**COVER PAGE**

**Title**

How to implement live video recording in the clinical environment: a practical guide for clinical services

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**DISCOLSURES**

**ABSTRACT**

The use of video in healthcare is becoming more common, particularly in simulation and educational settings. However, video recording live episodes of clinical care is far less routine. This is, in part, due to clinicians being faced with considerable ethical, legal and data protection challenges which are the primary barriers for services who pursue video recording of patient care. Existing accounts of video use rarely acknowledge the organisational and cultural dimensions that are key to the success of establishing a video system. Here, we address these issues and, using Kotter's 8-step process for leading change, provide a 'How to' guide to navigate the challenges required to implement a continuous video-audit system based on our experience of video recording in our emergency department resuscitation rooms. Using Kotter's structure emphasises the fact that the most significant hurdles in installing continuous video audit in a busy clinical area involve change management rather than equipment. By focussing on issues such as staff acceptability, departmental culture and organisational readiness, we aim to provide a roadmap that can be pragmatically adapted by all clinical environments, locally and internationally, that seek to utilise video recording as an approach to improving clinical care.

**BACKGROUND**

Being able to measure the diverse factors that effect quality of care is the starting point for improving clinical practice [1]. Traditional approaches predominantly rely on service level metrics or surrogate markers of quality, yet these are often insensitive to the subtleties of clinical care and the complexity of interactions between staff and their environment.

The Emergency Department (ED) epitomises the dynamism of clinical care. Similar to other clinical environments, there is considerable variation in ED care. For example, in Scotland, only 43% of patients with a stroke are thrombolysed within the recommended time window [2], and less than 40% of major trauma patients with a severe head injury receive a computed tomography (CT) scan within the one hour national target [3]. Furthermore, 38% of major trauma patients do not receive the recommended Consultant lead care on initial assessment [3], whilst patients with severe sepsis and septic shock receive inconsistent care [4]. The particular characteristics of a clinical service and its processes of delivering care can have a significant effect on clinical outcomes [5, 6].

In this article, based on our experience of continuous video-audit within the ED Resuscitation Room, we describe the implementation of a system to overcome the challenges of measuring clinical care processes. In doing so, we provide a 'how to' guide for clinicians and services who wish to pursue video audit.

**INTRODUCTION**

The first recorded use of video by physicians can be traced back as far as 1947 [7]. however it was not until the late 1960s that Peltier et al. described the use of video as an educational tool in emergency medicine [8]. Since then many authors have used video as a method of assessing clinical care in diverse settings, such as psychiatry [9], general family practice [10] and surgery [11]. In the emergency medicine speciality, it has been used to audit resuscitation [12-15], including neonatal [16, 17], paediatric [18, 19] and trauma resuscitation [20, 21].

These studies continually highlight the clear educational and clinical benefits of such systems. They predominantly report the degree to which their clinical practice rates have improved,

but there is often little-to-no explanation of system set-up [22]. In particular, studies rarely acknowledge the ethical, legal and cultural hurdles which are the main barriers to implementation. In a cross-sectional survey of 221 trauma centres in the USA, for example, Ellis et al. found that although 95% of centres who used video found it to be an effective quality improvement tool, 80% of centres were not videotaping [23]. Problems cited as preventing video audit included medico-legal, patient confidentiality, and lack of staff support for such a program.

Here, we address this gap in the literature. We do not intend to focus this article on our local practice outcomes as this would be repeating extant literature and provide the reader with little actionable information. Rather, by outlining the approach we used to navigate the technical and change-management challenges required to implement a video-audit system in our ED, we seek to provide a 'how to' guide that can be pragmatically adapted by other clinical services.

**SITE**

The ED at the Royal Infirmary of Edinburgh in Scotland serves a population of approximately 800,000. The hospital is a large 900-bed site with academic affiliation. In 2012 there were 113,000 adult patient attendances, with a majors:minors ratio of approximately 1:1. There are roughly 350 out-of-hospital cardiac arrest cases and 700 trauma cases annually, with approximately 6-7% of patients requiring immediate assessment in the Resuscitation Rooms after pre-alert by the Scottish Ambulance Service.

