Influence of changing work patterns on training in anaesthesia: an analysis of activity in a UK teaching hospital from 1996 to 2004

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Background. We aimed to assess the influence of reduced working hours on training in a UK teaching hospital as the specialist registrar grade was introduced in 1996, the New Deal was implemented in 2001 and the Working Time Directive (WTD) took effect for doctors in training in 2004.

Methods. We analysed data from operating theatres in our hospital looking at grade of anaesthetist, time of day, emergency category, and specialty for more than 50,000 cases.

Results. Although direct supervision of trainees increased from 32 to 37 to 47%, senior house officer (SHO) and specialist registrar (SpR) caseload reduced by 20 and 21%, respectively, while that of the consultants rose.

Conclusions. The reduction in total operating theatre cases for our trainees was evident across the epochs analysed, case numbers fell after introduction of the New Deal as well as more recently following the WTD, particularly for SHOs who are now doing a larger proportion of their work at night. SHOs and SpRs are doing more obstetric cases than in previous times but these are regional and not general anaesthetics.
prospect of further reductions in hours is worrying and training may need to change in response. For these reasons, we were keen to examine whether the perceived reduction in numbers of cases performed, both directly and indirectly supervised, has actually occurred in our teaching hospital. Our analysis was designed to show changes in number, urgency, time, and subspecialty of cases and could not address the question of quality or outcome either of training or patient care. Using a computerized data entry system based in the operating theatre, we are able to extract information to demonstrate experience and training for each individual or group over a period of time, as well as revealing the local activity of the entire department.

We have published previously a detailed analysis of theatre training in our teaching hospital. In this paper, we will divide further data for the last 8 yr into epochs to see if there has been any change in training or service pattern for anaesthetists following the introduction of the specialist registrar grade following the Calman report, implementation of the New Deal or enforcement of the Working Time Directive (WTD).

Methods

Definitions

All cases performed in operating theatres by consultants, specialist registrars, and senior house officers (in the second year of specialist training) were included over an 8-yr period (1996–2004). Direct supervision of a trainee was defined as the presence of a more senior anaesthetist in the same operating theatre and was further sub-divided into Specialist Registrars (SpR) or consultant supervisor. Trainees working ‘solo’ remained under the indirect supervision of a nominated consultant. Emergency cases were defined as those categorized as emergency or urgent by the National Confidential Enquiry into Perioperative Deaths (NCEPOD), elective cases were NCEPOD categories elective or urgent, and as a proportion of their caseload. SpRs showed a similar pattern, as well as doing a little more teaching of trainees themselves. The overall direct supervision rate for all trainee cases supervised directly rose during the day and was well maintained overnight, over the three epochs analysed.

Data collection

All theatre-based information was entered into a commercially available, computerized data collection system (Swiftop EDS Healthcare, Bristol, UK) at the time of operation. The system was installed in our hospital in 1993 for routine direct data entry onto a computer terminal in the operating theatre by a member of the nursing team.

Data analysis

Information was downloaded from the theatre database as a series of spreadsheet files then imported into a modified copy of the Royal College of Anaesthetists Electronic Logbook (Hammond/McIndoe). Three sets of data were extracted for time periods: 1996–1997, 2001–2002, and 2004 following the introduction of changes recommended in the Calman report (1996), the implementation of the New Deal (2000), and the Working Time Directive (2004) respectively.

Results

The full database includes theatre cases from all theatres in our hospital, including obstetric cases, for the last 8 yr. Our sample for this study included more than 50,000 cases in three time periods, the first two of 1 yr and the last a 6-month period.

Trainees were allocated into two groups, Senior House Officers (SHO) and SpR. Thus, the cases were divided between consultants, who may be supervising or solo, and trainees who may be directly or indirectly supervised. Trainees were considered directly supervised if they were in theatre with a consultant or if they were SHOs working with an SpR. The combinations of anaesthetic personnel in theatre are shown in the Venn diagram (Fig. 1).

The total number of cases for the time period 1996–7 was 17,883, for 2001–2 was 22,866 and for 2004–5 (annualized from 6-month sample) was 26,452. Over the 8-yr period, the number of trainees fell by two and a half whole time equivalents, then rose again as National Training Numbers were adjusted, while the number of consultants rose from 28 to 52 whole time equivalents (Fig. 1).

