

## **A Critical Essay on the Deployment of an ED Clinical Information System - Systemic Failure or Bad Luck?**

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This essay is about the effectiveness and impact of Cerner FirstNet in NSW hospitals. The need for a systemic study became clear during work that was being undertaken at a number of NSW hospitals when clinicians and administrators constantly expressed their dissatisfaction even hostility to FirstNet, to the point of often refusing to use it. As such, this essay aims at unravelling issues that are obscure and not normally associated so that a clearer picture of relationships and their interactions can be evaluated.

As an observational study, this essay is a synthesis of the various sources of evidence such as systematic studies, Delphi evidence, personal observations, and reports of other parties. It includes a collection of news reports from overseas, especially the UK and USA on the use of Cerner software in their hospitals, providing a comparison with the Australian experience. The essay presents the opinions of a broad spectrum of clinicians, nurses and administrators most experienced in using clinical information systems, across 4 of the 7 Area Health Services in NSW and in a mixture of clinical and administrative roles. NSW Health was offered the opportunity to provide comments to an earlier version of this essay but declined the offer. The essay assesses the rollout of the Firstnet system and the difficulties that have now become evident in its failure to satisfy Emergency Department (ED) clinicians, along with an analysis of systemic issues in provisioning clinical information systems.

The key finding of this essay is that there appears to have been mistakes made at different levels of administration of the project that have contributed to significant problems in the implementation and rollout of Firstnet, substantially increasing the risk of failure. In addition, the essay also finds that there are serious problems with the software itself, reflecting concerns that it is neither serving the clinicians' needs nor the needs of the patients.

### **BACKGROUND**

The health service of NSW comprises 220+ hospitals, 100,000+ staff, and has a \$15.1 billion budget to serve a population of approximately 7 million people. NSWHealth (the New South Wales government's Department of Health) appears to have wanted to introduce an enterprise wide solution to hospital information processing, across the state, yielding advantages classically associated with such standardisation.

A minority of hospitals in the system have an existing Emergency Department Information System (EDIS) in 4 or 5 different versions. There is general satisfaction with the EDIS although it was understood by ED staff that the next generation of software would provide a significant increase in functionality. It should be noted that

the EDIS product had been produced with clinical workflow in mind, with Triage, Clerical and Clinical as its main screens, reflecting the workflow of an ED, and that after numerous iterations, with many enhancements provided at the direct request of clinicians, it reflected their needs reasonably well. Clinicians, in particular, saw a greater role for themselves in designing the specifications for the new system given that they now had the knowledge as expert users of EDIS for a number of years.

Health bureaucrats saw the opportunity to stabilise software across many versions, and to expand the amount of IT service to EDs across the state by installing new systems in hospitals without EDIS. There was a general belief that this move to a more modern system was a good thing. NSWHealth issued a tender using a current period contract with all appropriate probity checks and selected 6 modules of Cerner Millennium which included FirstNet as their ED solution. Taking estimates from the Garling Report (see below) the sum for software licenses appears to be \$73m over 2008-2011, with a total IT spend of \$315.5m over the same period. There has been some turnover in the senior IT bureaucracy ranks since that decision was made.

### **The Garling Report**

The Garling Report<sup>1</sup> was published on the 27<sup>th</sup> November 2008 as a review of acute care services in NSW by Mr Peter Garling, Senior Counsel. It is extensive, covering all aspects of acute care in the state. He reserved chapter 14 of his report to discuss issues of Clinical Records and Information Technology. He noted a number of positive aspects in the use of Firstnet in EDs notably for: identifying patient observations outside normal range (14.40), number of waiting patients, vacant beds, availability of results of ordered tests including pathology, imaging and consultations, and, access to triage information (14.128, 14.129). Garling also reported some of the adverse comments he had received, such as: user unfriendly software, blowout in waiting times, no attention to complaints about software (14.199), patients exceeded triage benchmarks while staff were working on the clerical demands of the system (14.200), extended scrutiny of waiting times without improving patient care (14.201, 14.202).

Garling made the point that he considered: “The primary purpose for new information technology must always be recognised as the improvement of patient care.” (14.203)

He also commented on his concern that some EDs had opted out of using Firstnet and that there is a need for “appropriate change management and the involvement of clinicians” (14.205) and “in a way that ensures commitment from the staff who use it day to day”(14.206).

Garling noted a tension between the need to support local initiatives (14.209) and the counter demand of one NSW Health official for uniformity across hospitals that “life has changed, this is the way we are doing things in the future” (14.210) and justified using a trivial and irrelevant example of writing phone numbers on wrist bands. This convinced Garling of the need for uniformity of technology across the state. In his following statement he said that the evidence “points strongly in favour of uniformity over local requirements” (14.211). However, as will be shown the matter is far more complex. In the same paragraph he showed a certain contradictory position, also stating “uniformity need not obliterate local initiatives”, and he concluded this paragraph by giving emphasis to the importance of consultation with clinicians:

“The key principle is that there must be genuine consultation with clinicians at the hospital and

clinical unit levels to identify what data is needed to help improve quality of care and how requirements at the individual unit level may be accommodated *within* a uniform system.” (14.211)

In a parting comment Garling asserted that the economic benefit of electronic records was not the paramount reason for introducing them but rather:

“It should be borne in mind that the importance of the electronic medical record is not necessarily to save administrative costs, but to ensure that more accurate, comprehensive and accessible records are available to improve patient care.” (14.219)

### **Systematic Studies**

The most current formal study made of FirstNet has been made by the team of Professor Johanna Westbrook of the Faculty of Health Science at the University of Sydney. It is a sturdy report, presented at the HISA Conference in 2009, where it raised some criticism from a Cerner representative at its presentation<sup>2</sup>. The study collected “qualitative data relating to clinicians’ perceptions of a recently implemented ED patient management system (*Cerner FirstNet*)”. The study interviewed “thirteen physicians and seven nurses, combined with two observation sessions. Interview transcripts and observation field notes were analysed by two researchers using a thematic grounded theory approach.” It is hard to go past the authors own words for setting the scene on the problems with Firstnet:

“Interaction with the automated *FirstNet* interface in the management of patients was perceived to considerably increase the administrative workload of clinicians which decreased efficiency of work practices. The clinicians’ perceived that the complexity and user-unfriendliness of the system contributed to this increased administrative workload. They thought that otherwise simple processes became more complicated.”

#### **Also**

“The advanced functionalities of *FirstNet* with its integration of all clerical and clinical features into one program to accommodate the entire patient journey through the system were perceived by clinicians as potentially advantageous for clerical staff. However these advanced functions were thought to be unnecessarily complex to clinical staff and many of the features were considered to be redundant.”

#### **Also**

“Activity tracking features in *FirstNet* were intended to improve provider accountability and patient safety. However, these functions were perceived by clinicians as resulting in process duplications and redundancy.”

However some benefits from the system were also identified:

“the integration of *FirstNet* with the parallel clinical patient management system allowed the automatic sharing of patient information between the two systems, such as diagnostic tests ordered and test results”. Clinicians at other hospitals have expressed this same advantage to me.

In summary the authors reference to the failure of the system is powerful:

“Evident from participant testimony was the failure of the system to fully adapt to the unique context and work practices within the ED of a large metropolitan hospital where time was of particular importance.”

The authors noted that although there was discontent with the system at its introduction, there needed to be ongoing assessment of its effectiveness over time as some of the current problems might bed down as users became more familiar with the

system.

Another systematic study of note was done by Han et al (2005)<sup>3</sup> at the University of Pittsburgh Medical Centre, which identified problems with Cerner CPOE software and with the same problems of increased time burden to complete essential work. The authors pointed to a statistically significant increase in mortality from 2.80% to 6.57% with the introduction of the CPOE process. The authors believed that it was the time burden created by the design of the software system. They conjectured that the nurses spent a significant time at the computer terminal away from the bedside and the concomitant change in workflow caused delays to emergency treatment.

Other authors have made similar observations, Sittig et al (2006)<sup>4</sup> believes that the significant change in workflow for patient care is a primary reason CIS and CPOE are considered to be failures. Ash et al (2004)<sup>5</sup> comment that the adverse effects and unintended consequences of workflow disruption may make the situation far worse for patient care despite the intent to improve it by making it more efficient.

## **OPERATIONAL LEVEL**

The formal studies cited above provide one window into the problem, typically a study through a single location which has the advantage of canvassing experiences in a stable situation. However, this perspective suffers from the biases of staff feeling restrained in their comments due to their institutional role, their surrounding peers and authorities. A Delphi study on the other hand, as presented in this section, collects the experiences of a range of experts across disparate locations with differing operational environments. The following section is a representative sample of the positive and negative opinions of clinicians each with many years of experience working with Clinical Information Systems. The evidence of itself is qualitative and the message is clear.

### **Positives**

Two ED Directors liked Firstnet for its service tracking functions. One of them asserted that staff had too great an expectation of what Firstnet could deliver for clinical documentation and that its primary use is as a patient location and treatment status tracking service for which it is better than EDIS.

Another senior ED clinician reported that the workflow tracking function was very useful but expressed disappointment that it was the only useful component.

An interesting debate arose on an electronic list about the value of Firstnet amongst clinicians that revealed an important issue of secondary gain. The first clinician reported a productive outcome for Firstnet for his rural practice:

“From my point of view the Cerner roll out has been an overwhelming success. By that I mean I get a type written discharge letter from our local base hospital on 70% of ward discharges and about 30% of A&E discharges. In well over half the cases the reports are sent electronically often within two days of discharge. This is an incredible achievement compared to the usual practice of receiving a hand written, indecipherable, quadruplicate copy three months after the patient has left hospital.”

In response another clinician from another rural area made this counterpoint:

"my neighbours house burning down was an overwhelming success. By that I mean I get nice free warmth radiating onto my property, and could even roast a few potatoes on the fringes

of it.”

He later elaborated on this point making it clear that he considered this colleague’s benefit was only secondary gain, that is, a benefit from the misfortune of others, but also that the outputs from FirstNet were not something his colleague could rely on and so he could in fact be worse off rather than being apparently better off.

One example of the clinical community obtaining a benefit from the installed system is the clinical staff who have gained ready access to pathology reports at a level of convenience not previously available. However, this is because the pathology system now allows them access to the required data, an hence nota primary advantage of Firstnet, but rather a secondary gain from another system. Secondary gain herein is something that keeps an undesirable system active despite its obvious primary disadvantage, that on balance has worse impact on the staff than the positives created by the gain. A judgement about the validity of the interpretation of this benefit as a secondary gain can be deferred until the other side of the case is presented. However there is also the argument that the first clinician’s gain is actually illusory as the quality of data he receives is not sufficient for him to care for the patient appropriately, and he will only discover that by subsequently making painful mistakes. In addition, there is an implied secondary gain for the IT services, as the report of the first clinician will buoy IT services belief in the productiveness of their work. However, the primary users of the system will continue with their hostility producing conflicting feedback on the usefulness of the system. We will see later other examples of this type of feedback in the UK.

### **Negatives**

There has been a range of comments expressing dissatisfaction with Firstnet which in some cases has lead to strident objections to using it. This section presents a range of those objections. The objections can be divided into two categories: the adequacy of the functionality of the software, and clinician attitudes and difficulties in using the software.

One of the clinicians with IT training and industrial experience before he qualified in medicine, now working amongst a group of rural hospitals performed a systematic study of the use of Firstnet. He arrived at an estimate that it required 30% more time to complete the data entry of patient information relative to his existing system, and it therefore would cost an extra 30% in staffing costs yielding a 60% loss of productivity. This raises the question of whether an extremely complex system is needed for rural hospitals and whether a uniform version of FirstNet, as defined by the SBB, is appropriate for all hospitals regardless of the size.

Another operational feature that came in for criticism from clinicians concerned the availability of SNOMED for coding patient cases. It was found that the only information that could be coded is FINDINGS and that the consequent list loaded into the system was either too broad or too narrow for the needs of an ED. Thus, there was a need to develop an ED-centric subset of SNOMED for their purposes.

Another criticism of Firstnet is that the clinical documentation is built on the American model which doesn't fit the Australian workflow processes. In the same vein another commentator said it was a:

"system designed by administrators for administrators with no understanding whatsoever of clinical workflow and need".

At the operational level in EDs staff dislike the software for various reasons such as:

“too many keystrokes to load data, hence, too complicated search pathways to find data. In addition, they are unable to get extraction of reports.”

The dislike of Firstnet by staff in hospitals has reached very intense levels, with many staff dismissive of its usefulness and three senior staff asserting it was irredeemable. In one hospital, a graph was produced which purportedly represented a 50% decrease in the number of patients seen by a doctor in the first 20 minutes of their arrival at the ED. In more than one hospital the direct data entry of clinical notes has been abandoned and transferred to paper, as the Firstnet process was seen as too cumbersome and time costly. Previously staff had thought that recording clinical notes in EDIS was done quite well.

Entering patient notes onto paper forms is a return to the exact situation that Garling strongly decried in his report in pointing out that it lead to the problems of: lack of searchability, illegibility, missing time & date entries, inability to check entries, inability to take prompt action, confusing alterations, incomplete notes, limited ability to share records, lost records, increased storage and retrieval burden, lost records, and inability to collect data (14.20-14.72).

Other critical comments (made in writing) about the frustrations at using Firstnet include:

"I prefer looking at a paper result than the counter-intuitive waste of my time trolling through the system.

I keep forgetting how the damn thing is supposed to work and find it more a time waster than a help."

Similarly,

" every single user \*hates\* it with a passion...ENTERING the data is a pure nightmare"

And another

"it is exclusively used by the nurses and entirely ignored by the doctors"

and another,

"Clumsy, complicated (not complex), user hostile, and above all slow at any task I tried".

A very common complaint is that the system is very slow and takes a long time to respond to requests. To be fair this can be as much a problem with the NSWHealth network delivery services as the software, which has a reputation for poor response times for most of its services. One wonders if NSWHealth IT Services have specified response time conditions, and if they have, what is the quality of the performance standards on the current implementation.

### **Engagement with the NSW Health IT Bureaucracy**

Many of the clinicians made a distinction between the problems with the software and the problems of dealing with the NSW Health IT bureaucracy responsible for the technology rollout. Their frustrations in getting the IT bureaucracy to consider their issues were palpable and they found the stonewalling behaviour of the representatives entirely inflammatory.

Comments (abridged and anonymised here) from one clinician in rural NSW speaking about local community hospitals wrote these observations about a meeting with the bureaucrats to deal with complaints about Firstnet:

“We in X and Y had a major confrontation with the NSW ‘gurus’ and refused to use it in ED in its current state. A clinician produced a well-researched document to support our claims of its cumbersome stupidity.

“People present (at the meeting) were local VMOs, a nurse practitioner who works in ED and the local CEO etc, plus reps from Cerner, NSWHealth etc. One clinician was present by videoconference. Nurses presented a long document detailing multiple concerns. The meeting was quite emotional and heated as they tried over and over again to pull the wool over our eyes.

For example, they started out offering “more support”. One clinician replied that this was like giving us a defective car then sending out someone to show us how to drive it :-). I asked was the support available at 3am? Blank faces.

“They dissimulated info that “other doctors” in small country hospitals were trialing the system and had “no problems”. When asked which hospitals and which doctors again blank faces. They finally came up with a name who one of our partners rang that night and found him to be furious his name was used and that they were about to dump the system too.”

“ We stated the system was dangerous (multiple reasons) and that we would not use it in its current state. We also got agreement that the nurse practitioner not use it for clinical details.

“ “They” agreed to send down some experts to watch us work and help redesign the system etc. Incredibly stupid not to design the system properly in the first place. (has anyone of them completed computing 1 “System analysis and design” I wonder??).”

“BTW the regional hospital in X felt just as passionate re the deficiencies of the system and one of the directors has gotten himself seriously offside with the Regional Director for his public opposition. “

In other correspondence (abridged here) the same clinician said:

“We have refused to use it as we have two other hospitals. One clinician has insisted on a ‘full rewrite’ (pigs might fly I suggest) :-). I had heard three others were about to spit the dummy.

In many ways these small hospitals are unique as there is no clerical staff to assist with computer input, which means that the only casualty sister sits glued to the screen and miles behind what is actually happening. Trends are thus dangerously invisible etc. Often there is only one nurse and doctor to process the patients so it can all get seriously out of hand very quickly if there are unreasonable demands imposed externally. This is what the Health IT bureaucrats don’t seem to understand.”

It is notable that in the state of NSW nurses are state employees and hence are obliged to perform their work as they are instructed. Thus, nursing staff are not in a position to refuse to use Firstnet. Medical staff in larger hospitals tend to be employees but not in smaller hospitals but nevertheless informants say they now commonly boycott it.

Another report from an Area Health Service indicated that the attitude of the IT Services staff had also disrupted an effective rollout. In this case the senior IT bureaucrat refused to create an “issues register” so that problems could be documented, and refused to mount training programs at times that would be optimal for clinical staff. The informant also indicated that the IT staff generally had an unbelieving, even antagonistic attitude to clinical needs as “IT hates you saying it can’t be done” in the sense that clinical needs cannot be allowed to direct the use of technology functionality.

Further frustration with getting the bureaucracy to address the problems with the software have been expressed in this manner:

“far too many deficiencies in the Cerner software were obvious even prior to the first rollout, more deficiencies became obvious after the first roll out attempts, the vendor has not signalled any preparedness to seriously address the issues - so what is going on in the

responsible bureaucrat's space that ought to be occupied by brains is an utter mystery to us victims of their decisions."

Taken as a whole, the experts' complaints would appear to indicate that there was a lack of adequate consultation with the clinical staff that has led to the following issues:

- the software is not "fit-for-purpose" as it is too slow, and too cumbersome in its interface design,
- the bureaucracy failed to consult with clinicians so as to achieve a suitable design that worked efficiently and did not compromise patient safety,
- the bureaucrats and corporate representatives were less than forthright in dealing with the problems,
- the bureaucrats and corporate representatives failed to understand the nature of the expressed problems, that is, they couldn't understand why the clinicians complaints were an issue.

### **International Experience**

There is clearly a level of dissatisfaction with the design and functioning of Clinical Information Systems (CIS) generally and ED software systems in particular in the UK and USA. The most serious impact from a clinician's point of view is the time cost, and the risk to patient safety as it is in Australia. This section presents a collection of published comments and discussions from international experience over the past year, which have a considerable amount of commonality with the Australian complaints.

The most senior person to comment generally on Cerner software was Richard Granger the former Director of UK's Connecting for Health national clinical IT program, responsible for the roll-out of all technology for the UK's National Health Service. He has been reported widely in the press as saying:<sup>6</sup>

"Sometimes we put in stuff that I'm just ashamed of ... Some of the stuff that Cerner has put in recently is appalling ... Cerner and prime contractor Fujitsu had not listened to end users ... Failed marriages and co-dependency with subcontractors ... A string of problems ranging from missing appointment records, to inability to report on wait times ... Almost a dozen cancelled go-live dates ... Stupid or evil people ... Stockholm syndrome - identifying with suppliers' interests rather than your own ... A little coterie of people out there who are "alleged experts" who were dismissed for reasons of non-performance."

Criticism of Cerner software was also made by MP Richard Bacon of the UK House of Commons Public Accounts Committee. He commented that problems at BARTS hospital was due to Cerner's "dreadful" system.<sup>7</sup>

At Milton Keynes General Hospital 79 staff signed an open letter decrying the Cerner Millennium software as reported by e-Health Insider<sup>8</sup>:

"Seventy-nine clinicians and admin staff at Milton Keynes General Hospital have written an open letter to the management stating that the new Cerner Millennium system installed by Fujitsu in February is "not fit purpose". In their open letter, the staff describe the software as "awkward and clunky" and state: "In our opinion the system should not be installed in any further hospitals." Reported problems include clinics not being available, patient notes being lost or unavailable, staff being trained on a different system to the one implemented and problems with reporting around key areas such as 18-week waits. One senior clinician from the trust described the situation in outpatients as "a nightmare".

Other experienced international clinicians have expressed the view that FirstNet was not fit for their purposes, including one correspondent from a USA hospital who

claimed it did not fulfil the work needs of US hospitals any more than it did Australian needs.

At a more general level it has been reported that emergency clinicians are predominantly of the opinion that ED information systems add up to 20% workload for staff. One comment made this year about the problem across the ED discipline is:

“the problem ... is one that came up time and time again when I was at the last meeting of the American College of Emergency Physicians. I did not talk to one frontline emergency doc who was happy with their EHR. The biggest issue was related to usability and problems with data entry. Most indicated that there were long term reductions in productivity. They saw short term significant reductions but reductions in productivity in the range of 20% persisted. A number of people that I talked to were considering adoption of scribes to increase their productivity. Most attributed this to having to use the same EHR that was selected to work in the entire hospital instead of one designed to work in the ED. I would think that this environment would be one where a specifically designed EHR would be the solution.”

An even more radical position is that taken by the ED Department Chair, of a large teaching hospital in the Northeast United States serving half of the state who has taken the position that no CIS has yet reached a desirable standard of functioning and so he is yet to install such a system. He makes a strong statement about the deficiencies of CISs:

“I remain deeply ambivalent about adopting an EMR for the docs, and my intuitive assessment is that the cons still outweigh the pros. I review all the products out there roughly every two years, and still have not found one that creates a truly readable and helpful HPI/Assessment (the parts where medical decision and communication making is truly facilitated). In addition the ergonomics and design are generally terrible, while integration with other systems is, as ever, problematic to say the least. Many very knowledgeable people ... continue to say the (proven) benefits are minimal from a safety/communications viewpoint. Further, the EMR in the ED seems associated with an apparently inevitable decline in productivity, perhaps in the range of 10-20% even after becoming familiar with the system (which in our environment lead to further patient delays, in itself quite dangerous). This is not economically feasible given all the other things going on now. Finally, in my current incarnation I am actually quite pro-change; I really wish there was something good out there, and if there was I would go right for it. But... I still haven't found anything great. We will look again once CPOE is up and running (likely this Summer... how many years did that take!?!); maybe our wishes will be fulfilled (!).”

Looking at the problem of Clinical Information Systems more generally, a recent article by Alexi Mostrous in the Washington Post<sup>9</sup> includes the following comments:

“Interviews with more than two dozen doctors, academics, patients and computer programmers suggest that computer systems can increase errors, add hours to doctors' workloads and compromise patient care.

“Health IT can be beneficial, but many current systems are clunky, counterintuitive and in some cases dangerous,” said Ross Koppel, a sociologist at the University of Pennsylvania School of Medicine who published a key study on electronic medical records in 2005.”

And on a study of the problem being conducted by the US Senate:

“the Senate Finance Committee has amassed a thick file of testimony alleging serious computer flaws from doctors, patients and engineers unhappy with current systems.”

The Mostrous article states on physician satisfaction that:

“It's been a complete nightmare,” said Steve Chabala, an emergency room physician at St. Mary Mercy Hospital in Livonia, Mich., which switched to electronic records three years ago. “I can't see my patients because I'm at a screen entering data.”

“Last year, his department found that physicians spent nearly five of every 10 hours on a computer, he said. “I sit down and log on to a computer 60 times every shift. Physician

productivity and satisfaction have fallen off a cliff."

In a different report from the southeast USA, a physician turned Director of IT at a group of about a dozen hospitals has a different perspective, much more supportive of Firstnet, but also aware of its problems. The group had a "best of breed" ED system, for a number of years but Cerner Millennium software for other processes. However, admitting physicians and consulting physicians were frustrated by a lack of connectivity between the two. This led to a decision by the ED-Leadership group to replace the first system, which had been well appreciated, with Firstnet for the sake of integration, despite the loss of functionality. A range of staff have reported that the process of change has been very tough:

"But in summary, for good or bad, we did try to honour the principle of user involvement and leadership. This has indeed come at a price in terms of the original implementation schedule and costs—it is a project that we are over-budget for. But I am glad we put the users first."

In an assessment of the whole process he states:

"We each have our perspectives in our field, and I guess one of mine is that blaming the vendor is the first most available culprit. Sometimes it is their fault. But more often than not in my experience it is those "people" aspects of leadership and involvement. I have seen the same vendor, same build, same type of nursing unit in the same or different hospitals...one location ends in abysmal failure and another develops innovative and creative uses of their system and processes to improve care."

This Director also notes that there is a perception of a loss of physician productivity with the Firstnet system.

In summary, the complaints from the international community can be shown to cover issues such as: usability, excessive time cost, method of introduction, loss of productivity, and patient safety, as we have found in Australia.

## **SYSTEM DEVELOPMENT ISSUES**

NSWHealth determined that it would build a version of Firstnet for all hospitals in the state which is known as the State Based Build (SBB). This approach was possible as the Firstnet information system can be assembled by user-selected modules. Subsequently, some hospitals negotiated variations to the SBB for their own purposes, but that was the exception rather than the rule. The author attended a meeting between an AHS and Cerner, where clinicians were invited to define their needs but ultimately were not able to direct the specifications as much as they wished due to the need to conform to a single State Based Build. This led to disaffection from some clinicians very early in the project process and has been expressed subsequently by other clinicians.

Subsequently, after the introduction of the SBB in a number of hospitals, ED Directors and others found they were unable to get the reports previously available from EDIS, or the type of report they had expected from a more modern system. In one case, an ED Director had Firstnet decommissioned within the first few days of it being installed, supposedly on the grounds of patient safety, as there apparently had been frequent instances of the product failing to operate.

There appears to have been considerable short-sightedness in making the deliberate decision to design a State Based Build of Firstnet providing all EDs with the same system, even despite the fact that that policy would bring leading IT users compared to non-IT EDs, back to 'the pack', especially with respect to direct data entry of clinical notes. This disregard for the importance of data entry of clinical notes

in the clinicians workflow is implicitly supported by material presented in the Garling Report, which has the NSW Health schedule for commissioning Clinical Documentation set for 2018. This demonstrates unfortunately its low priority for the clinicians doing the point-of-care work.

The dissatisfaction was also true for hospital administrators. Their frustration reached the point where one administrator stated that Firstnet might be seen solely as a backend repository without a role for its data collection and retrieval interfaces, which had been forced on the AHSs by NSWHealth. Any other processing, such as report writing, would be undertaken with other third party software. However there is a difficulty in achieving this strategy as the Cerner software does not provide direct access to the underlying data tables, hence AHSs do not have the level of control and access to their data that would allow them to readily create this solution.

### **CONTRACT ISSUES**

The generation of reports is also a problem that has its origins in the contract. One of the reasons offered to staff in EDs by NSWHealth for their difficulty in being able to get certain types of reports is that it appears the software modules needed to generate a variety of reports were not included in the original contract with Cerner. The resulting situation means that there would be further costs to obtain those modules. This was confirmed from three different sources, and in one case the cost of the reporting software was estimated to be about \$1 million. The Garling report also seems to confirm this state of affairs in giving another example of the need to extend the license at more cost in a request to add a “To Do list” on a Firstnet screen (14.40). Furthermore NSW Health’s response was inflexible to serving local needs in its response to Garling in saying:

“NSW Health does not consider these sorts of configurations to be essential components of the electronic medical record it is implementing and, thus, it is not part of the functionality of the electronic medical record currently being rolled out.” (14.41)

One would have thought that Cerner was aware of the failure of the contract to specify the necessary reporting module and so it appears to be a form of gazumping<sup>10</sup>, that is, effectively raising the price of the sale after final offers have been accepted. Nevertheless, the net effect is that the contract was not negotiated for all the needs of all the classes of users, suggesting that there was not a sufficiently detailed study of the requirements of active EDs, even to the extent of not ensuring all the functionality in the current EDIS system were included in the Firstnet contract.

One would think that it is a straightforward task to write a tender that requires all existing reports and agreed improvements to be available in the new system.

An IT colleague made the observation that:

“It seems that Cerner knew what they wanted from the negotiations and NSWHealth didn’t. This difference is not uncommon in the IT industry. Cerner have the option of completing the contract and then moving on to another customer of which there are many, whereas NSWHealth has to live with the situation they have settled on for a very long time. Therein is the imbalance”.

The contract limitation fits well with another perceived communication difficulty, that Cerner is a difficult organisation to get co-operation from and that they are unresponsive to requests. Cerner might well argue that this is not true, but it is certainly a perception on the ground as it is one of the alleged excuses provided by NSWHealth for delays in providing certain software functionality. However, in one

case a former employee of Cerner asserted that getting responses from the USA office for software changes was as much a frustration for Cerner staff in Australia as it is for hospital staff using their software.

There seem to be two other factors contributing to the difficulty of getting Cerner to attend to issues. Firstly, comments from people familiar with the Cerner methodology say that their processes are fairly rigid as to what can be done with their generative scripts. Another commentator pointed out that the Cerner responses to requests to change parts of their system is driven solely by the USA user community so the small Australian user base has no capacity to effect changes for its own needs. A colleague informed me that at one time Cerner apparently did produce a very stylish and adaptable web-enabled version of their interfaces but it was discontinued as it couldn't be made to work in a full-scale production environment.

Some technically experienced colleagues asserted that the limitations of Cerner software included that it had been developed over a long period of time so that there was not necessarily compatibility between versions, leading to some Cerner systems not being able to communicate reliably with each other. To be generous to Cerner this suggests the software has a long historical code base which is so large, continually growing, and complex that they are very cautious about dabbling with it to satisfy individual customer requests. Nevertheless, such a situation is no help to the frustrated clinicians and ill patients.

Models of the relationship between sale and maintenance costs indicate that as software products grow larger the maintenance costs accelerates<sup>11</sup>. This model puts a ceiling of 10-12 years for the growth of a product after which the costs of maintenance outweighs sales income and therefore products should be revamped and re-engineered after that time. Cerner software appears to have reached that threshold.

### **Hold Harmless Clause and Confidentiality Constraints**

Commonly, Health IT corporations include in their contracts a clause where they are “held harmless” for any faults in their systems and the consequences that might flow therefrom. This is often found in concert with a clause that prohibits the contractee from expressing any public comments about the deficiencies of the software. These clauses have raised a great deal of discussion<sup>12</sup> in the USA where there are strong advocates that the clauses are a serious hindrance to improving the quality of software. In effect, agreeing to a “hold harmless” clause constructs a relationship of the form that the customer is, in some way, captive to the vendor especially when in concert with a concomitant confidentiality stricture. Subsequently, benefits emanating from some parts of an enterprise wide implementation could be held out as testimony to the success of a system, whilst primary dysfunctionality is ignored and even suppressed. It would be useful for all of us to know if such clauses exist in NSWHealth's contract with Cerner.

The current justification for including a “hold harmless” clause in a contract seems to be inappropriate for a health department responsible for a major health system to agree to. It would appear to be a useful clause if software were to be provided as ‘open source’ where the contractee can alter the code to suit its needs and the source corporation has no quality control over the process of further development, but otherwise it is not appropriate.

## COMMENTARY AND ASSESSMENT

Wholesale changes to processing systems within large organisations such as introducing an enterprise wide information system is known to be fraught with dangers because their implementability is not consistent for all users and so lead to disadvantages for some groups within an organisation. One of the principle strategies for gaining acceptance for an enterprise wide system is to convince the disadvantaged that is, those that have nothing to gain from its introduction or actually lose something, that they should be accepting for the greater good of the whole organisation. Failure to persuade any important group of this overall benefit is a recipe for failure. In this case, the evidence so far indicates that the ED clinicians have been omitted from the process. However there are other systemic issues that need to be assessed before a comprehensive understanding of how the current situation arose and what might be suitable courses of action to improve matters.

### **Why was Cerner FirstNet System bought?**

The answer to this question is straightforward. In this case, a committee was convened to make a selection. Three solutions were considered: Cerner, iSoft and Epic. The last system although considered the best of all systems is not marketed in Australia. iSoft was ruled out because it didn't cover the scope of the tender specifications leaving only one tenderer. Hence, the committee was left with no choices and called for a second round of tenders but could find no alternative. This situation begs the question should the committee have still made the decision to use Cerner or retreat from the tender altogether citing a lack of acceptable solutions. In retrospect, it seems that is what should have been done, but would it have been a reasonable decision at the time? Did the situation lead the committee into a false sense of security believing that a large and successful system could not be defective, or was there some inexorable force pushing them towards accepting this solution without assessing or understanding its validity for the NSW ED system.

It has been proposed to me that there was in fact a subtle force pushing the committee. The proposal from Cerner suggested that they were giving a cheap price for the system and this was only attainable with a speedy finalisation of the contract. