Best evidence topic - Cardiac general

Does the introduction of duty-hour restriction in the United States negatively affect the operative volume of surgical trainees?

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Summary

Over the last few years, both sides of the North Atlantic have witnessed compulsory duty-hour restrictions for doctors. It has been suggested that the reduction in working hours for surgeons in training may have a negative impact on their exposure to surgical procedures and therefore, on the quality of training. A best evidence topic in cardiac surgery was written according to a structured protocol. The question addressed was: among surgeons enrolled in a training program, does the introduction of duty-hour restrictions have a negative impact on their exposure to surgical procedures and therefore, on the quality of training? In total, more than 74 papers were found using the reported search, of which 15 represented the best evidence to answer the question. All these manuscripts came from the USA. The authors, journal, date and country of publication, group studied, study type, relevant outcomes and results of these papers are tabulated. Studies from different surgical disciplines, such as general, orthopedic, pediatric, cardiothoracic and vascular surgery were included. Among the studies analysed, eight revealed a decrease, five showed no change, and two studies demonstrated an increase in the operative experience of residents following the introduction of the 80-hour limit. The changes appear to have more negatively affected junior residents in favor of more senior ones due to a shift in the surgical workload to the latter. Interestingly, some studies demonstrated better results in the in-training examinations (testing for clinical and basic science knowledge) following the duty-hour restrictions. We conclude that although most of the studies included in this review revealed that the introduction of working-hour restrictions in the USA has produced a decrease in number of cases performed by trainees, some have failed to do so. Changes in the residents’ working patterns, such as ‘night float’ and ‘leave early’ models, may be useful to preserve exposure to surgical procedures.

Keywords: Duty hours; Review; Training

1. Introduction

A best evidence topic was constructed according to a structured protocol. This is fully described in the ICVTS [1].

2. Three-part question

Among [surgeons enrolled in a training programme], does the [introduction of duty-hour restrictions] have a negative impact on [their exposure to surgical procedures and therefore, on the quality of training]?

3. Clinical scenario

You have been the resident on call for cardiothoracic surgery during the night, and after the morning round you are about to have your post-take day off. Your senior surgeon tells you that under the current duty-hour restrictions, there is no way you will ever make it to be a fully trained surgeon. You decide to find out whether there are ways to obtain adequate exposure to surgical procedures in a duty-hour restriction environment.

4. Search strategy

A Medline search for publications in English up to May 2011 was performed using the terms [exp Workload/OR exp ‘Personnel Staffing and Scheduling’/OR working time.mp. OR exp Work Schedule Tolerance/OR 80 hour.mp.] AND [Surgery.mp. OR exp General Surgery/OR exp Thoracic Surgery/] AND [exp United States/or USA.mp]

5. Search outcome

Seventy-four papers were found using the reported search. From these, 15 papers were considered to provide the best evidence to answer the question. These are presented in Table 1.
Table 1. Best evidence papers

