

# Pansurgical Electronic Operative Records within a National Healthcare System: A Single Centre Experience and National Review of Practice

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## ABSTRACT

**Background:** Clear, legible and accurate documentation remains an important medico-legal challenge, being fundamental to good medical practice as endorsed by the General Medical Council. Operative records are no exception with the Royal College of Surgeons of England (RCSEng) providing contemporaneous guidance on information they should include, preferably being typed.

**Method:** A single-centre, pansurgical, prospective review of 100 randomly selected operative records was carried out. Fisher's exact test was used to compare compliance of handwritten versus electronic notes with the RCSEng guidelines. All NHS England trusts with surgical services were contacted with a questionnaire to collect data on use of electronic operative records.

**Results:** 78 records were handwritten of which illegibility necessitated a second independent review in 37.2%. None of the records met all guidelines with zero compliance noted in recording DVT prophylaxis, anticipated blood loss and elective/emergency procedure. Only documentation of antibiotic prophylaxis was statistically higher in electronic versus handwritten records (46.4% vs 16.7%;  $p = 0.03$ ). 31 NHS England trusts responded of which 18 use electronic, six usehandwritten and seven accept both handwritten and electronic records. 25 different electronic systems were identified with *Cerner Millennium* being used most often.

**Conclusion:** Compliance with the RCSEng guidelines remains poor warranting further education. Collaboration between software developers and surgeons may improve functionality and uptake of electronic systems. Practice across NHS England is variable with in-house and more widely available electronic systems in use questioning whether an era of homogenising programmes across trusts is the future.

**KEYWORDS:** Operative records; Electronic systems; Handwritten; Rcseng guidelines; Compliance

## INTRODUCTION

In keeping with Good Medical Practice, surgeons amongst other clinicians must keep legible, accurate, comprehensive and contemporaneous records regarding all patient interactions [1]. This includes but is not limited to surgical operation notes. Not only is a clear operative record essential for post-operative management of patients and establishing good communication between the surgical team and other professionals, but also for medico-legal reasons. Nowadays there is a growing emphasis and scrutiny on the detailed and clear documentation of operation notes, and the value of quality operation notes when medical litigation arises cannot be disputed. In fact, poor handwriting not only causes frustration amongst healthcare professionals who take over care of patients and contributes to the high incidence of medical errors in the United Kingdom, but also could contribute to patient discomfort and even patient mortality [2,3]. To aid the consistency, legibility and clarity of the operation notes in order to enable continuity of patients' care and reduce the number of avoidable errors, the Royal College of Surgeons of England (RCSEng) sets clear guidelines on what operation notes should include (Table 1) and advises for the operation notes to be typed [1,4,5]. However, regardless of the clear RCSEng guidelines, compliance has been found to be variable across the United Kingdom, and despite the digital revolution and many available electronic systems in use across the United Kingdom, most operation notes are still handwritten, contributing to bias of illegible handwriting [4,5].

|                                      |   |
|--------------------------------------|---|
| What to include in an operation note | Date and time                                       |
|                                      | Patient identification details                      |
|                                      | Type of surgery (elective/emergency)                |
|                                      | Names of the operating surgeon and assistant        |
|                                      | Names of theatre anaesthetist                       |
|                                      | Operative procedure carried out                     |
|                                      | Incision  |
|                                      | Operative diagnosis and findings                    |
|                                      | Any problems/complications                          |
|                                      | Any extra procedure performed and the reason for it |
|                                      | Details of tissues removed, added or altered        |
|                                      | Details of any prosthesis used                      |
|                                      | Details of closure technique                        |
|                                      | Anticipated blood loss                              |
|                                      | Antibiotic prophylaxis (where applicable)           |
| DVT prophylaxis (where applicable)   |   |
| Detailed postoperative instructions  |   |
| Signature                            |   |

**Table 1:** The Royal College of Surgeons guidelines on what to include in an operation note (where applicable) [1].

The aims of this study were two-fold. Firstly, we compare the clarity of electronic and handwritten notes and ascertain whether recoding operations electronically is as effective at complying with the RCSEng guidelines as handwriting in our centre. Secondly, we review practice across NHS England trusts with regards to use of electronic theatre management systems and the range of systems in use.