**'HOW TO' SET-UP VIDEO AUDIT: A FRAMEWORK**

Soon after Peltier set up a video system to teach emergency medicine in 1969 he described the issues associated with its implementation: *"What is the legal status of the videotapes?... do they become part of the patient record? Can they be used in the courtroom…Can such television videotapes be used legitimately to evaluate the performance of emergency room personnel for the purposes of promotion of dismissal?"* (p 823) [24]. Although written nearly 50 years ago, these reflections illustrate that although installing a video recording system has become technically straightforward, it's use raises important ethical, legal and personnel issues.

Accordingly, we have described our process of introducing a continuous Resuscitation Room video audit system using John Kotter's 8-step template for leading change [25]. Using Kotter's structure emphasises the fact that the most significant challenges in installing video audit in a busy clinical area involve change management rather than equipment; the success of introducing video audit depends on influencing local culture and nuancing the initiative to resonate with local clinical needs. As has been demonstrated in other initiatives involving change management, ignoring these organisational and cultural dimensions will likely lead to stalled progression [26].

**step 1. create a sense of urgency**

Before embarking on video recording in the clinical environment, it is incumbent those involved to consider the reasons why video audit is necessary. The novelty of video recording real patient episodes is appealing for clinicians who seek to improve patient care, but staff at all levels of the organisation will ask whether video audit is needed, especially when most clinical services measure care processes through a range of performance and patient indices already. Our emergency department setting, akin to other acute specialities, has to deal with complexity that spans disease, patient, staff and organisational factors [27]. In keeping with high-reliability organisations, we viewed video audit as a way of understanding this complexity rather than oversimplifying these factors [28]. Video audit offers a unique window into how service processes unfold, as well as giving insight into the behavioural aspects of clinical care that underpin team performance.

When hearing about the possibility of continuous video recording taking place, it is understandable that some staff will have a visceral reaction of unease. Addressing this was arguably the most important step in the process of implementation. This involved fundamentally shifting the tone of video-audit discussions from one of hesitation to one of opportunity – video can *"help drive quality improvement to the next level"* (p 1592) [29]. Clinicians and managers need to hear that video offers a level of analytical detail that is unmatched through traditional observational methods [30, 31]. Video-based studies have demonstrated that routine audit measures, by comparison, only capture about 10-20% of performance deficiencies [18, 32].

A clear argument should be articulated consistently, from early discussions right through to system implementation. Kotter suggests that for change to be successful, 75% of an organisation needs to buy into any proposed change. In other words, you have to work really hard on Step 1, and spend significant time and energy building urgency, before moving onto the next steps. In clinical settings, it is equally important to build a sense of safety. Whilst we were able to capture imaginations by enthusiastically articulating the benefits of continuous video audit, we also needed to allay fears by being clear about the proposed 'rules of engagement' – being explicit about exactly what video would be used for (see Step 3 below).

**step 2. build a guiding coalition**

Creating a sense of urgency allowed supporters and early adopters from within the organisation who were receptive to the 'big opportunity' to come forward. As more discussions were had, more people engaged with the conversation around video-audit. This took several months, however at the end of this process we were in a position to build what Kotter describes as a 'Guiding Coalition'. A guiding coalition including a range of expertise, status and organisational influence is essential to institute the attitudes and practices necessary to launch and, most importantly, to sustain change.

