Log-book implementation in Anaesthesiology residency training:
A retrospective analysis

Title: Online log-book in Anaesthesia

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Log-book implementation in Anaesthesiology residency training:
A retrospective analysis

Abstract

Background
An activities log-book can support the teaching/learning process in Anaesthesiology.
The primary objective of this retrospective investigation was to compare residents’ recording compliance between computerized and computerized web-based *log-books* during their first two years of Anaesthesiology training and the variation in the degree of detail for the recordings.

Methods
Data for this retrospective study came from the University of Modena and Reggio Emilia (Italy)’s database of residency activities for two consecutive academic years.
Anaesthesia training activities were grouped into three categories: pre-operative patient assessment, peri-operative management of anaesthesia, post-operative patient follow-up.
Compliance was measured as the ratio between activities and *log-book* entries, the degree of detail as the ratio between specific activities and entries.

Results
The data of 10 residents attending the first and the second years at the School of Anaesthesiology and Intensive Care were included.
The Wilcoxon signed-rank test was used to compare 2009-2010 vs. 2010-2011 activities / entries ratio distributions. There was a statistically significant difference for peri-operative management of anaesthesia, where ratio medians were 29.81 in 2009/2010 and 13.03 in 2010-2011, *p*-value 0.0117.
Specific activities/entries ratio medians were 22.00 in 2009-2010 and 13.71 in 2010-2011, *p*-value 0.0117.

Conclusions
A computerized, web-based *log-book* performed better than a computerized *log-book* in the peri-operative management of anaesthesia setting and in the degree of detail it featured. Thus, it can serve as a monitoring tool during residency training in Anaesthesiology and as an aid for keeping track of a medical professional’s career.
Log-book implementation in Anaesthesiology residency training:  
A retrospective analysis

Introduction

Post-graduate training in medicine is fundamental for acquiring the knowledge and skills needed to reach the level of competence expected of a health-care professional. Residency is a unique moment where the physician in training has the opportunity to engage in medical practice with a view towards developing professionalism while under the supervision of a tutor in a protected environment. Once the resident has completed his or her specialized training, a diploma is issued by the institution where the training took place.

Anaesthesiology is a diversified medical specialty whose scope ranges from pre-operative patient assessment, intra-operative anaesthesia conduct, post-operative care, intensive care, emergency management, and pain medicine. All of these competences have different characteristics with specific organizational aspects. For example, they take place in different settings and locations.

A recent decree has reformed post-graduate medical training in Italy and introduced a registry in order to keep track of each activity performed during residency.

Not all forms of residency training are equal, and not all residents perform the same tasks with a comparable level of competence due to personal differences, the particular characteristics of the training environment, and the educational program that each institution has developed. The increasing demand for specificity and reliability as expressed by the job market is not matched by an equal level of detail by the training institutions which, in the end, can do damage to newly specialized physicians by reducing their career options.

The creation of a log-book to record all work-related activities during residency training (Denton, 2009; Hammond 2001; Nixon, 2000; Supiano, 2002), from lectures to single tasks in the daily routine, can address the need for specificity as required by the job market. A log-book, however, could become part of the teaching/learning process as a way to monitor the working status of trainees not only in order to document their progress, but also in order to identify areas where further training is necessary (Beasley, 2011). Such a document could become part of the curriculum vitae that professionals develop throughout their residency and, if properly updated, could also be maintained during their post-specialization working life. This document could serve as an international record of activities, and competences – a sort of professional identity card that could be readily translated from one language to another, because of its standardized format. Thus, the medical professional could present it to a prospective employer.

The effectiveness of a log-book is directly related to how regularly and in how much detail it is completed. Paper or other physical records are impractical due to the extreme variability of the
Log-book implementation in Anaesthesiology residency training: A retrospective analysis

activities performed. A computerized (Hammond, 2000), web-based record (Lonergan, 2011), by contrast, has the necessary flexibility and customizability to adapt to each trainee’s path of professional development. Moreover, it enables the supervisor to quickly extract data regarding a single resident or a group of residents.

The use of digital, online log-books in anaesthesiology training is a very circumscribed topic, so it has been seldom dealt with in the medical literature.

