

Physicians' working time restriction and its impact on patient safety: an integrative review

A restrição da jornada de trabalho do médico e seu impacto na segurança do paciente: uma revisão integrativa

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ABSTRACT | Background: Although shift work is a part of the physicians' routine, there is controversy on the length of shifts and adequate rest for safe professional practice. If on the one hand long working hours might have negative impact on patient safety by interfering with the psychological and physical functioning of physicians, on the other shorter working hours might impair the safety of patients due to interference with the continuity of care. **Objective:** To analyze the impact of restrictions to physicians' working hours on patient safety. **Method:** Integrative literature review in which we surveyed studies on restriction to physicians' working time and patient safety included in databases National Library of Medicine (PubMed) and Scientific Electronic Library Online (SciELO) until May 2018. Thirty-five studies which met the inclusion criteria were included. **Results:** Patient safety outcomes analyzed in the included studies were mortality, adverse events, continuity of care, in-hospital complications, readmission rate and length of stay at hospital. Restriction to working time was associated with variable impact on patient safety indicators, but often did not modify their performance. **Conclusion:** Restrictions to physicians' working time did not always improved patient safety indicators. Focusing on interventions which only seek to limit the workload of physicians might be insufficient to bring consistent improvement to patient care.

Keywords | patient safety; work hours; occupational medicine.

RESUMO | Introdução: Apesar da jornada de trabalho em regime de plantão ser marco da rotina do profissional médico, há controvérsias em relação à duração dos turnos, bem como aos intervalos de repouso apropriados que tornam a atividade desse profissional segura. Se, por um lado, jornadas longas de trabalho podem gerar impacto negativo à assistência segura do paciente por alterar o funcionamento psicológico e físico do profissional, por outro, a redução do tempo de jornada de trabalho pode prejudicar a segurança do paciente por reduzir a continuidade do cuidado. **Objetivo:** Avaliar o impacto da restrição da jornada de trabalho médico na segurança do paciente. **Método:** Estudo do tipo revisão integrativa da literatura. Foi realizado um levantamento das publicações relacionadas a restrições na jornada de trabalho do médico e à segurança do paciente disponíveis nas bases de dados *National Library of Medicine* (PubMed) e *Scientific Electronic Library Online* (SciELO) até maio de 2018. Foram selecionados 35 artigos que atenderam aos critérios de inclusão. **Resultados:** Os desfechos relacionados à segurança do paciente avaliados pelos estudos foram mortalidade, eventos adversos, continuidade do cuidado, complicações intra-hospitalares, taxa de readmissões e duração da internação. A restrição à jornada de trabalho gerou impacto variável quanto aos indicadores de segurança do paciente entre os estudos. No entanto, frequentemente não modificaram sua *performance*. **Conclusão:** As restrições à jornada de trabalho frequentemente não resultam em melhora da *performance* dos indicadores de segurança do paciente. O foco em intervenções com propósito único de limitar a carga de trabalho médico é insuficiente para gerar melhoras consistentes ao cuidado do paciente.

Palavras-chave | segurança do paciente; jornada de trabalho; medicina do trabalho.

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DOI: 10.5327/Z1679443520180294

INTRODUCTION

Long and unpredictable working hours have been a part of the routine of physicians for many centuries. Indeed, this professional category has the longest weekly working time, with a mean of 52 hours /week, as found in a study performed by the Getulio Vargas Foundation¹. According to estimates, about 40% of the Brazilian physicians work 41 to 60 hours / week, and 82% have up to three jobs². The data for physicians in the United States are similar: according to the American Medical Association, 23% of physicians work more than 60 hours / week³.

The medical shift regimen varies across Brazil. Some Regional Medical Councils permit only a maximum of 24-hour shifts^{4,5}. However, physicians often start shifts after a regular work day, resulting in 36-hour work days⁶. Despite the educational, professional and financial arguments adduced to justify such work routine, the evidence showing its negative impact on the physicians, and their patients' well-being is increasing.