Our initial Coalition included individuals from within the ED – the Clinical Director, Clinical Nurse Manager and senior clinical staff. Of equal importance, however, was the need to reach out to other divisions and levels of the organisation. During our implementation, we found that multi-level engagement with the hospital's clinical management team as well as the Medical Director allowed us to canvas the views of staff from the bedside to executive level. The ED Resuscitation Room is not only the domain of ED staff, but is also frequented by a range of clinicians from acute specialties. These non-ED clinicians would also be a part of our continuous video audit. Expanding our guiding coalition to include personnel from outwith the immediacy of ED allowed the message of change to diffuse throughout the organisation as a whole.

**step 3. form a strategic vision**

Before outlining what this involves, it is important to recognise that the previous steps required continual attention and re-evaluation. No matter how powerfully the strategic vision

is set out, should the message behind the big opportunity be lost, the project will inevitably lose traction. A strategic vision goes beyond simply installing a video audit system. The work that goes into – and results from – video implementation is achieved through a series of interconnected value adding frontline clinical processes; the vision is to make those processes visible to all staff and then empower them to make change.

There are several pillars that are foundational to the strategic vision of our video-audit system. These centre around practical questions such as: what is the purpose of the video-audit system; how will the video be used; who will have access to the footage; what governance measures are in place; what data management system is in place; what about patient privacy and confidentiality; will individual performance be assessed. These questions should be answerable in a clear and consistent manner. There is an imperative to be honest about the challenges that exist, but also to create a sense of trust that the system is intended to improve patient outcomes and benefit staff.

At this stage it was necessary to formalise the strategic vision, including addressing the questions above. Our approach involved production of several key documents:

*1- Video Audit Framework.* This is considered the master document which detailed our approach to many of the key issues associated with video audit. Our document had several distinct sections. The main section describes the allowed uses of the video. Our system is designed solely for audit and service evaluation purposes. It does not form part of the patient record and it is never used for individual assessment or feedback; this is a strictly non-punitive system. Similarly, it is never used for teaching purposes or Morbidity and Mortality meetings. Furthermore, the video footage can only be viewed by a member of the department's Video Audit Team (VAT) who are a small group of ED staff (4-6 people). It is allowable for an individual member of staff to request to review video of an episode they were directly involved in. In this case, a member of the VAT who has training in video debrief facilitates the viewing. Video review is used for auditing technical and non-technical aspects of care as well as ergonomic evaluations of the room and equipment. Output from video-audit is fed back at a service level.

The second section of the Framework documents the chain of accountability and what to do should there be a cause for concern while reviewing a section of video footage. The VAT

report to a Departmental Oversight Team which includes senior clinical and managerial staff as well as the Medical Director of the hospital. From here, regular reports of activity are provided to the hospital's Clinical Management Group. This group contains the heads of nursing and medical directorates as well as the clinical leads from all hospital divisions. Furthermore, within this section of the *Video Audit Framework* we have an explicit escalation policy. Should any member of the VAT witness behaviour on the video that is a cause for concern, for example professional misconduct or criminal activity, then they report this through an escalation policy. This is reviewed by the Departmental Oversight Team in the first instance and the Clinical Management Group should the situation require.

*2- Data Management Framework*. This document outlines how the video will be collected, stored and accessed. We used a fixed camera installation from Scotia UK PLC called smots™ (Figure 1). This combination of cameras and microphones allows continuous 24-hour audio-visual recording of our 4 resuscitation bays, as well as the screen display from our vital signs monitors (Figure 2). Video data is sent is sent to a secure server behind 2 card-entry door systems within the ED. An automatic 7-day deletion loop is set on this server, meaning that the vast majority of footage is never viewed. Members of the VAT consult a prospectively maintained log of patients treated in the Resuscitation Room, identifying cases fulfilling audit criteria. These files are transferred through a secure, offline network connection to a video viewing room which is locked at all times – key access is controlled using a delegation log. We created a separate LAN within our hospital building between the ED and viewing room to ensure data security. Once within the video viewing room, footage comes under an automatic deletion policy of 180 days to allow time for video analysis within smots™ which allows footage to be studied and tagged with metadata. Standard Operating Procedures govern the workflow for the collection and analysis of video and create an audit trail of what resuscitation episodes were being viewed and for what purposes. Summary information is reported back to the Departmental Oversight Team.