The total number of SHO cases decreased over time showing the same change after introduction of the New Deal as following the recent implementation of the WTD. Total SpR case numbers initially remained constant; then fell by 25% following the implementation of the WTD. Consultant caseload rose markedly over the 8-yr period.

The average annual caseload for an individual SHO fell from 496 in 1996–7 to 449 in 2001–2 and will be about 400 for 2004–5. SpR average annual caseload rose from 395 to 424 and will be approximately 316 for 2004–5. For consultants, the individual annual caseload has increased from 313 to 328 to nearly 400 (Fig. 2).

Direct supervision rates also show changes over the period studied (Figs 1 and 3). SHOs were increasingly supervised, as determined both by the total number of cases they did with a senior anaesthetist in theatre (direct supervision) and as a proportion of their caseload. SpRs showed a similar pattern, as well as doing a little more teaching of trainees themselves. The overall direct supervision rate for all trainee cases (SHO and SpR), included in the analysis, was 32% in 1996–7, 37% for 2001–2, and 47% for cases done in 2004 (Fig. 1).

Caseload and supervision were inspected over the 24-h period for each group of trainees and consultants (Table 1). The data suggest that the increase in direct supervision of SHO cases occurred across the day, evening, and night, with a doubling of percentage supervision in the evening period for SHOs after implementation of the WTD. The proportion of SpR cases supervised directly rose during the day and was well maintained overnight, over the three epochs analysed. The total number of supervised cases has risen for both...
SHOs and SpRs (Fig. 1), thus the actual number of cases undertaken with direct supervision has risen. Therefore, the decrease in total trainee case numbers occurred in the solo, indirectly supervised work.

The consultants’ work pattern over the 24-h period has not changed as much as that of the SHO and SpRs (Fig. 4). For SHOs, there was a reduction in the proportion of cases done during daytime, 08.00 to 18.00 with increases in evening, 18.00 to midnight, and night, midnight to 08.00, cases. For SpRs the trend is similar but less marked. The consultants’ increased caseload occurred during the daytime. The ratio of emergency to elective cases has remained constant for all grades of anaesthetist in our hospitals (Table 2). SHOs have a 45:55 split, SpRs 35:65, and consultants 12:88.

Fig 1 SHO, SpR, and consultant theatre case numbers, solo and supervised, for each time period. Data do not include any work undertaken outside the operating theatre.

Fig 2 (Left) Total annual case numbers anaesthetized by the entire department for each time period. (Right) Average annual number of cases per staff member by grade and time period.
Cases were subdivided by specialty and obstetric cases selected for further analysis (Table 3). The number of general anaesthetics given by indirectly supervised trainees for Caesarean section fell between 1996–7 and 2001–2 but appears not to have fallen further in the 2004 sample. The number of regional anaesthesia blocks performed increased substantially, thus the percentage of obstetric cases done by junior anaesthetists under general anaesthesia fell significantly between 1996–7 and 2001–2 and remains low in the 2004 sample.

**Discussion**

It is reassuring to see that much of the operating theatre work done by our trainees remains directly supervised by consultants. We cannot measure the efficacy of this training, but note that 35% of SHO cases and 44% of SpR cases in our hospitals are directly supervised by a consultant who is in the same operating theatre, and that a further 16% of our SHO cases are directly supervised by more senior trainees. These figures compare favourably with the overall supervision rates of 23 and 28% for SHOs in 1996–7 and 2001–2 and with the SpR supervision at 32 and 35% for these periods. Teaching in the operating theatre and close supervision are essential elements of the training of junior anaesthetists. This facet has survived the reduction in working hours following the introduction of the New Deal and implementation of the WTD for doctors in training.

Another aspect of training is working in the operating theatre under indirect supervision and the gathering of experience over time, which provide the trainee with confidence and consolidate the skills enabling him/her to become an independent practitioner. Concentrating only on the direct supervision rate, risks losing sight of total caseload and, therefore, experience. Over the three time periods studied we saw a reduction in caseload for SHOs from an average of around 500 to 450 to 400 cases per SHO per year. The SpRs did an average of 400 cases per year when the specialist registrar programme started, and approximately 316 annually following the introduction of the WTD. This represents a reduction of 20% in annual case numbers for our trainees. The reduction in SHO caseload occurs primarily during the daytime, with night numbers increased. Perhaps surprisingly, this does not appear to have affected the emergency/elective balance which has

