The George Hospital theatre documentation and information system

H Stark

Department of Surgery, George Provincial Hospital, South Africa

Corresponding author, email: *hugostark@gmail.com*

George Hospital is a secondary level hospital in the Garden Route district of the Western Cape. Its theatre complex consists of five theatres and an endoscopy suite. The main stakeholders in the theatre complex are the surgical disciplines, the nursing staff and anaesthesiology. The thread that connects all stakeholders of theatre is the documentation requirements of every case that passes through the complex. This process has historically been associated with two specific frustrations: the legibility of notes and the duplication of information evident in creating the necessary documents for the surgeon, anaesthetist and nursing staff. The information recorded was often illegible, uncoded and incomplete. This resulted in concerns about inappropriate patient care as a result of misinterpretation of notes, insufficient data surrounding pending medico-legal cases or for morbidity and mortality review, and the inability to review individual and theatre complex performance. These issues were not unique to our hospital but when I arrived in 2010, the frustration they engendered was enough for me to try and create a solution – an automated documentation and information system. The clinicians needed a tool to make their work easier, and management needed an operational tool that would provide them with clinician-created data reflecting the efficiency of the theatre environment. The ultimate aim was to create a user-friendly digital platform for clinicians to engage with in theatre to assist in patient care.

There was no blueprint to guide the process. The first steps were small and uncertain and took the form of a Microsoft (MS) Word document template. The template offered a consistent layout of data points, with some aesthetic elements. While addressing the pressing need for legible theatre notes, no useable data was stored for future reference. MS Excel was then introduced to serve as a primitive dataset with elementary data points stored at the end of every case. These early attempts triggered a research period into the concept of databases, the different types, their respective programming languages, and their potential. I had no prior knowledge on anything related to databases and had no IT support services to guide the process. There were many commercial options available, but our hospital IT platform did not support any online web applications due to restrictive governance policies in place limiting internet connectivity. MS Excel, however, was supported.

It was freely available on computers in the hospital, and most importantly, it imposed no extra costs. In-depth online training in MS Excel was available on websites like Lynda.com and YouTube and provided a focused virtual training environment. An important yet unfamiliar aspect of MS Excel slowly became apparent – it can be programmed, and therefore its creative limitations are user/creator dependent. Unknowingly, I ventured into the vicious cycle of create-test-implement-review-update-test-implement-review.

The current version of our theatre information and documentation system involves a multi-UserForm-based application built in MS Excel. The main focus points of the application are to avoid duplication of any data points by sharing data amongst stakeholders in theatre, surgeons, anaesthetists, and nursing staff, and to capture all the data required to inform on every case that is performed. The data is then reflected on comprehensive and consistent theatre documents. Different UserForms address different information requirements, and it is the responsibility of each stakeholder group to complete their respective data entries during the duration of the case.

ICD 10 and ICD 9 coding tools are built into the User-Forms to assist with accurate clinician-driven diagnostic data to advise local, provincial and national health policy. The UserForms have evolved to limit the input of free text into fields, which assists in data processing. Dependent dropdown selections guide the data capturing process, and navigational buttons direct the flow between UserForms.

A crucial aspect of the data entry process involves validating entries before they can be committed to the database and, therefore, the notes. Validation rules ensure predictable entries according to expected data types and thereby reduce input errors. Many inputs are validated when exiting the particular field with error handling strategies programmed into the field to promote accurate data capturing. A selection of the data fields is set as required and once these are completed the data is sent to the other stakeholder data files to serve as the source data for their respective theatre notes. The data is used to automatically populate key components of the primary theatre document, according to a predetermined layout, with the help of a myriad of equations.

The operative description by the surgeons is the only free text space in the theatre note. A standardised postoperative

instruction, dependent on the site of where care will be delivered, is incorporated to offer predictable and standardised care for the first 24 hours postoperatively. The theatre note is printed and saved as a PDF for electronic archiving purposes and for immediate uploading to the enterprise content management (ECM) platform. All other required documents are also auto populated from the same initial data entries, ready to be printed at the same time as the surgeon's theatre note, including referrals to allied health disciplines for postoperative care requirements, sick notes and discharge instructions.

The data also creates the nursing document relevant to each case processed in the same manner, removing the need to duplicate theatre episodes in large theatre registers – a big win towards lean document management in an otherwise congested paper landscape. It also achieves the goal of completing all the necessary documents for a case prior to the start of the next. Postponing any action related to a case inevitably creates blind spots in the paper trail.

