

APPENDIX B **SYSTEMATIC REVIEW OF THE LITERATURE:** **RESIDENT DUTY HOURS AND RELATED TOPICS**

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Executive Summary

In 2003, the Accreditation Council for Graduate Medical Education mandated duty hour restrictions, with a goal to reduce resident sleep loss and fatigue and improve patient safety.¹ This decision was fueled in part by public concerns that physicians-in-training are overworked and that the resulting fatigue contributes to medical errors. Research from the sleep community, which demonstrates that sleep deprivation impairs performance, also raised concerns. With little data to guide these decisions, the shift limits were largely based on New York State's experiments with duty hour regulations, which began in 1998 and limited hours to 80 per week. The New York State code 405 regulations were a result of the examination of graduate medical education by the Bell Commission² in the wake of Libby Zion's death and were based on the best opinions of experts, but not on strict science.

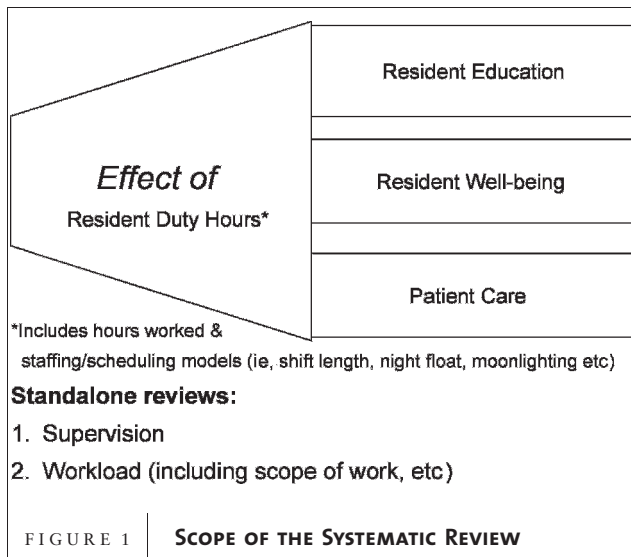
Since 2003, several articles examining the effects of the ACGME duty hour regulations on a variety of relevant outcomes (including patient safety, resident education and well-being, and working conditions) have been published.^{3,4} In addition, research studies examining sleep deprivation and neurocognitive outcomes in physicians and nonphysicians have been reviewed.⁵ Systematic examination of this literature is of utmost importance 5 years after the implementation of duty hour reform owing to the recent recommendations for further restrictions in duty hours put forth in December

2008 in the Institute of Medicine's report on duty hours, supervision, and patient safety.⁶ The ACGME has launched a formal process to refine and revise duty hours. Reviewing the literature and the strength of the evidence is a critical first step in designing evidence-based policy changes to the current proposed rules.⁷ Specific attention to field studies examining the impact of duty hour reductions, and related interventions, among residents in actual practice are particularly relevant, given the concerns regarding implementation of the Institute of Medicine recommendations.⁸ Reviewing the evidence is also important to inform the current debate and to highlight gaps in the literature from which to direct the design and conduct of future studies in this area.

In response to the request for proposals from the ACGME for thorough reviews of the literature relevant to a broad array of topics in graduate medical education during the past 20 years, our aims were to perform a systematic review to investigate the effect of the 2003 resident duty hours on resident education and well-being and on patient care (see *FIGURE 1*). In addition, the body of literature of the past 20 years was reviewed to understand the impact of various staffing and scheduling models, such as appropriate shift length, implementation of night float, and moonlighting. Lastly, stand-alone reviews on supervision and workload, although not specifically related to duty hours, were performed because of their central role in the resident work environment.

It is important to note that certain types of literature were not considered the focus of this review. Specifically, this review does not cover sleep literature that focuses on neurocognitive outcomes or the myriad studies that assesses the generic topic of "learning environment." While important to consider in the debate on residency duty hours, sleep deprivation and

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neurocognitive outcomes in residents have been covered in a prior review.⁵ Owing to the expansive nature of the learning environment, which includes topics such as curricular evaluation, professionalism, and burnout to name a few, we restricted the focus of this review to studies of learning environment that relate to duty hour restrictions directly or through our focus areas (ie, workload, supervision). In addition, literature that evaluated the impact of duty hour restrictions before 2003 were covered in prior systematic reviews^{3,4} and was not repeated in our review. Finally, our focus was predominantly limited to studies that took place in the United States. While our initial search strategy did not eliminate articles from other countries, the uniqueness of the US medical system/graduate medical education system convinced us to narrow our scope. Synthesizing the volume of data that exists for studies done in the United States was daunting, but including the rest of the world’s experience would have been nearly impossible.