Little attention was paid to the consequences of physicians' fatigue regarding the patient safety until March 1984, when Libby Zion died from an error in a prescription made by a medical resident working 36 hours / day⁷. The debate triggered by this event led to changes in the working day laws in the United States, and encouraged research on the physical and psychological problems developed by physicians working under shift regimen.

Sleep deprivation impairs several aspects of human functioning, including many which are crucial to medical practice, such as cognitive performance, memory and fine motor skills⁸. Impaired cognitive performance has been compared to alcohol intoxication. One study showed that the cognitive performance of individuals who remain awake for 17 hours is similar to that of people with 0.05% blood alcohol content⁹.

Although shift work is a part of the physicians' routine, there is controversy in regard to its length and the rest periods considered adequate for safe professional practice. If on the one hand long working hours might have negative impact on patient safety by interfering with the psychological and physical functioning of physicians, on the other shorter working hours might increase the frequency of shift-to-shift handoff, thus interfering with

the continuity of care and increasing the occurrence of adverse events, in addition to contributing to increase the cost of health care, given the need to hire a larger number of professionals.

Based on the aforementioned considerations, we sought to assess the impact of restriction of the physicians' working time on patient safety. In addition, we also sought to identify the patient safety outcomes more frequently assessed in the literature, and to describe how they change under restriction of the working time.

METHOD

The present study consisted of an integrative review of the literature on the impact of limitations to the physicians' working time on patient safety. This method is an evidence-based healthcare practice which involves analyzing relevant studies which support decision making to improve clinical practice. This type of study allows summarizing studies to draw inferences on a given subject, in addition to detecting gaps in the current knowledge which need to be filled through further research^{10,11}.

The steps of the present study were: definition of the subject of interest, formulation of the research question, selection of inclusion and exclusion criteria, selection of the information to be extracted from the included studies, analysis of the results reported in the included studies, interpretation of the results, and review presentation¹⁰.

Data collection was performed in June 2018 in databases National Library of Medicine (PubMed) and Scientific Electronic Library Online (SciELO). An initial date was not set, the final date was 31 May 2018. The search terms used were variably combined and exchanged:

- Terms related to patient safety: patient safety incident, adverse event, harmful event, sentinel event, patient outcomes;
- Terms related to working hours: duty hour, work shift, shift length.

The search strategy was adjusted to the specific characteristics of the selected databases, including the use or not of quotation marks, brackets or parentheses. In all the cases, the research question and inclusion criteria

guided the search. All potentially relevant records were exported to an EndNote X8 library for the purpose of inclusion / exclusion of studies according to the preset criteria.

The inclusion criteria were: study aims included analysis of the impact of restriction to physicians' working hours on patient safety; inclusion in the aforementioned databases; published in English or Portuguese; and full text available. Studies on the working time of other health professionals, which did not analyze patient safety, duplicate papers, studies on professionals' self-perception, editorials, theoretical reflections, reviews, dissertations, essays, meeting abstracts and book chapters were excluded.

First, we analyzed the studies' titles and then their abstracts in order to establish whether they met the inclusion criteria. Whenever titles and abstracts did not suffice to identify the subject of studies, we performed full-text analysis. In this way we ensured the application of all the defined criteria, and the inclusion of all the studies which addressed the research question.

We developed a data collection form to guide analysis and extract relevant data, which was filled for each and all the studies included in the final sample. Data considered were: identification and authors; year and country of publication; aims; methodological characteristics; results; and conclusions. The data were processed, organized and stored on an electronic Excel® (Office 2016®) spreadsheet per publication year and author. The quality of the reported evidence was analyzed following the recommendations of the Oxford Centre for Evidence-based Medicine¹².

RESULTS

We initially retrieved 674 studies; following title and abstract analysis, 74 were selected. Full-text analysis led to select 35 studies which met the review aims, which are described in Table 1.

Main changes introduced by the Accreditation Council for Graduate Medical Education (ACGME):

- 2003: 80 working hours per week and 24-hour shifts;
- 2011: 16-hour shifts for first-year medical residents and 24-hour shifts for second-year residents; restriction to 80 hours / week remained.

It should be observed that there was no restriction to the working hours of medical residents before 2003⁴⁸.

DISCUSSION

Length of shifts and related fatigue are important sources of adverse health events and patient safety⁴⁹⁻⁵¹. However, the present literature review indicates that working time restrictions often do not translate into improved patient safety indicators.

Upon reviewing studies which correlate working times and patient safety one should consider the nature of the analyzed outcomes. Within this context, distinguishing between intermediate — such as potential errors, errors without clinical consequences, and perceived patient safety — and definitive — such as adverse events, avoidable events, and mortality — outcomes is highly relevant⁵².

The present review of literature published in the last decades found that the outcomes most frequently analyzed were mortality, adverse events, continuity of care, in-hospital complications, readmission rate and length of stay at hospital. Most studies analyzed outcomes after the implementation of changes in the working time, usually of medical residents in the United States and formulated by ACGME in 2003 and 2011.

One of the main goals of restricting the working time is to protect patients from the deleterious effects of physicians' fatigue. However, most of the analyzed studies did not evidence any impact of restrictions to physicians' working time on mortality^{13-18,20,22,24,26-32,35,36,39-41,44-46}. Fletcher et al.²¹ and Helling et al.²³ found that mortality decreased after changes were implemented in the working time, however, they explained this finding as a transient reduction unrelated to changes in the workload. Only Volpp et al.⁴⁵ reported that restriction of the working time to 80 hours / week and shifts of up to 24 hours was associated with reduced mortality, however, for only four clinical conditions (acute myocardial infarction, stroke, gastrointestinal bleeding and heart failure).

The term adverse event is applied to events involving damage to patients. Medical errors — defined as acts of omission or commission in planning or execution which contribute or might contribute to an unintended

Table 1. Characterization of studies on the impact of restrictions to physicians' working time on patient safety, São Paulo/SP/Brazil, 2018

| Authors | Year | Study design | Working time | Outcomes | Sample | Relevant results | Evidence level |
|-------------------------------------|------|---------------------------|--|---|------------------|--|----------------|
| Ahmed et al. ¹³ | 2014 | Systematic review | 80 h/ week, 16 h / shift and night float | Mortality, morbidity and continuity of care | 135 studies | Restriction to 80 hours / week: inconclusive impact on patient safety, but the physicians' perception suggests negative outcomes Restriction to 16-hour shifts: inconclusive objective impact, but reduced patient safety according to the physicians' perception. Interference with the continuity of care and higher frequency of shift handoff were mentioned as causes of deterioration Night float: no study evidenced improved patient safety outcomes | 2A |
| Alshekhlee et al. ¹⁴ | 2009 | Cohort | ACGME 2003 | Mortality | 377,266 patients | No significant changes in mortality by stroke after implementation of ACGME 2003 restrictions | 2B |
| Anderson et al. ¹⁵ | 2017 | Cohort | ACGME 2011 | Adverse events and mortality | 383 patients | No difference in mortality or rates of complications between restricted (80 h / week and 16-h shifts) and flexible (no restrictions) working time. No difference in the nature of errors. Most errors were due to cognitive flaws, and the smallest proportion was related to teamwork. No difference in the nature of errors made at night or during the day | 2B |
| Babu et al. ¹⁶ | 2014 | Cohort | ACGME 2003 | Surgical complications, mortality, length of stay at hospital and hospital discharge rate | 90,648 patients | Significant increase of postoperative complications at teaching hospitals after implementation of changes in working time compared to non-teaching hospitals | 2B |
| Babu et al. ¹⁷ | 2014 | Cohort | ACGME 2003 | Morbidity, mortality, length of stay at hospital and hospital discharge rate | 693,058 patients | Significant increase of postoperative complications at teaching hospitals after implementation of changes in working time compared to non-teaching hospitals | 2B |
| Bilimoria et al. ¹⁸ | 2016 | Randomized clinical trial | ACGME 2011 versus flexible hours | Postoperative mortality rate, 30-day severe and other postoperative complications | 138,691 patients | Less restrictive and more flexible working times were not associated with higher mortality, rates of severe complications or any analyzed secondary postoperative outcome | 1B |
| Bolsterand and Rourke ¹⁹ | 2015 | Systematic review | ACGME 2011 | Patient care | 27 studies | ACGME 2011 did not have any impact on patient care | 2A |

Continue...