*3- Audit programme.* Decisions about what to audit and who should be involved in video review are taken by the Departmental Oversight Team. We wished to ensure that process of selection of audit projects is transparent and reflects the needs and concerns of all of the groups working in the Resuscitation Room. The Departmental Oversight Team are also appraised of audit findings and provide a conduit for positive feedback to staff, and ensuring

that training needs and process refinements are fed into the educational and operational activity planning of the ED.

**step 4. enlist a volunteer army**

The ability to enlist a volunteer army will be dependent on how successful a sense of urgency has been created, how well constructed the guiding coalition is and how clearly the strategic vision has been communicated. The volunteer army needs to come from within the clinical department's own ranks, including doctors, nurses, clinical support workers, porters, radiographers and visiting specialities; the staff must feel this initiative is happening 'with them' rather than 'to them'. The concerns of staff will have been verbalised by this point and these should be addressed in the strategic vision. Failure to acknowledge the broad range of people's apprehensions will lead to pockets of negativity which can permeate throughout the department and the hospital more widely.

Our approach was to engage with staff in a variety of locations and formats. We presented the initiative to all medical and nursing staff at clinical handovers. This took approximately one month to ensure we covered the full staffing rota. Other groups of ED staff including Radiographers and Porters were visited opportunistically by the project team or by requesting an audience at their team meetings. Following this, a series of open 'drop-in' sessions were advertised throughout the hospital, where staff could come to the ED and ask about the proposed system in more detail. Providing this opportunity was a vital part of wider hospital staff engagement. We recognised that staff may feel hesitant about voicing their anxieties in the open forum of clinical handovers. Offering this type of session gave the opportunity for individuals to address their specific concerns in a one-to-one capacity.

The final strand of staff engagement involved speaking with groups who are not permanently based in the ED, but who will be observed on the video-audit system nevertheless. This includes visiting specialities (e.g. Anaesthetics, Critical Care, Surgery, Cardiology). Importantly, staff partnership representatives were included in these conversations from the outset. Transparency in these interactions was important in building safety into communication with staff. Enlisting this volunteer army took a considerable amount of time. However, ensuring that this group was large and diverse helped the initiative succeed.

**step 5. enable action by removing barriers**

According to Kotter [33], leading change is *"less about finding or generating brand-new good ideas than about knocking down the barriers to making those ideas a reality"* (p 97). Embedding video cameras in the Resuscitation Room has, broadly, two categories of obstacles. Thus far we discussed the first category - the change management hurdles - in detail. The second category are procedural hurdles, such as the ethical, legal and data protection approvals that are needed to implement video-audit. By thoroughly addressing steps 1, 2, 3 and 4, these procedural challenges were far easier to overcome. At this stage we had the support and backing of the guiding coalition and a growing acceptance from our volunteer army. A sense of urgency and a powerful strategic vision were beginning to transform general concerns into excitement about the clinical impact of video data. This created a sense of readiness within the organisation.

The momentum gathered up to this point was harnessed when seeking ethical, legal and data protection approvals. The purpose and vision of the initiative, as well as its robust security, was communicated as clearly to the approval groups as it was to the staff. Opinions and written permissions were sought and received from the local Caldicott Guardian and Data Protection Officer. Their input helped to further shape our Framework documents. Our Research Ethics service was consulted to ensure that our planned audit and service improvement projects would not require further ethical review or that patients and staff would not need to give consent to video being utilised in this way. We posted signage around the ED to explain to all visitors that video footage recorded in the Resuscitation Rooms would be used for audit purposes. The Central Legal Office – the in house solicitors to the Scottish Public Sector – were also contacted for advice. They were satisfied that in the unlikely event of Resuscitation Room video footage being requisitioned by the courts, it would be likely to aid timely settlement or, in fact, admonition where appropriate.