## MATERIALS AND METHODS

This prospective study of operation notes across all surgical specialties was carried out at a single centre (King George Hospital, Barking, Havering and Redbridge University Hospital NHS trust). The inclusion criteria were patients who had undergone any surgical operation between 21<sup>st</sup> of August 2019 and 9<sup>th</sup> of September 2019. Data was collected twice daily at 09:00 and 14:00 by a single member of the audit team (AO) during the study period excluding weekends and bank holidays. All operations/procedures that were booked onto the patient manager *Bluesprier* by these times were included in the selection process. For each operating session (am and pm) patients were sequentially numbered and five patients were selected at random using a random number generator. Cases that were cancelled on

the day of the operation were excluded from data analysis with reasons for cancellation justified. Data for each case was collected to include patient hospital number, date of surgery, consultant in charge, type of surgery (emergency/elective), surgical speciality, handwritten or electronic note. For each operation note, documentation data was collected by a single reviewer (AO) and reviewed against the RCSEng guidelines (Table 1). For any operation note where data collection was limited, for example, due to legibility, then a second reviewer (NHB) reviewed the operation note. Any disagreement was settled by a third reviewer (DKP). Each component of the RCSEng guidelines was assigned a score of one point when present, zero when absent and no score when not applicable. Compliance was defined as good if fell between 90% and 100%, fair between 70% and 90% and poor if less than 70%. When comparing whether the use of recording operations through *Bluesprier* was as effective at complying with RCSEng guidelines as handwritten operation notes, test of significance by Fisher's exact test with p value of less than 0.05 as significant was carried out.

To contextualise our own experience we reviewed practice across NHS England trusts. A list of all NHS trusts in England was obtained from the NHS UK website [6] and trusts undertaking emergency or elective surgical care were included. Surgical secretaries and departmental managers of those trusts were contacted by secure NHS email for the distribution of an electronic questionnaire [7] to collect data on type of operation note in use (electronic or handwritten) and name of electronic system if applicable. Incomplete responses were excluded.

## RESULTS

A total of 115 patients were included in the study, of which 15 were excluded due to cancellation of which the most common cause of cancellation was "Did Not Attend" (DNA) (Table 2). Of the 100 included procedures 10 were emergency and/or urgent cases performed in a designated emergency and/or trauma theatre and 90 were performed electively. 34 procedures were completed by General Surgery, 29 by Trauma & Orthopaedics, 36 by Urology and one by Ophthalmology. A total of 22 notes were completed electronically (of which two also had a handwritten note attached) and the remaining 78 notes were completed by hand. 29 of the handwritten and none of the electronic operative notes required second independent review due to illegibility (37.2% vs 0%;  $p = 0.0037$ ). Out of these, 20 were completed by the urologists, two by general surgeons

and seven by trauma and orthopaedic surgeons. Despite second review, some aspects of two of the operation notes completed by the urology team, including recording of any problems/complications and any tissue alteration, remained unclear and unresolved following third review.

| Total search (115)           |   |
|------------------------------|---|
| Included (100)               | Excluded (5)                            |
| General surgery (34)         | DNA (5)                                 |
| Trauma and orthopaedics (29) | Unfit/unsuitable for surgery (4)        |
| Urology (36)                 | Lacked capacity (1)                     |
| Ophthalmology (1)            | Tim pressure (3)                        |
|                              | Patient refused (1)                     |
|                              | Lack of preoperative investigations (1) |

**Table 2:** Sample size. The numerical value in the brackets corresponds to the number of cases. A total of 115 patients were included in the study. 15 patients were subsequently excluded for a number of reasons, including being unsuitable for surgery and DNA. 100 operation notes across a number of specialties were included in the analysis, 10 of which were emergency surgeries and 90 elective procedures.

None of the operation records (0%) met all of the RCSEng guidelines. With reference to *Figure*, areas that were recorded well across both handwritten and electronic notes included the date of operation (100% vs 90.9%) and patient identification details (100% vs 100%). However, despite a good compliance with date recording, only one operation note (electronic) had time of operation recorded. 100% and 95.5% of handwritten and electronic operation notes respectively, had a record of an operating surgeon/assistant. Where applicable, 97.3% of handwritten and 83.3% of electronic notes displayed the name of an anaesthetist. Similarly where applicable, 92.9% of handwritten and 100% of electronic notes had a record of an incision made. Operative diagnosis/findings were described by 92.1% of handwritten and 95.0% of electronic notes. Any changes to the tissues (removal/alteration/addition) were mentioned by 65.4% of handwritten and 77.3% of electronic notes. Where applicable, 89.5% and 100% of handwritten notes had details of prosthesis used. Similarly, 92.7% and 100% of handwritten and electronic notes, respectively, recorded

closure details. Signature of an operating surgeon was present in 96.2% of handwritten and 86.4% of electronic notes. Finally, name of procedure and post-operative instructions were recorded in all handwritten and electronic notes (100% compliance).

Areas that were recorded poorly across both handwritten and electronic notes in addition to the time of operation included presence/absence of operative complications (5.1% and 18.2%, respectively). It should be noted that two out of 78 handwritten notes were unclear in this regard, despite being reviewed by a second independent reviewer. Similarly, the record of an extra procedure performed/not performed was also poor (1.3% of handwritten and 4.5% of electronic notes), with two handwritten notes being unclear. Only 46.4% of handwritten and 16.7% of electronic notes included details of antibiotic prophylaxis if applicable. Type of surgery (emergency or elective), anticipated blood loss and VTE prophylaxis were not recorded in any operative note regardless of whether it was handwritten or electronic.