Table 1. Continuation.

| Authors | Year | Study design | Working time | Outcomes | Sample | Relevant results | Evidence level |
|--------------------------------|------|-------------------------------|-----------------------------|--|-----------------------|--|----------------|
| Choma et al. ²⁰ | 2013 | Cohort | ACGME 2011 (30 versus 16 h) | Continuity of care; efficiency; quality and patient safety; mortality; readmissions; and transfer to ICU | 3,991 patients | Higher weekly frequency of shift handoff (from 56 to 126) after implementation of working time restrictions. No difference in length of stay at hospital or patient safety indicators | 2B |
| Fletcher et al. ²¹ | 2011 | Systematic review | ACGME 2003 | Mortality, complications and adverse events | 28 studies | Significant reduction of mortality after 2003, for both clinical and surgical patients. | 2A |
| Harris et al. ²² | 2015 | Systematic review | ACGME 2011 | Mortality, morbidity, adverse events, sentinel events, complications | 11 studies | No objective data assessing the relationship between patient clinical outcomes and changes in the working time | 2A |
| Helling et al. ²³ | 2010 | Time series | ACGME 2003 | Mortality, length of stay at hospital | 126,396 patients | Reduced mortality and length of stay at hospital were probably not related to restriction to the working time, but to global improvement of healthcare facilities. Restrictions to residents' working hours did not have any evident effect on patient care (non-inferiority) | 2C |
| Hoh et al. ²⁴ | 2012 | Time series | ACGME 2003 | Mortality and clinical complications | 107,006 patients | Risk of complications increased (23%) after working time restriction was implemented. No significant difference in mortality or length of stay at hospital before and after restriction implementation. Hospital costs were significantly higher after restriction implementation | 2C |
| Landrigan et al. ²⁵ | 2008 | Cohort | ACGME 2003 | Self-reported medical errors in medication prescription and administration | 220 medical residents | No changes in the global medication error rate, and slight increase of the prescription error rate. No changes in self-reported medical error rate | 1B |
| Leafloor et al. ²⁶ | 2015 | Review of time-motion studies | ACGME 2003 and 2011 | Adverse events and mortality | 8 studies | Higher frequency of shift handoff was associated with larger number of adverse events, including death. However, there are discrepancies among studies | 1A |
| Marwaha et al. ²⁷ | 2016 | Cohort | ACGME 2011 | Mortality, length of stay at hospital, quality indicators | 11,740 admissions | Working time restriction was not associated with changes in primary outcomes, except for length of stay at hospital. There were changes in several quality indicators. Total number of operating room visits and bedside procedures per admission increased after implementation of working time restrictions, resulting in 9,559 additional procedures and 1,584 operating room visits. Bedside procedures, such as laboratory and imaging tests, significantly increased | |

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Table 1. Continuation.

