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 Commission\(^2\) 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

Kathlyn E. Fletcher, MD, MA, is Associate Professor, Medicine (General Internal Medicine) at the Medical College of Wisconsin. Darcy A. Reed, MD, MPH, is Associate Director, Internal Medicine Residency Program and Assistant Professor in the Department of Internal Medicine at the Mayo Clinic College of Medicine. Vineet Arora, MD, MA, is Assistant Professor in the Department of Internal Medicine at the University of Chicago.
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 al\(^11\) 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

Total Abstracts Reviewed
4805
Medline: 2910  Embase: 1895

Abstracts included
1809
Medline: 1341  Embase: 468

Excluded Medline
1569
Wrong topic: 1037
Not research: 521
Other: 4
Still outstanding: 7

Excluded Embase
1427
Wrong topic: 753
Not research: 647
Other: 19
Still outstanding: 8

Articles included
795
Medline: 693  Embase: 108

Excluded Medline
654
Wrong topic: 266
Not research
Letter: 47
Editorial: 39
Other: 284
Other: 5
Still outstanding: 8

Excluded Embase
372
Wrong topic: 110
Not research
Letter: 83
Editorial: 21
Other: 119
Other: 8
Still outstanding: 21

New articles since search was conducted: 6

Total included
807

Others excluded:
Non-US, pre-2003 work hour limitations, general learning environment

Post-2003 data on duty hours: 157
Workload studies: 54
Night work: 20
Shift length: 42
Moonlighting: 9
Supervision: 14
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.

References