<table>
<thead>
<tr>
<th>Study group</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Comments</th>
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<tbody>
<tr>
<td>120 general surgery trainees in a single training programme</td>
<td>General surgery resident operative experience during a four-year period</td>
<td>Significant decrease in operative experience in PGY1 and PGY5 but not in PGY3</td>
<td>The four-year period was divided into two groups: before and after implementation of the duty-hour restrictions.</td>
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<td>37 residents from three different training programs in cardiothoracic surgery</td>
<td>Thoracic, cardiac and all combined cases were reviewed separately for all residents at yearly intervals</td>
<td>Number of thoracic cases was lower during the first year of training but increased in the second and third years of training after working-hour restrictions. Cardiac cases were substantially lower during each year of training after working-hour restrictions. Overall total cases were also lower over all years of residency after working-hour restrictions.</td>
<td>Residents were divided into pre- (1999–2002) and post- (2003–07) working-hour restriction groups. Thoracic, cardiac and all combined cases were reviewed separately for all residents at yearly intervals.</td>
</tr>
<tr>
<td>Residents on an integrated residency program in general surgery</td>
<td>Operative experience</td>
<td>An overall decrease of nearly 20% occurred in resident operative volume after promulgation of duty-hour restrictions.</td>
<td>Index surgical procedures for surgery performed by graduating residents were tabulated for the academic years from July 2000 to June 2005. Duty-hour restrictions were instituted in June 2002.</td>
</tr>
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<td>General surgery residents at a single hospital</td>
<td>Recorded missed surgical procedures on post-call days</td>
<td>Significant decrease in operative experience</td>
<td>Before implementation of a night rotation, residents were projected to miss an average of 202 operations over four years. After its implementation, the projected loss would drop to 107 operations over four years.</td>
</tr>
<tr>
<td>General surgery residents at a single university hospital</td>
<td>Number of surgical cases carried out by the residents</td>
<td>No decrease in operative experience overall. PGY5s did have statistically fewer cases after working-hour restriction</td>
<td>Data compiled retrospectively from ACGME logs and operating room records for 2002 and 2003.</td>
</tr>
<tr>
<td>13 general surgery residents in a city hospital</td>
<td>Emergency abdominal procedures by PGY4 and PGY5 residents</td>
<td>No difference between groups in the mean number of procedures performed as the primary surgeon</td>
<td>Comparisons between number before and after duty-hour restriction.</td>
</tr>
<tr>
<td>22 general surgery residents at a single hospital</td>
<td>Number of cases performed by chief residents</td>
<td>Decrease in the number of total chief cases. Total major cases, total trauma operative cases and total teaching assistant cases did not change significantly. There was an increase in the number of teaching assistant cases.</td>
<td>Comparison between before and after the 80-hour working-hour restriction in their centre.</td>
</tr>
<tr>
<td>Review of the ACGME Resident Statistics Summary Reports</td>
<td>Number of total major operations reported by residents</td>
<td>Decrease in number of cases reported by residents as surgeon and chief surgeon, and as first and teaching assistant. No change in reported number of surgeon junior cases.</td>
<td>Review of reports from academic year 1992–93 through to 2006.</td>
</tr>
<tr>
<td>Data obtained from telephone conversations with 10 program directors</td>
<td>Operative logs from chief residents graduating in 2002 and 2003</td>
<td>No decrease in operative experience for chief residents</td>
<td>No significant difference in chiefs’ operative volume between programs that did and did not experiment with working-hour reform during 2002–03.</td>
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Table 1. (Continued)

<table>
<thead>
<tr>
<th>Author, date, journal and country</th>
<th>Study type</th>
<th>Outcomes</th>
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</thead>
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<tr>
<td>Ferguson et al., (2005), Curr Surg, USA, [11]</td>
<td>Descriptive study</td>
<td>General and vascular surgery residents at a single university hospital</td>
<td>Number of surgical cases carried out by residents</td>
<td>Total case volume was unchanged. Overall, no change in mean operative volume per year for surgical residents in this program. For PGY5 residents, case volume increased; for PGY3, PGY2 and PGY1 residents, case volume remained stable</td>
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<tr>
<td>Durkin et al., (2008), J Surg Educ, USA, [12]</td>
<td>Descriptive study</td>
<td>Residents on a general surgery training program</td>
<td>Number of major cases recorded by graduating residents and ABSITE scores</td>
<td>Resident operative experience was not affected. Improvement in ABSITE scores</td>
</tr>
<tr>
<td>Spencer and Teitelbaum, (2005), J Am Coll Surg, USA, [13]</td>
<td>Descriptive study</td>
<td>47 residents in a pediatric surgery service</td>
<td>Total number of cases performed</td>
<td>Number of cases performed either by residents did not change</td>
</tr>
<tr>
<td>Bland et al., (2005), Am J Surg, USA, [14]</td>
<td>Descriptive study</td>
<td>All registered residents in general surgery</td>
<td>Major surgical procedures per resident (per program)</td>
<td>Number of procedures was not statistically different</td>
</tr>
<tr>
<td>Barden et al., (2002), J Am Coll Surg, USA, [15]</td>
<td>Survey</td>
<td>29 graduating chief residents</td>
<td>Total number of surgical cases performed and ABSITE scores</td>
<td>Increase in the number of cases performed by chief residents. Increase in ABSITE scores</td>
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<tr>
<td>Baskies et al., (2008), J Bone Joint Surg Am, USA, [16]</td>
<td>Descriptive study</td>
<td>190 orthopedic surgery residents in a single training program</td>
<td>Operative logs of 109 consecutive orthopedic surgery residents (PGY2-PGY5)</td>
<td>No significant difference in the operative volume for PGY2, PGY3 or PGY4 residents. However, the average operative volume for a PGY5 resident increased</td>
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</tbody>
</table>

ABSITE, American Board of Surgery In-Training Examination; ACGME, Accreditation Council for Graduate Medical Education; PGY, postgraduate year.

6. Results

Sixteen studies were identified on the impact of the restriction of duty hours to 80 per week on exposure to operative experience among trainees. Two papers made reference to the same programme, so only one of these is described.

Eight studies revealed a decrease in the number of cases performed by trainees.

Carlin et al. evaluated the operative experience of general surgery residents over two years prior and subsequent to the introduction of duty-hour restrictions. There was a significant decrease in the mean number of total and primary surgeon cases following the restriction on duty hours for postgraduate year (PGY) 1, 2 and 4. Nevertheless, there was no difference in the operative volume for residents in PGY3 and PGY5 [2].

