Toward the paperless hospital?


Summary
This report describes an ethnographic study of document use by anaesthetists. In doing so, it focuses on the role of the preoperative risk assessment form as used in anaesthetic practice at a cardiothoracic hospital, and considers what would be the advantages and disadvantages of shifting the paper into the electronic form. Evidence from this case study is used to comment on how the practical use of documents by medical professionals can be fundamentally at odds with how the organization at large would like to use them. We argue that hospital trusts need to take into account this practical perspective in order to build effective, on-line document systems. (Br. J. Anaesth. 1997; 78: 762–767).

Key words

Hospitals, in common with most other organizations, depend on a wide range of documents for the day-to-day accomplishment of work. These documents take on a myriad of formats, both paper-based and computer-based. With advances in digital technologies, there are many pressures to do away with what is often perceived to be the unnecessary clutter and cost of paper documents. There is a common perception that improved efficiency and productivity can be gained by transferring information “on-line” to take advantage of computer-based tools.

We report on a study of anaesthetic practice, the purpose of which was to understand the practical aspects of document use in a medical organization, and the implications of paper documents moving “on-line”. The method reported is based on “sociological ethnography”, a branch of sociology which developed from a social anthropological tradition that involved “ethnographers” spending long periods of time closely observing small scale societies. This approach has been developed for the observation of social behaviour within any and all institutions. It involves observation of work and activities in their “natural” setting, in addition to extensive interviewing. As such, it offers an “outsider’s” perspective on anaesthetic practice and document use.1

For this case study, we chose to focus on anaesthetists because the research team already had some background knowledge and experience in studying anaesthetic practice.2–4 The hospital which we selected for the study is a cardiothoracic hospital where there is a desire to take advantage of new technology in developing its document practices.

While we considered all of the key documents that anaesthetists in this hospital use, we were concerned mainly with the preoperative risk assessment (PRA) form which was designed within the study hospital. Although not every hospital trust uses such a form or even ones that are similar, we focused on this form because it contains the most extensive set of anaesthetic relevant data and, as such, is seen as potentially a useful resource for organizational purposes such as auditing and assessing preoperative risk. Indeed, one of the general purposes of the PRA form when it was first introduced was that it would contain data which would be useful for audit purposes and risk stratification. The information contained in the forms could then be used to calculate various statistical scores, such as UK ACTA (UK Association of Cardiothoracic Anaesthetists) and Parsonnet.5

However, this hospital has experienced two major obstacles to using the data in this way. First, the PRA forms tend to be filled out inadequately, making analysis difficult. Second, the data are in paper form and therefore need to be entered manually into the electronic system. Currently, the paper forms are sent to a central store in theatre reception so that the data can be entered later into a computer. However, for the most part, the paper remains in store and no major effort, to date, has been made to use the data.

The PRA form therefore represents an interesting case of a document which, while now well established in use in this particular hospital, is seen to fall short in terms of serving its original purposes. As it happened, it was also a particularly opportune time to conduct the study as a new electronic alternative to the paper PRA form was about to be introduced.

Although this is a study of the use of one particular type of form in one hospital, we believe that findings from this study can be applied to medical document systems at large. The case of the PRA form illustrates how the practical use of documents...
by medical practitioners can sometimes be fundamentally at odds with organizational aims and purposes. We discuss the reasons why, and argue that these practical issues need to be taken into account in order for medical document systems to effectively move forward.

**Methods**

There are a variety of ways that document-related activities can be investigated. For example, one standard procedure is to conduct a time and motion study of document use. However, this type of technique overlooks the motivations that underlie people’s activities, and the particular perspective that professionals take toward their work. One technique that can capture these concerns is sociological ethnography. This approach involves close observation of work as it occurs in situ and extensive open-ended interviews.

In this study, the ethnographic approach was used to understand the ways in which anaesthetists responded to the particular circumstances in which they found themselves, and the practical concerns that they brought to their work. Throughout, the focus was on how documents—and the PRA form in particular—played a role in this work. The study took place over a period of 5 days. Specifically, this ethnographic approach involved:

1. Observing anaesthetists at all stages of their work, from patient interviews to the operating theatre to the recovery unit.
2. Examining what was done with the PRA form during its entire life cycle. This began at the point where anaesthetists were observed going through patients’ files at the ward reception, and ended with observing their postoperative use.
3. Undertaking interviews with trainees and consultants about their work. When possible, these interviews focused on particular examples of PRA forms which were in the process of being completed.