The primary objective of this retrospective investigation was to analyze the difference in the degree of compliance for recording anaesthesia practice-related activities after the implementation of a computerized, web-based log-book procedure over two consecutive years of residency training at the School of Anesthesiology and Intensive Care. The secondary objective of this investigation was to measure the variation in the level of detail with which practice-related activities were recorded.

Materials and Methods

Data for this retrospective study came from the computerized, web-based database of residency activities developed by the University of Modena and Reggio Emilia (Italy)’s Residency Office in collaboration with the School of Specialization in Anaesthesia and Intensive Care. The data were collected from July 2009 to June 2011, which corresponded to two academic years: the study cohort had completed its second year of specialization at the end of June 2011. The School’s training program focused mainly on Anaesthesiology during the first two years of residency.

The registry has been integrated into the personal page of the University of Modena and Reggio Emilia’s Student Personal Career Management Application (or ESSE3) as log-book. This computerized working environment was set up as a series of windows to describe the area of training, the facility where the training took place, the specific tasks performed, the supervisor, the degree of professional autonomy the resident has attained, and the date.

The computerized log-book could be accessed by every computer linked to the University of Modena and Reggio Emilia Network. One such computer was available in every training facility at Policlinico Teaching Hospital (Modena, Italy) for a total of 6 computers in multiple locations throughout the University. Every resident was also given a paper record sheet as a back-up.

The computerized, web-based log-book could be accessed online, from every computer or smartphone with an Internet connection, by entering the personal username and password directly on the ESSE3 personal career page.
Log-book implementation in Anaesthesiology residency training:  
A retrospective analysis

The School of Specialization had a network of 19 supervisors spread over 15 facilities, and each resident was matched with a personal tutor who was responsible for monitoring the resident’s progress each year.

Every facility was linked to the various activities and participating supervisors, in order to facilitate data entry. The choice tree was structured as follows:

- facility (Hospital, ICU, emergency medical service, etc.);
- activities linked to a specific facility (intubation, general anaesthesia conduct, regional anaesthesia techniques for upper and lower limb surgery, spinal anaesthesia, peridural and perineural catheter placement for post-operative analgesia, central venous line placement, management of renal replacement therapy, pre-hospital trauma care, etc.);
- degree of professional autonomy (from the need for the tutor to be present to complete independence);
- date.

Every resident was instructed to retrospectively update the log-book daily and, where this was impractical, to update it weekly for purposes of accuracy.

The list of activities was updated using the residents’ and tutors’ feedback to better represent the training opportunities that each facility could provide. This was then compared with the core curriculum that each user had to develop at a specific stage of specialization in order to identify the network that could best meet the training needs of each resident.

The degree of completeness was evaluated during the final exam each year where the log-book served as a record of the activities performed and a measure of how well residents had met the educational objectives of their training program.

The report of all computerized web-based log-books was then transferred to an electronic work-sheet (Microsoft Excel® 97-2003).

Anaesthesia training activities were grouped into three categories:

- pre-operative patient assessment, covering all pre-operative anaesthesia-related activities necessary to correctly stratify risk and prepare the patient for anaesthesia;
- peri-operative management of anaesthesia, that included all anaesthetic techniques (regional and general anaesthesia, sedation), all the necessary skills required for induction, maintenance and wake-up from anaesthesia, and the management of peri-operative complications and emergencies;
Log-book implementation in Anaesthesiology residency training: A retrospective analysis

- post-operative patient follow-up, which accounted for post-anaesthesia care and post-operative pain management.

Compliance was measured as the ratio between activities performed and log-book entries. All personal profile updates that affected the number of activities recorded in the personal log-book were considered entries for determining the activities / entries ratio.

The duration of Anaesthesia training was calculated as months of rotation in a specific surgery.

Each user was able to specify the surgical specialty where the peri-operative management of anaesthesia activity was performed. The degree of detail was measured as the ratio between the number of specific activities entered (activities where the surgical specialty was specified by the user) and entries as the specific activities / entries ratio.

The surgical specialties that could be included were: abdominal surgery, obstetrics and gynaecology, orthopaedics and specialized surgery (thoracic, vascular, kidney transplant surgery, urology, paediatrics, neurosurgery).

Statistical Analysis

Skewness and kurtosis tests for normality were applied to the distributions of activities / duration, activities / entries, and specific activities / entries ratios.