**step 6. generate short term wins**

Completing the steps up until this point should enable a clinical service to implement video-audit. This will be a notable achievement for any clinical department and it may be tempting to rest on the laurels of success. Yet this phase is arguably the most fertile in terms of evolving

the video system from one which is merely active to one which is truly embedded. The catalyst for this evolution is what Kotter terms 'short term wins'.

Wins must be collected, categorised, and communicated — early and often — to energise staff. Kotter argues that *"Action here also ensures that the wins are as visible as possible to the entire organization and that they are celebrated, even if only in small ways. These wins, and their celebration, can carry great psychological power…"* (p 32) [33]. What form these wins take will depend on what data is being captured. From our experience it is sensible to focus on practices of care that staff currently perform well. Providing detailed feedback from these areas of good practice will put that staff at ease and lay the groundwork for more critically constructive feedback further down the line.

Our department used video to augment the implementation of a new Rapid Sequence Intubation (RSI) checklist. We video recorded 25 RSIs and found that the team leader was not clearly verbalised in any of the 25 cases. Similarly, the emergency 'can't intubate, can't ventilate' airway plan was only verbalised in 5/25 cases. A new checklist, informed by these findings, has been implemented. We video recorded 25 RSIs using the new checklist and found that the team leader is now verbalised about 75% of the time (16/25), whilst the emergency airway plan is verbalised in about 60% of cases (15/25).

## step 7. sustain acceleration

All new initiatives run the risk of losing momentum after start-up. To sustain acceleration, it is necessary to build on initial change and look for deeper, more long-term improvements. Here, it will appropriate to seek ideas from staff about which aspects of care they believe are in need of improvement. There needs to be a strong sense of usefulness and clinical relevance which can only come from within departmental teams; this creates a sense of ownership over the system from the doctors and nurses 'on the ground'.

We have begun work mapping our stroke and major trauma pathways by video recording 25 patients who received thrombolysis and 25 trauma patients who required an urgent CT scan respectively. This involved constructing a critical path of activities that must be completed prior to intervention, as well as the length of time these activities take. Our preliminary findings suggest that a combination of clinical tasks (e.g duplication of patient examination

by the stroke and ED physician) and service processes (e.g time of ordering scan) both contribute to avoidable delays in care pathways. Findings from video audit should be coupled with existing service evaluation metrics to optimally improve patient care.

**step 8. institute change**

The end goal of initiatives such as these is to institute change over the long-term, change that effects clinical practice as well as institutional norms. Benefits to clinical practice will be felt almost immediately and be visible to staff. The process of change will occur when these improvements are communicated in such a way as to represent a broader, more systemic institutional behaviour rather than just isolated pockets of work. Change should be anchored within the organisational culture so that efforts to improve clinical practice becomes 'business as usual'.

**CONCLUSION**

Embedding a continuous video-audit system within a clinical environment is a challenge of culture change rather than technological innovation. The technology for implementing 24/7 video-audit has existed for decades, but despite the power of video as a tool for measurement and improvement, it is not commonplace in clinical settings. Furthermore, accounts of video use in patient care describe the deployment of equipment or its use, rather than how the system was developed and accepted. By mapping our experience against Kotter's 8 steps for leading change, we present a 'how to' roadmap that recognises the primacy of change issues, such as acceptability to staff, departmental culture regarding use of sensitive data and organisational readiness. It is only by carefully addressing these factors that there can be a move towards video-audit becoming a routine part of clinical practice.