Connors et al. reviewed the operative logs of cardiothoracic surgery residents at three training institutions. Residents were divided into pre- and post-working-hour restriction groups. The number of thoracic cases was lower during PGY1 but increased in PGY2 and PGY3, after the working-hour restrictions. Cardiac cases were substantially fewer during each year of training after the working-hour restrictions [3].

Damadi et al. evaluated the self-reported operative experience of the chief resident in a residency program in general surgery before and after duty-hour restrictions. An overall decrease of nearly 20% occurred in resident operative volume after the duty-hour restrictions [4].

Jarman et al. compared the number of surgical cases ‘lost’ by residents after the introduction of the duty limitations because of their on-call commitments. They found a significant decrease in operative experience [5].

McElearney et al. compiled data from the Accreditation Council for Graduate Medical Education (ACGME) logs and operating room records at a university hospital for 2002–2003 for general surgery residents. Only PGY5s had statistically fewer cases after the work-hour restriction [6].

Feanny et al. retrospectively compared the operative experience in emergency abdominal procedures of PGY4 and PGY5 residents in a city hospital before and after duty-hour restriction. Although there was no difference between groups in the mean number of procedures performed as the primary surgeon, the researchers noticed a 40% decrease in technically advanced procedures and a 44% increase in basic procedures after the duty-hour restriction [7].
Christmas et al. retrospectively analyzed the case logs of 22 chief residents before and after the 80-hour work restriction in their centre. They found a statistically significant decrease in the number of total chief cases. Total major cases, total trauma operative cases and total teaching assistant cases did not, however, change significantly [8].

Kairys et al. reviewed the ACGME Resident Statistics Summary reports from academic year 1992–93 through to 2006. The number of total major operations reported as surgeon and surgeon chief decreased by 2.3% and 8.3%, respectively [9].

Five studies failed to demonstrate a negative impact of duty-hour restriction on the number of cases carried out by trainees.

Mendoza and Britt collected data from 80 training programs in the USA. There were no significant differences in the chiefs’ operative volume between programs that did and did not experiment with working-hour reform, and no relationship was found between working hours and volume of operative cases. Furthermore, for residents in New York programs, there was an inverse relationship between working hours and operative volume [10].

Ferguson et al. compared the case volume before and after changes by PGY year. The total case volume was unchanged over this period. Overall, there was no change in mean operative volume per year for surgical residents in this program, and for PGY5 residents, the case volume actually increased [11].

Durkin et al. evaluated the operative volume from 1997 to 2005 of all general surgery residents on the University of Wisconsin training programme. The number of major cases recorded by graduating residents did not change [12].

Spencer and Teitelbaum quantified residents’ operative experience, by case category, on a pediatric surgical service in the year before and after the 80-hour limit. The total number of cases performed by either senior or junior residents did not change [13].

Bland et al. published a prospective analysis by ACGME for total surgical procedures and chief resident cases after the first year of successful full compliance with the 80-hour working week. The average (of averages) for major surgical procedures per resident (per program) in academic years 1997–2004 was not statistically different for the academic years evaluated when compared with the year of implementation of duty-hour standards (2003–04) [14].

Finally, two studies revealed an increase in the operative experience of residents after the 80-hour limit was applied.

Barden et al. from New York reported that the total number of cases performed by the chief residents increased significantly after the working time limitations [15].

Baskies et al. analyzed the operative logs of 109 consecutive orthopedic surgery residents (PGY2– PGY5). Following the implementation of the new working-hour policies, there was no significant difference in the operative volume for PGY2, PGY3 or PGY4 residents. However, the average operative volume for a PGY5 resident increased [16].

Concerns have been voiced on both sides of the Atlantic with regard to the effect of the reduction in working hours on the quality of surgical training. Contrary to the situation in the USA, the situation in Europe with regard to the impact of the application of the European Working Time Directive on operative training has not been investigated in depth.

Even though pure procedural experience may have been taken by some as the main indicator of surgical proficiency, many other aspects of surgical training have not been considered in this review, namely the effect of duty-hour limitations on exposure to outpatient clinics and on the opportunity to learn as clinical episodes evolve through the longitudinal course of patient’s illness.

7. Clinical bottom line

Although a majority of the studies included in this review revealed that the introduction of working-hour restrictions in the USA (to an average of 80 working hours per week) has produced a decrease in the number of cases performed by trainees, there is some evidence that, with the adoption of alternative working patterns, it is possible to preserve the exposure of residents to surgical procedures.

References