher priority)

	Average priority ranking		
Research topic	**Initial Author Poll**	**Forum Participants Poll**	**Final Author Poll**
Work schedule design	2.23	4.76	2.00
HCSA culture	3.69	3.05	3.00
HCSA leadership approach	4.46	4.53	4.00
Education/training for managers and workers	4.85	5.42	4.30
Fatigue countermeasures	4.15	5.37	4.50
Drowsy driving	6.23	6.32	6.10
Fitness for duty	6.08	6.16	6.30
Technology to reduce workload and fatigue	7.15	5.21	7.20
Individual differences	6.15	6.24	7.60

Abbreviation: HCSA, healthcare and social assistance sector.