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**Table 1** Supervision of trainees by time of day. Day=08.00–18.00; eve=18.00–24.00; night=00.00–08.00

<table>
<thead>
<tr>
<th>Time of day</th>
<th>1996–7 (%)</th>
<th>2001–2 (%)</th>
<th>2004–5 (%)</th>
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</thead>
<tbody>
<tr>
<td>Direct supervision of SHOs (% cases)</td>
<td>52 17 17</td>
<td>61 22 17</td>
<td>71 44 26</td>
</tr>
<tr>
<td>Direct supervision of SpRs (% cases)</td>
<td>36 26 24</td>
<td>42 23 20</td>
<td>53 37 23</td>
</tr>
</tbody>
</table>

**Fig 3** Directly supervised and solo cases as a proportion of total caseload by trainee group and time period: (A) SHO supervision; (B) SpR supervision; (C) consultant as teacher.
remained remarkably constant. It is well known that performance at night is not as good as in the day and it has been the aim in our hospitals to reduce night-time theatre work where possible.\textsuperscript{67}

The increase in obstetric cases seen in SHO and SpR practice is as result of increased regional anaesthesia, in keeping with national obstetric practice. General anaesthesia for obstetric patients is rarely performed by trainees. Our analysis mirrors the national picture where lack of training in obstetric anaesthesia airway management is a concern.\textsuperscript{8}

We were primarily looking for trends in junior doctors’ training, but it is interesting to note that the individual consultant caseload appears to be increasing, even though the number employed has risen. For consultants, as for trainees, calculating an average number of cases oversimplifies the situation. It does not take account of sessions spent outside theatres in pain management, preoperative assessment, intensive or perioperative care, nor of the duration of theatre lists. Of the current 52 consultants, 20 have timetabled sessions in intensive care units or the pain service. It may be, that with lower numbers of training cases, consultants are able to do more solo cases without increasing the length of theatre lists, a statement which might equally apply to our surgical colleagues. Although the total number of consultant-supervised cases has increased, the consultant-teaching load has reduced from 45 to 22% of their in-theatre caseload; the unused training capacity has increased from 4835 to 10 431 to approximately 16 000 cases per year.

Our data suggest that theatre caseload for trainees in anaesthesia has been declining over the last 8 yr as junior doctors’ hours have been reduced. It is thought widely that the WTD is the major cause, but this analysis shows that much of the change occurred before its introduction, and may have been a consequence of changing work patterns to suit the New Deal. Whatever the cause, there is reason to be concerned as there may come a point at which lack of experience will reduce safety for our patients. With

\begin{table}
\centering
\caption{Elective:emergency case ratio by grade of anaesthetist}
\begin{tabular}{|l|c|c|c|}
\hline
\hline
SHO elective:emergency & 58:42 & 54:46 & 56:44 \\
SpR elective:emergency & 70:30 & 66:34 & 64:36 \\
Consultant elective:emergency & 88:12 & 88:12 & 89:11 \\
\hline
\end{tabular}
\end{table}

\begin{table}
\centering
\caption{Total trainee GA and regional anaesthetic Caesarean sections during each time period. *Annualized data}
\begin{tabular}{|l|c|c|c|}
\hline
\hline
SHO GA cases & 32 & 25 & 6 & 28 & 8 \\
SHO regional cases & 148 & 371 & 94 & 326 & 92 \\
SpR GA cases & 59 & 34 & 6 & 32 & 4 \\
SpR regional cases & 375 & 524 & 94 & 722 & 96 \\
\hline
\end{tabular}
\end{table}

Fig 4 Caseload and supervision level throughout the 24-h period by trainee group and date: (a) SHO 24-h caseload; (b) SpR 24-h caseload; (c) consultant 24-h caseload.
the introduction of the 48-h working week in 2009, we can expect further reductions in trainee case numbers. Even with improved structured teaching, use of simulation for rare event management and focused in-theatre training we may need to change our training programme.

We have looked at the quantity of anaesthetic training over 8 yr but can make no measure of quality from our data. A fully trained anaesthetist should be able to work unsupervised within his/her area of expertise as well as supervising others more junior. Perhaps the move to competency rather than time-based training and assessment will provide a safety net, enabling extension of training time to those who need it. Planning training programmes on this basis will pose practical difficulties but it may become essential if present standards are to be maintained.

Acknowledgements
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