Data were expressed as mean ± standard deviation (SD), when normally distributed, or median, when non-normally distributed, and numbers (percentages).

A Wilcoxon signed rank test was used to compare the paired median ratio distributions between the first and second year of Anaesthesia School.

All p-values were two-tailed and a p-value of <0.05 was considered significant. Statistical analyses were performed on a personal computer using STATA (10.0)© software.

Results

The data for the first and the second academic years (07/2009 – 06/2010 and 07/2010 – 06/2011) of 10 residents attending the School of Anaesthesiology and Intensive Care at the University of Modena and Reggio Emilia (Modena, Italy) were included. No data were excluded. Data came from the University of Modena and Reggio Emilia’s Student Personal Career Management Application, ESSE3.
Log-book implementation in Anaesthesiology residency training: A retrospective analysis

The average cohort age was $30.50 \pm 2.84$ years with 60% males. All residents were attending the same academic year within the anaesthesia School and were in similar training programs.

The ratios between activities performed during anaesthesiology practice, divided into pre-operative patient assessment, peri-operative management of anaesthesia, post-operative patient follow-up, and their durations were calculated. Skewness and kurtosis tests for normality of these distributions were negative, so the median was chosen as the summary variable and the non-parametric Wilcoxon signed-rank test for matched data was used to compare 2009-2010 vs. 2010-2011 distributions. Median 2009-2010 vs. 2010-2011 pre-operative assessment ratios were 12.70 and 13.14, respectively, $p$-value 0.1159; peri-operative management of anaesthesia medians were 25.75 and 20.65, respectively, $p$-value 0.7794; and post-operative patient follow-up medians were 11.25 and 9.43, respectively, $p$-value 0.5002.

The ratios between activities performed during anaesthesiology practice and log-book entries were calculated, their distribution tested negative for normality, so the median was chosen as the summary variable and a non-parametric Wilcoxon signed-rank test for matched data was used to compare 2009-2010 vs. 2010-2011 distributions. The pre-operative assessment activities / entries ratio was 27.50 in 2009-2010 and 23.00 in 2010-2011, $p$-value 0.6002; the peri-operative anaesthesia management ratio was 29.81 in 2009-2010 and 13.03 in 2010-2011, with a statistically significant difference, $p$-value 0.0117; the post-operative patient follow-up ratio was 27.67 in 2009-2010 and 8.25 in 2010-2011, $p$-value 0.1380 (Figure 2).

Residents were required to specifically record in the personal log-book their activity in five different surgical fields. The ratio between specific activities performed and the duration of training was calculated. The skewness kurtosis test for normality turned out negative, so the median was chosen as the summary variable and a non-parametric Wilcoxon signed-rank test for matched data was used to compare 2009-2010 vs. 2010-2011 distributions. The median 2009-2010 vs. 2010-2011 ratios were 17.01 and 13.50 respectively, $p$-value 0.7213.

The ratios between activities performed in these specific fields and log-book entries were calculated for each academic year. Their distribution tested negative for normality, so the median was chosen as the summary variable and a non-parametric Wilcoxon signed-rank test for matched data was used to compare 2009-2010 vs. 2010-2011 distributions. The specific-activities/entries ratio was 22.00 in 2009-2010 and 13.71 in 2010-2011, $p$-value 0.0117 (Figure 3).
Log-book implementation in Anaesthesiology residency training:  
A retrospective analysis

Discussion
Anaesthesiology practice comprises a variety of different, specific activities ranging from pre-operative patient assessment, post-operative pain therapy, to peri-operative management of anaesthesia, all of which constitute the core academic curriculum for the School. Because of this wide range of training activity, it becomes necessary to keep a record of all residents’ educational career in order to monitor their progress, identify areas of improvement, and certify the fulfillment of minimum requirements in order to qualify them for the specialization in Anaesthesiology.

From this perspective, a log-book serves as a useful tool to keep track of residents’ progress. Users’ compliance, however, represents a significant limitation to its effectiveness. The development of a computerized, web-based record that guides trainees through the data entry process has the potential for improving not only accuracy but also completeness.

The group of residents analyzed were enrolled in the same academic year and had a similar educational curriculum. Thus, the choice to focus this investigation on anaesthesiology practice was motivated by the fact that in the first two years there are very few ICU rotations and, in any case, they are of limited duration.

The number of procedures entered by each user for a given length of time did not vary significantly between the first and second year, which was a direct consequence of the School’s yearly planning: the first two years were characterized by a more distinct focus on Anaesthesiology and most residents rotated between the same surgical specialties, mainly within the same Policlinico Teaching Hospital (Modena, Italy), the headquarters of the University of Modena and Reggio Emilia’s Faculty of Medicine.

The activities / entries ratio was chosen as a measure of user’s compliance in recording Anaesthesia practice-related data as it could be easily obtained from the computerized record and was an objective measure of how many times each profile was updated. These ratio medians showed a statistically significant difference for the peri-operative management of anaesthesia between the first and second year, whereas no significant difference was present both for the pre-operative patient assessment and the post-operative patient follow-up. The latter two were, for the most part, ambulatory activities within a setting that favoured compliance, whereas the former, being intrinsically connected to the operating theatre, was seen as a less friendly environment, and benefited more from the implementation of a web-based system, accessible from every computer with an Internet connection, and facilitating the data entry process through a guided interface and predefined entries.
Log-book implementation in Anaesthesiology residency training: A retrospective analysis

Even though predefined, each activity entered in the log-book was updated according to users’ feedback to better represent the actual training that each resident had undergone.

Each resident could specify the surgical specialty for which the anaesthesia was performed. The ratio between the number of each detailed activity and entries was chosen as a measure of detail reached by the system. There was a statistically significant difference between the first and second year, and for each personal profile update fewer specialties were entered, even if the total number of specialties recorded per month did not change.

Although an indirect measure of the academic quality of Anaesthesia training already exists in the form of the yearly final examination, anaesthesia practice quality assessment can be implemented using this computerized, web-based log-book. It requires a standard set of evaluation criteria which should be defined at a European level by each country’s Society of Anaesthesiology, with the greatest possible degree of consensus in order to contribute to the definition of the core competences and skills that each physician must acquire to become a certified specialist in Anesthesiology. The log-book could serve as an identity card that records the work experience and competences that each professional has developed in his or her career.

Although there were no differences found for ambulatory activities, a computerized, web-based log-book proved more effective than a computerized log-book in the peri-operative management of an anaesthesia setting. In the same setting the paper handbook can sometimes represent an obstacle to compliance, and in addition, digital data is more convenient for storage and availability. The log-book also improved the degree of detail with which data were entered. A web-based log-book is a flexible, portable tool, and can be accessed and updated from any device that can connect to the Internet, even a smartphone.

In conclusion, a computerized, web-based log-book is not only an effective monitoring tool, useful during residency training in Anaesthesiology, but it is also a potential aid for keeping track of the career development of each professional.
Log-book implementation in Anaesthesiology residency training: A retrospective analysis

References


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Figure 1. Median activities / entries ratios for pre-operative patient assessment, peri-operative management of anaesthesia, post-operative patient follow-up for the academic years 2009-2010 and 2010-2011. The Wilcoxon signed-rank test for matched data was used to compare distributions. The median pre-operative patient assessment ratio was 27.50 (min 10.00, max 43.34) in 2009-2010 and 23.00 (min 4.12, max 43.50) in 2010-2011, \( p \)-value 0.6002; the peri-operative anaesthesia management ratio was 29.81 (min 7.50, max 200.00) in 2009/2010 and 13.03 (min 1.80, max 20.00) in 2010-2011, with a statistically significant difference, \( p \)-value 0.0117; the post-operative patient follow-up ratio was 27.67 (min 5, max 41.67) in 2009-2010 and 8.25 (min 2.70, max 19.17) in 2010-2011, \( p \)-value 0.1380 (Figure 2).
Figure 2. Median specific activities / entries ratios for pre-operative patient assessment, peri-operative management of anaesthesia, post-operative patient follow-up for the academic years 2009-2010 and 2010-2011. The Wilcoxon signed-rank test for matched data was used to compare distributions. The specific-activities/entries ratio was 22.00 (min 7.17, max 120.00) in 2009-2010 and 13.71 (min 1.67, max 20.00) in 2010-2011, $p$-value 0.0117.