An important development in the documentation process was the understanding that "every click counts". Creating multiple instructions for MS Excel to execute with a singular click on pre-programmed buttons helps to create consistent outputs with little effort, saving time. These instructions for MS Excel are referred to as *macros* and consist of lines of code that run after a triggering event like pressing a button. Certain data points captured are used to evaluate theatre efficiency measures when paired with a separate efficiency file that measures and graphically displays agreed-upon performance measures.

Different obstacles presented themselves during different phases of the process. One of the most challenging being dealing with different types of users; young, old, with or without computer skills, those embracing change and those promoting the status quo. Creating different buy-in strategies was a big part of the development, including incorporating departmental specific requests over time. Anaesthetic requests evolved around setting up data structures for regional anaesthesia, postoperative patient-controlled anaesthesia (PCA), comprehensive airway assessments, anaesthetic risk stratification tools including a revised cardiac risk index and the African Surgical Outcomes Study (ASOS)-based peri-operative risk calculator in response to the multi-centre ASOS trial. Surgical departments' requests evolved around quantitative statistics to assist during governance meetings locally and provincially.

The junior staff recognised the potential for logbook creations, and it offered an incentive to complete the data capturing process. The promise of a single data entry process with a multi-document output also incentivised their efforts. Ad hoc presentations of data captured proved invaluable in shifting the status quo towards an electronic process. The raw data was intimidating, yet by bringing it to life through real-time data processing, stakeholders were starting to make sense of the theatre narrative revealed in the numbers.

Historically, nursing has often been excluded from these types of clinician-driven projects, yet transformation to a completely digital theatre also needed their conversion away from paper. They, however, represented the group with the most variable amount of computer literacy. In-service training started with a small group of nurses in a specific theatre, who became the champions of change amongst the rest of the nursing staff – training done by nurses for nurses. Familiarity with the process, over time,

brought new suggestions to the capturing process, which I tried to incorporate at the time of the suggestion. Seeing their suggestions so quickly represented in the programme brought a sense of ownership, and therefore encouraged sustainability in the process. We were establishing a *culture to capture*.

Dealing with outdated computer hardware and software has been a continuous challenge over the years. Incompatibilities between the different software versions and their 32- or 64-bit profiles created challenging debugging situations where the same MS Excel file would respond differently on different computers – between the creator-computer and the theatre complex computers, and even between the individual theatre computers. Similar to web browser incompatibility – certain websites are created with certain browsers in mind – unpredictable performances are seen with untested browsers that interpret the same websites differently. Finding the offending code and reprogramming it to fit the software environment was a mammoth yet essential task to keep the momentum of the process. Computers being locked due to incorrect passwords, printers not printing, computers not switching on or computers switching off during loadshedding all became my problem. But to ensure that data capturing continued, I addressed these issues for the sake of the programme. I became the computer-one-man-band for the theatre – creator, user, administrator. I became my own obstacle. There was no-one to hand the maintenance of the programme over to. The programme had become complex with user-driven specifics, executed from within an unpopular programming language. Despite the fact that the GUI (graphical user interface) had become more and more familiar to the users, the back-end had proven itself to be hieroglyphics. Helpdesk-Hugo was open round the clock.

There are many weaknesses in the process. Setting up different versions of the capture process for different departments, in different theatres, at different stages of stakeholder engagement, at different stages of process development, created datasets that could not represent a department's data at a glance. That required amalgamating datasets across theatres. Questions about "how many of what" were difficult to answer without "I just need some time". Frustrations about dependence on one another to be able to complete theatre notes on time sometimes questions the benefits of co-creating a singular dataset for a case. Cleaning up data still stands in the way of streamlined reporting from theatre – new staff, new procedures, new requests, old mistakes, yet when cleaned, it speaks convincingly. Regrettably, data from these datasets have only been utilised for small research activities up until now, yet the overwhelming consensus from the hospital is that it must be published to highlight the surgical context of a regional hospital's theatre activity. Our work is more relevant than ever before, yet only we know about it. If data is currency, our purse is empty.

The future of the programme is not secure. Provincial developments are set to make it redundant at some point, but it has shown its worth as a rural, local innovation for creating local documents and representing local data. The lessons learnt are ready to be shared, and MS Excel remains ever ready to surprise any curious visitors. Although I led the users over the parapet, this is truly a multidisciplinary effort created by users for users and, if nothing else, it has established the culture to capture.