| Authors | Year | Study design | Working time | Outcomes | Sample | Relevant results | Evidence level |
|--------------------------------|------|---------------------------|--------------------------|---|------------------------------------|---|----------------|
| Mautone ²⁸ | 2009 | Time series | ACGME 2003 | Length of stay at hospital, readmissions within 30 days and mortality | 5,671 admissions | Changes in working hours did not involve additional cost or any changes in the patient clinical outcomes | 2C |
| Navathe et al. ²⁹ | 2013 | Time series | ACGME 2003 | 30-day mortality, patient safety indicators, long stay at hospital rate | 3,614,174 patients | No difference in patient safety indicators or mortality. The rate of long stay at hospital increased only for surgical patients on the second year after implementation of working time restrictions, but this effect was very small | 2C |
| Norby et al. ³⁰ | 2014 | Time series | ACGME 2003 | In-hospital complications and procedures, hospital discharge characteristics, mortality | 2,400,000 patients | No changes in number of procedures or in-hospital mortality. Larger number of postoperative complications and discharges to long-term care institutions after implementation of ACGME 2003 | 2C |
| Ouyang et al. ³¹ | 2016 | Cohort | 80h / week | Length of stay at hospital, mortality, transferal to ICU, readmission within 30 days | 4,767 admissions of 3,450 patients | Compound outcome increased (death, transferal to ICU, readmission within 30 days and length of stay at hospital) for patients whose physicians worked more than 80 h/ week. No statistically significant difference in the 30-day readmission rate or in-hospital mortality | 2B |
| Parshuram et al. ³² | 2015 | Randomized clinical trial | 12-, 16- and 24-h shifts | Adverse events and death | 971 admissions | No impact of working time on adverse events. 7 out of 8 preventable adverse events occurred during 12-h shifts. Mortality was similar for all 3 shift regimens | 1B |
| Philibert et al. ³³ | 2013 | Systematic review | ACGME 2003 and 2011 | Patient safety, continuity of care | 83 studies | Results conflict. Interference with continuity of care and work overload had negative impact on the resident and patient outcomes | 2A |
| Press et al. ³⁴ | 2011 | Time series | ACGME 2003 | Readmission rate | 750,000 patients | No difference in the readmission rate the 2 first years after implementation of working time restrictions | 2C |
| Rajaram et al. ³⁵ | 2015 | Cohort | ACGME 2011 | Compound outcome (death, severe morbidity within 30 days after surgery) | 190,000 patients | No significant association between working time restrictions and compound outcome (death or severe morbidity) for all analyzed surgical specialties | 2B |
| Rajaram et al. ³⁶ | 2014 | Quasi-experimental | ACGME 2011 | Complications, mortality and costs | 204,641 patients | No significant association of working time with mortality, severe morbidity or adverse postoperative outcomes | 2B |

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Table 1. Continuation.

| Authors | Year | Study design | Working time | Outcomes | Sample | Relevant results | Evidence level |
|----------------------------------|------|---------------------------|--------------------------|---|---------------------------------|--|----------------|
| Rajaram et al. ³⁷ | 2016 | Time series | ACGME 2013 | Care indicators and patient experience | 2,116 hospitals | ACGME 2013 implementation was not associated with changes in patient experience or care procedures | 2C |
| Rosen et al. ³⁸ | 2009 | Time series | ACGME 2003 | 10 patient safety indicators clustered into 3 compound outcomes: "continuity of care", "technical care" and "other" | 14,193,320 patients | Changes in working time did not have systematic impact on patient safety indicators | 2C |
| Scally et al. ³⁹ | 2015 | Cohort | ACGME 2011 | 30-day mortality, severe morbidity, readmission | 1,699,077 patients | No difference in outcome changes between teaching and non-teaching hospitals after implementation of changes in the working time | 2B |
| Schroepffel et al. ⁴⁰ | 2015 | Cohort | ACGME 2011 | Mortality, length of stay at ICU and at hospital | 9,178 patients | Length of stay in ICU and e hospital was longer after implementation of changes. No changes in mortality | 2B |
| Schuster et al. ⁴¹ | 2018 | Cohort | 24-h shifts | Mortality and severe morbidity | 611 cases | Mortality and severe morbidity were similar between tired and well-rested surgeons | 1B |
| Shea et al. ⁴² | 2014 | Randomized clinical trial | 3-h protected nap period | Length of stay at hospital, transferal to ICU, death and readmission within 30 days | 94 physicians | No difference in patient clinical outcomes between the analyzed working time regimens. Physicians who rested 3 hours exhibited less attentional lapses on the Psychomotor Vigilance Test | 1B |
| Shelton et al. ⁴³ | 2014 | Time series | ACGME 2003 | Primary outcomes were differences in patient safety indicators before and after restriction to the working time | 376 million hospital discharges | Lack of change patterns suggests non-mensurable effect of working time changes on patient safety indicators | 2C |
| Volpp et al. ⁴⁴ | 2007 | Time series | ACGME 2003 | Mortality and readmission within 30 days | 318,636 patients | Mortality significantly decreased on the second year after implementation of working time changes at teaching hospitals, but only for clinical patients | 2C |