These activities generated a detailed picture of the work in question, and in particular the practical, “real world” orientation of anaesthetists.

**Results**

The ethnography found that, from the anaesthetist’s perspective, the PRA form had a significant role within two main stages of the work: during the interview with the patient and in the anaesthetic room. The patient interview stage, normally undertaken on the day before an operation, can be characterized as an information gathering stage with the PRA form serving as an information repository. Most of the information to be entered on the form is pre-specified, but some is also added in the form of free-hand notes. While information is also obtained from the patient’s notes at this stage, much of it can be gathered only from the patient during the interview (for example NYHA status, dentition and drug allergies).

In its role as an information repository, the PRA form serves three main purposes. The first is to enable the anaesthetist to think about and plan the anaesthetic during the operation on the following day. The second is to enable the anaesthetist to write notes to serve as reminders during the impending operation. (Such reminders are especially important given that anaesthetists may manage several anaesthetics during a list.) The third purpose is to enable the “handing over” of an operation to another anaesthetist should the need arise. Because of the volumes of work and the fact that the workload cannot always be predicted, it is not always possible to ensure that the person who interviews a patient is also the one managing the operation.

During the second phase—in the anaesthetic room—the PRA form is used mainly as a reference source before induction of anaesthesia. It is here that free-hand, written reminders can be critical to the smooth management of the anaesthetic, and it is here that a colleague’s notes taken during the patient interview serve their purpose.

For the anaesthetist, when anaesthesia is induced, the PRA form remains available but has effectively come to the end of its useful life. In terms of documents in the operating theatre, the anaesthetist turns his or her attention primarily to completing the anaesthetic record. It is unlikely that the anaesthetist will look at the PRA form again, although sometimes the surgeons or other operating theatre staff may do so.

This description helps to make clear the practical role of the PRA form. For these anaesthetists, the PRA form serves as a unitary repository of information and reference tool. As such, our observations confirmed that this paper document is not only adequate, but is a useful practical tool in facilitating anaesthetic work.

However, our observations also confirmed that, for organizational purposes (i.e. data for computing UK ACTA scores or for carrying out organizational audits), there are two ways in which the forms are inadequate or problematic: the data on the forms are incomplete and there are difficulties in transforming the paper-based data into electronic data.

**PROBLEM OF INCOMPLETE DATA**

If the information on the PRA form is examined in detail, it is apparent that there are almost always missing data. Indeed, of the 517 PRA forms we had at our disposal, none contained complete information. We also found that most consultants never filled out a PRA form. Of the three consultants we observed that did so, two filled out only 10 of the 517 forms. We learned that most consultants prefer to delegate this job to trainee staff. Consultants still use the forms to manage operations, but they use their junior colleagues’ PRA forms. A by-product of this is that the consultants’ practice is in part undocumented and it is only the trainees whose assessments are recorded.

We believe that the salient issue here is not who fills out the form but the relationship between documents and how they are used. Why are the data so incomplete? One reason often cited by hospital trust managers, systems designers and other commentators on hospital life is that anaesthetists (in
common with any group of professionals) are simply unwilling to fill out forms correctly. We believe, however, that this is to misunderstand the issues. On closer inspection of the PRA forms and the associated work practices, there are at least two good reasons why PRA forms show absence of information. The first is related to the fact that anaesthetists adapt the PRA form in such a way as to transform a form designed for general purposes into one that is useful for specific purposes. In other words, anaesthetists treat the PRA form as a device that enables them to gather information that they need for that particular operation, and not as a device for the gathering of information for generalized use—whether it be for post hoc analysis or administrative audit. By way of example, a copy of a real form is shown in figure 1, altered only in order to disguise the identities of the patient and anaesthetist. Most of the fields in the section labelled Diagnosis, are blank; all the fields under the section Results from Notes have not been completed.

The reason for the lack of data is the fact that in this case, for this operation and for this patient, the information requested in those sections was not as relevant. This patient was about to have an operation on an incisional hernia. Previous cardiac surgery had provided symptomatic benefit and there had been no subsequent cardiac catheterization. For these reasons, the anaesthetist made the judgement that, from his point of view, it was not worth the effort of entering the information on the form. This does not mean that the form was of no use. This example shows that what is omitted may be as informative as what is completed. In this example, the anaesthetist has written in the operation being undertaken. Concerns which were relevant for this operation were then remarked upon, in this case in the section marked Specific Patient Queries. Therefore, questions on allergies, history of hypertension, and so on, were answered. Thus, if another anaesthetist needed to refer to this form, they would be able to know the areas of concern by seeing what operation was scheduled. In this respect, the form is filled out correctly, that is providing information that anaesthetists need in the course of their work.