When comparing compliance at recording certain areas of operation note between handwritten and electronic notes with reference to the expected value of 100% (gold standard as per the RCSEng guidance), electronic recording is better at recording antibiotic prophylaxis only ( $p = 0.03$ ). However, there are no statistically significant differences between handwritten and electronic recording of any other component of an operation note.

A total of 148 NHS England trusts undertaking emergency/elective surgical care were contacted and invited to participate in an electronic questionnaire on type of operation note in use and name of electronic system employed if applicable [7]. Of the 148 trusts contacted 31 provided data on inclusion. Of those, more than 50% use electronic note documentation only (18 trusts), six use handwritten notes only and seven use both handwritten and electronic operation notes. 25 different electronic theatre management systems were identified (Table 3) with *Centre Millennium* being the most commonly used (five trusts), one of which additionally accepts handwritten notes. Similarly, a number of other systems, including *Meditech*, *Medisec Software*, *Lorenzo*, *Evolve* and *Bluesprier*, are employed in some trusts in conjunction with handwritten documentation. Finally, three trusts use a unique electronic system designed locally by the trust itself (Table 3).

| Name of the system in use                           | Number of the trusts |
|---|----------------------|
| Bluesprier  | 1                    |
| Cerner Millennium                                   | 4                    |
| Epic EPR  | 2                    |
| EPR (in-house system)                               | 1                    |
| QuadraMed   | 1                    |
| Patient Electronic Notes System                     | 1                    |
| GSIC (in-house system)                              | 1                    |
| Ormis   | 1                    |
| Lorenzo   | 1                    |
| Solus Electrical Clinical Record                    | 1                    |
| Clinical Web Portal                                 | 1                    |
| Unity   | 1                    |
| Clinical Results Reporting System (in-house system) | 1                    |
| HICCS by Emis Health                                | 1                    |

(A)

| Name of the system in use | Number of the trusts |
|---------------------------|----------------------|
| Meditech                  | 2                    |
| Bluesprier                | 1                    |
| Cerner Millennium         | 1                    |
| Medisec                   | 1                    |
| Lorenzo                   | 1                    |
| Evolve                    | 1                    |

(B)

**Table 3.** A) The range of electronic theatre management systems across the 18 NHS England trusts that use electronic operative recording only. B) The range of electronic system software used by seven trusts, which also accept handwritten notes.

## DISCUSSION

Operation note documentation is important not only for ensuring the best on-going care for patients but also for medico-legal reasons [8,9]. For these to be fulfilled an operation note must be clear, legible, accurate, comprehensive, and preferable typed [1]. This study demonstrates that handwritten operation notes provide an example of where improvements in recording clearly and accurately still need to be made. 37.2% of handwritten notes as compared to 0% of electronic notes were hard to read and required a second independent review, raising similar issues that were highlighted in a number of other studies [10,11].

Similar to our results on clarity, the content of operative records should also be improved. When compared against RCSEng guidelines our centre's data failed to fulfil many of the requirements. Our study revealed that although a number of operation note components show good and fair compliance, both handwritten and electronic notes demonstrated poor compliance in some areas such as time of the operation, antibiotic prophylaxis, any problems/ complications and any extra procedures performed (Table 4). A zero compliance was noted in area of documentation of DVT prophylaxis, anticipated blood loss and type of surgery (elective/emergency). The poor compliance in some areas of information documentation may be attributed to lack of education about the RCSEng guidelines and lack of a standardized operative note proforma with mandatory fields. Our study demonstrated trends favouring

electronic operative records over handwritten with respect to compliance although largely without statistical significance. This may partly be attributed to small numbers of electronic records included but may also indicate the implementation of electronic records are unlikely to fully improve compliance without improved surgical education. Displaying the RCSEng guidelines in theatres, for example, could be a powerful means of providing a visual reference of a gold-standard for surgeons. In addition, there is some evidence that a procedure-specific proforma could improve compliance with the RCSEng guidelines [12]. However, there are some limitations in the use of a template, such as hesitation to change existing practice and potential for an operation note recording to become a tick box exercise, especially if areas using drop-down selections have been created.

| Areas of Good Compliance                     | Areas of Fair Compliance       | Areas of Poor Compliance                            |
|--|--------------------------------|---|
| Date   | Details of any prosthesis used | DVT prophylaxis                                     |
| Patient identification details               |                                | Antibiotic prophylaxis                              |
| Names of the operating surgeon and assistant |                                | Anticipated blood loss                              |
| Name of the theatre anaesthetist             |                                | Details of tissues removed, added or altered        |
| Operative procedure carried out              |                                | Any extra procedure performed and the reason for it |
| Incision                                     |                                | Any problems/complications                          |
| Operative diagnosis and findings             |                                | Type of surgery                                     |
| Details of closure technique                 |                                | Time  |
| Detailed postoperative care instructions     |                                |   |
| Signature                                    |                                |   |