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Table 1. Continuation.

| Authors | Year | Study design | Working time | Outcomes | Sample | Relevant results | Evidence level |
|----------------------------|------|--------------|--------------|--|------------------------|--|----------------|
| Volpp et al. ⁴⁵ | 2007 | Time series | ACGME 2003 | Mortality and readmission within 30 days | 8,529,595 patients | No difference in mortality between high-risk clinical and surgical patients | 2C |
| Volpp et al. ⁴⁶ | 2009 | Time series | ACGME 2003 | Mortality and readmission within 30 days | 8,529,595 patients | No difference in mortality between clinical and surgical patients | 2C |
| Wen et al. ⁴⁷ | 2017 | Time series | ACGME 2003 | "Never events," long stay at hospital rate, hospital costs | 228 million admissions | The odds of "never events" increased 18% in teaching hospitals. No changes in non-teaching hospitals | 2C |

ACGME: Accreditation Council for Graduate Medical Education; ICU: Intensive Care Unit; Nightfloats: Job schedule with many consecutive nights working.

result — not always result in adverse events⁵³. The detection and analysis of individual or combined adverse events reveal organizational, systemic and environmental problems⁵⁴. In the present review we found that, except for one single study⁴⁷, the incidence of adverse events did not change following the implementation of restrictions to the working time^{20-22,25,26,32}. As shown by Anderson et al.¹⁵, in a prospective cohort study with 383 patients, the nature of adverse events did not differ upon comparing medical residents working 16-hour shifts versus no restrictions to the length of shifts.

Shift handoff is the time when healthcare professionals exchange information on patients, and includes transfer of control and responsibility of decision-making⁵⁵. Communication flaws in this period of transition are frequent causes of medical errors and adverse events⁵⁶⁻⁵⁸. Two arguments are adduced against restricting the working time: higher frequency of shift handoff and interference with the continuity of care. Choma et al.²⁰ found higher frequency of shift handoff after implementation of restrictions to the working time, however, without any impact on patient safety indicators. Anderson et al.¹⁵ observed that errors due to communication flaws within surgical staff were more frequent among doctors without restrictions to their working time. In a systematic review of 83 studies, Philibert et al.³³ found evidence for impaired continuity of care, however, with no impact on patient

safety. Rosen et al.³⁸ reported that reduction of the working time did not have systematic impact on the continuity of care or patient safety indicators.

The results relative to the impact of the working time on length of stay at hospital varied among the analyzed studies^{16,17,27,28,31,40,42}. There was a trend for shorter stay at hospital in most studies. However, the studies which analyzed differences in the impact of ACGME restrictions between teaching and non-teaching hospitals found shorter stay at hospital only among the latter, which indicates that the impact of restriction was negative^{16,17}. Ouyang et al.³¹ and Schroepel et al.⁴⁰ found longer stay at hospital after implementation of working time restrictions. Only Shea et al.⁴² did not find difference in length of stay at hospital.

The limitations of the present integrative review are due to heterogeneity among the analyzed studies. In addition, most studies analyzed outcomes retrospectively, before and after implementation of ACGME restrictions to the working time of medical residents. Considering that residents are fresh graduates and require supervision, their contribution to patient safety is rather limited. In addition, working time is just one of the aspects related to patient safety, while other factors, such as the role of other professionals, patient involvement and the institutional patient safety culture, need to be taken into consideration.

CONCLUSION

In the present review of 35 studies we found that restrictions to the working time often do not lead to improvement

of patient safety indicators. Therefore, a focus on interventions which only seek to limit the workload of physicians might be insufficient to bring consistent improvement to patient care.

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