One could argue that the form in figure 1 is simply inappropriate for this particular operation, or that this is an exceptional case. However, we found that this case exemplifies, although perhaps exaggerates, how all PRA forms are used.

The second, perhaps more mundane, reason for incomplete data is that, in some situations, the information anaesthetists require is not available. Patients’ notes are often so extensive that it makes information difficult, if not impossible, to find. Different wards often have their own ways of...
organizing a patient’s file and the patient’s previous hospital may have different standards of record keeping. This too can make it difficult to find facts. Often the cost in time and effort of prolonged searches for information may not justify the small benefits to be obtained from certain types of information (e.g. height).

Further, some information, although ideally important for the anaesthetists, may not be available when the form is filled out. An example of this type of information is blood test data: haemoglobin counts are very useful to anaesthetists but may not be available when they undertake the patient interview.

Taken as a whole, these considerations could indicate that there are good reasons for PRA forms to be somewhat bad clinical records—bad in the sense that they are never filled out completely (cf. quality of records in mental health agencies). However, to think of them in this way is to ignore the fact that these forms are useful for anaesthetists in that they record local knowledge and needs, and reflect the requirements of each particular case.

USE OF PAPER

The second major obstacle to organizational use is that the PRA data are paper-based and need to be entered manually into the computer system. Our observations confirmed that, in the face of many other more pressing demands, the rather tedious job of entering this information into the system was not a high priority. Consequently the data were not transferred.

What might be the impact of replacing the paper PRA system with a computer-based PRA system? In order to assess this, we first need to consider in more detail the ways in which the paper form serves important functions in the various phases of anaesthetists’ work. There were three main advantages to the use of paper that we observed.

(1) Flexibility of paper

We have already seen that the task of filling out the PRA form through consultation of patients’ notes may result in omitting information either because it is not always important to a specific case or because it is not always available. Because it is a paper form, this allows a flexibility of completeness whereby only the relevant information for that particular patient is recorded. Free text annotation is also easy with paper and thus short explanatory notes and reminders can be added to the form. This type of information cannot be expressed easily within the constraints of a structured on-line form. The paper form is thus highly flexible.

(2) Non-disruptive nature of paper

Related to the flexibility issue is the fact that paper is a medium that supports non-intrusive ways of taking notes during a patient interview because it can be marked directly in a relatively unconstrained way (cf. the process of general practitioner–patient interviews). Thus note taking can be interwoven easily with the ongoing discussion. This is important because the patient interview is not simply about obtaining information from the patient. It can often be a delicate social activity which is there to help make the patient feel more comfortable about the nature of the operation and to personalize the situation for both the patient and anaesthetist. At present, paper supports this process because it allows attention to be devoted to the management of the interview.

(3) Portability of paper

A third set of issues relates to the fact that paper is portable and that its contents are quickly accessible. These properties are important in all stages of the life of the PRA form. It is important during preparation of the PRA form in conjunction with the patient’s notes because it is sometimes the case that the forms are filled out away from the busy ward rooms. At the bedside, the portability and accessibility of the paper PRA form is important in supporting the patient interview process. With paper, anaesthetists can make use of a clipboard resting on their knees. Portability is also beneficial between operations: sometimes the anaesthetist may consult the PRA form while moving between different operating theatres in preparation for a new patient.

Discussion

IMPLICATIONS FOR MOVING ON-LINE

From this case study, we have seen that the PRA form is an example of a medical document which is tailored in accordance with the practical realities and idiosyncrasies of each case. As a result, this often implies that data are missing and forms are incomplete. We have also discussed the ways in which the fact that the paper PRA is flexible, non-disruptive and portable can make it a very useful device in support of the work practices of medical professionals. Both facts militate against efforts to aggregate the data on-line and use it for statistical analysis.

Yet there are many potential benefits to moving to an electronic PRA system. As we have already discussed, from the Trust’s point of view, there are the benefits of the reduced cost of storage space, and of using a format that allows aggregation of data and on-line analysis. With regard to the problem of incompleteness, a technological alternative could force anaesthetists to be more complete by requiring them to fill out every field, and by preventing them from bypassing fields until data are entered.