A comprehensive search strategy was developed in consultation with a reference librarian to ensure capture of the target literature. Using this search strategy, MEDLINE, PreMEDLINE, and Embase were searched with a focus on studies relating to graduate medical education. Abstracts were reviewed by the 3 investigators (see FIGURE 2). Articles were excluded if they did not describe original

research or if they did not address one of the topics in the review. For those articles that were included in this review, data were abstracted into a structured data abstraction tool in a database called Research Electronic Data Capture (REDCap), which is a secure Internet-based program that allows multiple users at different sites to access it at any time. It is maintained by the Medical College of Wisconsin’s Clinical Translational Science Institute.⁹

To assess study quality, the Medical Education Research Quality Index (MERSQI) was used. The MERSQI, developed by Reed and colleagues,^{10,11} has been shown to have content validity; interrater, intrarater, and internal consistency reliability; criterion validity; and predictive validity. The MERSQI evaluates 6 domains of study quality: design, sampling, type of data, validity, data analysis, and outcomes. Items are scored on an ordinal scale with a maximum of 18 allowable points. Another major advantage of the MERSQI is that it is easily applied to any medical education study, regardless of design, method, or outcome. Previous work by Reed et al¹¹ has demonstrated that a MERSQI score of 9.95 is average for medical education research studies overall.

The article reflects the major areas of work from this systematic review that are relevant to the current debate on resident duty hours, specifically addressing questions surrounding the impact of the current ACGME duty hour rules, the optimal shift length, what is known about night float systems, workload, supervision, and moonlighting. The areas of the report are as follows:

1. Review of studies examining the impact of the 2003 ACGME duty hour rules on resident health, education (ie, test scores, operative experience), and patient safety;
2. Review of studies examining the impact of consecutive work hours (shift length) on resident or patient outcomes;
3. Review of studies examining the impact of night float/night work on resident or patient outcomes;