**AUTHOR CONTRIBUTIONS**

**FUNDING AND ACKNOWLEDGEMENTS**

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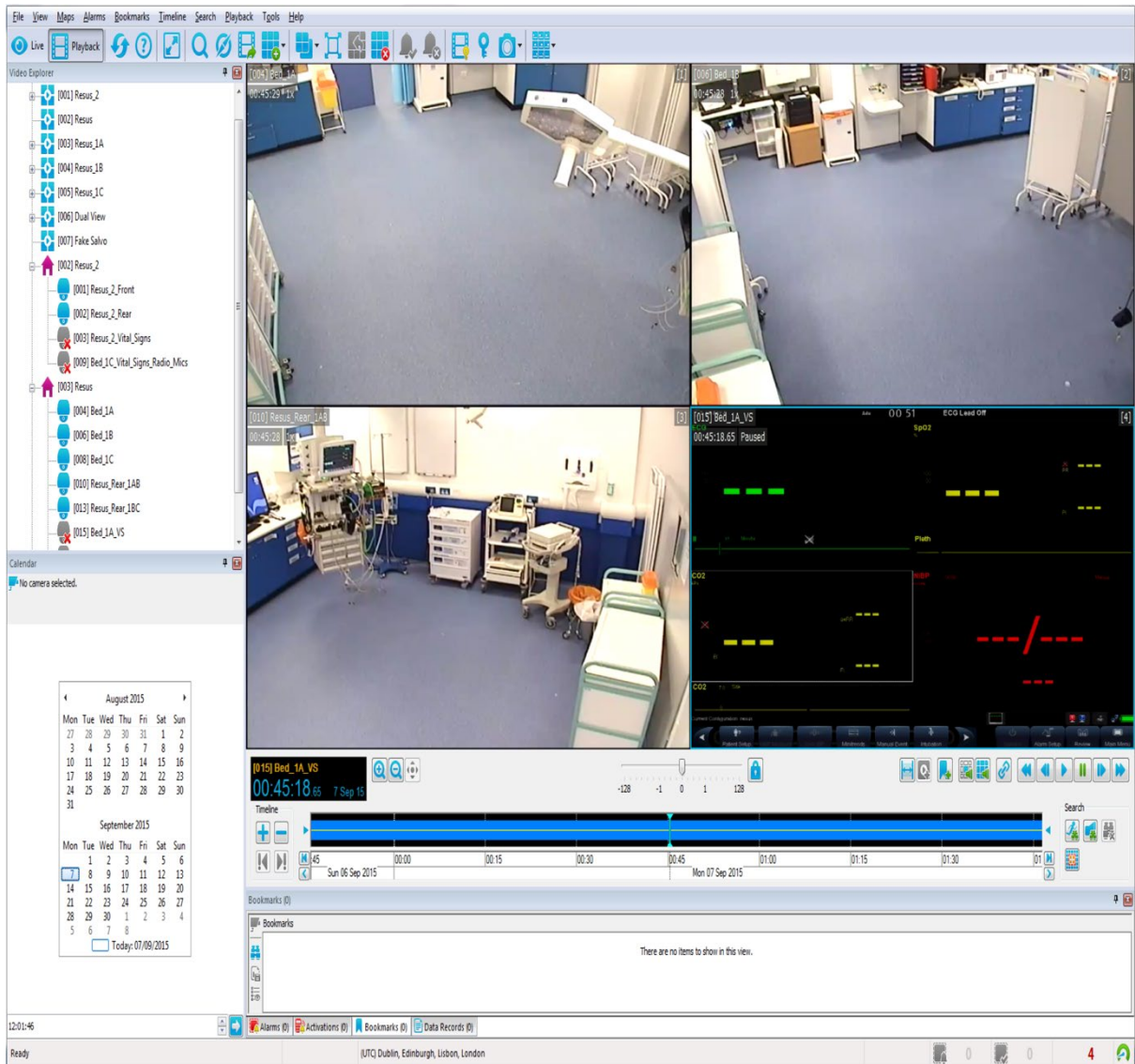33.     Kotter JP. Accelerate. Boston, Mass.: Harvard Business Review Press 2014.

Figure 2. View of clinical department from viewing terminal **figure included in manuscript as unable to upload through scholar one – editorial office will be informed***