This is not to say that electronic document systems need necessarily always work to the benefit of Hospital Trusts and to the detriment of medical professionals. Electronic access to data may be very advantageous to practitioners in the course of preparing and referring to a medical form. It may help to eliminate much of the redundant form-filling activity that currently occurs with paper forms by linking to a centralized data store. It may solve problems of accessing and retrieving data that are
otherwise difficult to find among paper notes, or which are generated by different departments or hospitals. It can help in ensuring that data are as up-to-date as possible. It could also provide remote access to information. At the present time, some consultants obtain information read to them over the phone by trainees. The introduction of digital technologies could offer networked access to the forms. This would have at least two advantages: first, it would release trainees from making phone calls to their superiors; second, it would allow consultants to access information when and where they need it (e.g. from home or from another hospital).

However, designing such systems is challenging. We have discussed the importance of the flexibility, markability, portability and accessibility of the paper PRA form. Most current electronic document systems tend to provide more structured and constrained interfaces, require indirect forms of input via keyboards, are relatively immobile and are cumbersome to navigate. Added to this are problems of screen size, viewing angle and the ability to share multiple documents concurrently by people in the same room.

The new electronic system now in place in the hospital we studied suffers from many of these problems. Perhaps unsurprisingly, therefore, the paper PRA form continues to be used throughout its "natural life cycle" from the ward room to the operating theatre for all the reasons that we have outlined. Anaesthetists then enter the data from the paper PRA forms into the new electronic system, usually during the course of an operation. This means that the paper PRA form continues to be the useful artefact for the anaesthetist. Entering the information electronically simply resuscitates the document after its "organizational death". The new system therefore does not directly support the day-to-day activities of the anaesthetists, but is an additional activity that is required purely for purposes outside the local concerns of the practitioner. The success of the system therefore relies primarily on a "moral obligation" on the part of the anaesthetists to complete the form, rather than on good clinical reasons to do so.

The question, then, is whether one can devise electronic document systems that concurrently serve the purposes of both the medical practitioner and the organization at large. Such a technology would have to be suited for all stages of the life cycle of the PRA form. For the first stage, the patient interview, the device would have to allow ease of navigation, incompleteness of data entry and free text entry. One way of providing these features is to offer a relatively unconstrained interface; another is to allow more direct input via electronic stylus devices, for example.

The electronic alternative to the paper PRA form must also have the flexibility to be used not just at the bedside, but in the ward rooms, in the anaesthetic room, in the operating theatre or even moving between theatres. It must not be affected by the constraints imposed by these environments. For example, at the patient’s bedside there are no desks or supporting surfaces. This may make even lightweight portable computers cumbersome to use. Other considerations include poor lighting conditions, which suggests the need for good displays which are legible at a range viewing angles.

Finally, in the anaesthetic room and the operating theatre the technology must not hinder staff accessing various documents concurrently. Therefore, a technological solution which provides only one display screen for access to the PRA form and other documents may be problematic (although this could be managed by users “taking turns” for screen access).

For all of these reasons, we believe an effective technological alternative to the paper-based PRA form requires careful design and iterative testing in a real work setting. These requirements also suggest that the best design options will rely on new technologies that are currently still in their developmental infancy (e.g. portable, wireless computing, pen input and lightweight, high resolution screen technologies). In the meantime, an alternative approach is to accept the fact that paper is a tool that is extremely useful for some types of medical documentation including the PRA form, at least in the foreseeable future. This approach involves: (1) distinguishing between those types of medical documents which are best kept as paper and those which are best transferred to the digital realm; (2) concentrating on technologies which bridge the paper and electronic world, such as scanners; and (3) investigating and developing further those technologies and techniques that bring further “intelligence” to these scanning technologies through the use of such procedures as bar coding to facilitate document identification and tracking.

With regard to (2) and (3), this implies viewing such technologies not simply as a way of dealing with the legacy of paper, but rather as a way of supporting an ongoing mix of paper and electronic media.

Any of the above approaches requires a comprehensive understanding of the work practices of medical professionals in relation to the documents they use. In particular, they require an understanding of how practical requirements of medical practice can lead to the use of documentation that is not ideally suited for generalized consumption and use. Changes can be brought about in these practices with the introduction of new technologies, but must not be at the expense of the requirements of clinical professionals. In this article, we hope to have demonstrated one approach which is capable of uncovering what those practical concerns may be, and their implications for the design of new document technologies. Further use of this approach will, we suggest, lead to decisions about investment in electronic or in mixed paper and electronic document systems that are based on more accurate appraisals of the balance between the local, practical needs of medical professionals and those generalized needs of NHS Trusts as a whole.

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References