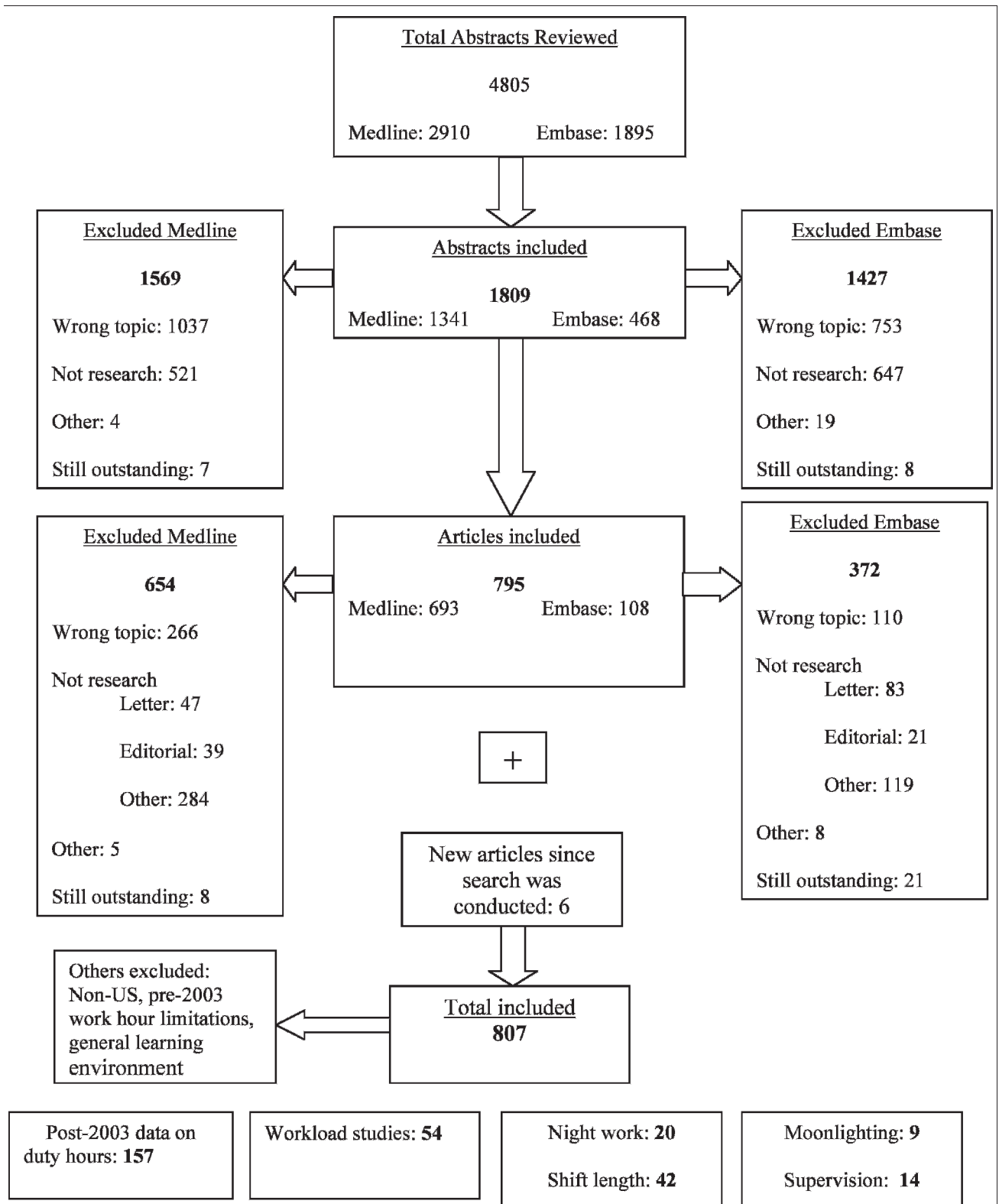


FIGURE 2 | INCLUSION AND EXCLUSION PROCESS

4. Review of studies examining the type of work residents do, in addition to the impact of resident workload on resident and patient outcomes, and interventions that have been tested to reduce workload;
 5. Review of studies related to moonlighting; and
 6. Review of studies related to supervision.
- 6 Ulmer C, Wolman D, Johns M, eds; Committee on Optimizing Graduate Medical Trainee (Resident) Hours and Work Schedules to Improve Patient Safety, Institute of Medicine. *Resident Duty Hours: Enhancing Sleep, Supervision, and Safety*. Washington, DC: National Academies Press; 2008.
 - 7 Accreditation Council for Graduate Medical Education. ACGME request for proposal for a comprehensive literature review and analysis of residency training and duty hours experience. Available at: http://www.acgme.org/acWebsite/home/acgme_nascaletter_RFP.pdf. Accessed May 17, 2009.
 - 8 Blanchard MS, Meltzer D, Polonsky KS. To nap or not to nap: residents' work hours revisited. *N Engl J Med*. 2009;360:2242–2244.
 - 9 Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42(2):377–381.
 - 10 Reed DA, Beckman TJ, Wright SM, Levine RB, Kern DE, Cook DA. Predictive validity evidence for medical education research study quality instrument scores: quality of submissions to JGIM's Medical Education Special Issue. *J Gen Intern Med*. 2008;23(7):903–907.
 - 11 Reed DA, Cook DA, Beckman TJ, Levine RB, Kern DE, Wright SM. Association between funding and quality in published medical education research. *JAMA*. 2007;298(9):1002–1009.

References

- 1 Philibert I, Friedmann P, Williams WT. New requirements for resident duty hours. *JAMA*. 2002;288:1112–1114.
- 2 Bell BM. Resident duty hour reform and mortality in hospitalized patients. *JAMA*. 2007;298(24):2865–2866.
- 3 Fletcher KE, Underwood W III, Davis SQ, Mangrulkar RS, McMahon LF Jr, Saint S. Effects of work hour reduction on residents' lives: a systematic review. *JAMA*. 2005;294(9):1088–1100.
- 4 Fletcher KE, Davis SQ, Underwood W, Mangrulkar RS, McMahon LF Jr, Saint S. Systematic review: effects of resident work hours on patient safety. *Ann Intern Med*. 2004;141(11):851–857.
- 5 Philibert I. Sleep loss and performance in residents and nonphysicians: a meta-analytic examination. *Sleep*. 2005;28(11):1392–1402.