## (A)

| Areas of Good Compliance                     | Areas of Fair Compliance                     | Areas of Poor Compliance                            |
|--|--|---|
| Date   | Signature                                    | DVT prophylaxis                                     |
| Patient identification details               | Name of the theatre anaesthetist             | Antibiotic prophylaxis                              |
| Names of the operating surgeon and assistant | Details of tissues removed, added or altered | Anticipated blood loss                              |
| Details of any prosthesis used               |  | Any extra procedure performed and the reason for it |
| Operative procedure carried out              |  | Any problems/complications                          |
| Incision                                     |  | Type of surgery                                     |
| Operative diagnosis and findings             |  | Time  |
| Details of closure technique                 |  |   |
| Detailed postoperative care instructions     |  |   |

## (B)

**Table 4:** A) Handwritten operation note components that show good, fair and poor compliance to the RCSEng guidelines. B) Electronic operation note components that show good, fair and poor compliance to the RCSEng guidelines.

Modernisation of surgical records has been an on-going process, starting with Cambridge University Hospital Trust becoming the first NHS England trust to become entirely paperless in 2014 [13]. However, despite recognition that healthcare information technology plays a significant role in clinical efficiency and care improvement the majority of the NHS England trusts are yet to become fully digitalised [14,15]. Our study showed that only 18 of the NHS England trusts that completed the questionnaire on the type of operation note recording rely completely on an electronic system to record operation notes. Our results also highlighted a widerange of electronic theatre management software across 31 NHS England trusts, which use 25 different software programmes, three of which have been designed locally by the trust itself. This heterogeneity in the nature of software used highlights individuality and potentially unique needs of each trust, makes it a challenge for staff to become familiar with new IT systems when rotating, costs trusts time and money to train to use their IT system, and becomes a barrier when transferring information across to different sites.

The heterogeneity in the use of the same electronic system has also been demonstrated by our study. Some trusts that use the same electronic system are electronic only, whereas others use both the electronic system and handwritten notes, once again highlighting differences in local practice. Our institution was amongst the NHS England trusts that integrates both electronic and handwritten records. For example, although visual aids, such as diagrams, are not part of operation note documentation completeness, a large proportion of both handwritten and electronic notes (41.0% and 40.9%, respectively) included a handwritten diagram of an incision or operative findings. Although an option of cutting and pasting using other graphics software is open for clinicians, currently there is no flexibility in being able to have drawing templates of professional anatomical images pasted onto electronic operation notes in some software, including *Bluespier*, highlighting the need for further developments in the functionality of the existing electronic platforms. For example, creating anatomical drawing templates that could then be pasted on the operation note could make an electronic system more user-friendly and thus increase its uptake and therefore improve the quality and effectiveness of patient care. Regardless of what improvements are proposed, implementing any changes in the functionality of the electronic software should be a collaborative process between the developers

and the users if our aim is to gain surgeon acceptance of electronic based systems favoured by the RCSEng.

## CONCLUSIONS

Compliance with RCSEng guidelines remains poor with minimal uptake of electronic systems in our centre despite its availability warranting further education of the guidelines and improvements in the functionality of the existing electronic systems. Collaboration between software developers and surgeons may make electronic programmes more user-friendly and thus increase their uptake. Such a wide range of electronic software used across NHS England trusts to create operation notes and their interoperability questions whether an era of homogenising IT programmes across trusts is the future. New approach away from every trust having their own architecture and closed-off systems could reduce the cost of staff training and ease the information flow between trusts, although raising uncertainties regarding NHS safety and vulnerability to cyber crime.

## LIMITATIONS

Small data set of the study, while being an obvious limitation for statistical purposes, did not prevent us from demonstrating a point of the minimal uptake of electronic operative recording at King George Hospital. Despite receiving a small number of responses from the NHS England trusts, we highlighted the heterogeneity of electronic software used. Finally, legibility is subjective and difficult to define, however the impact of this bias could have been reduced by increasing the number of reviewers.

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There are no financial or personal conflicts of interests to declare.

## CONTRIBUTORS

Otamias A (BSc (Hons), MbCHB) and Bedwani NH (MA cantab, MB BChir, MRCS (Eng) contributed equally to data collection, analysis and interpretation, and writing of the article. Ogedegbe AJ (MD, MB BS, FRCS (Gen), FRCS (ed) contributed to the critical appraisal of the article. Patten DK

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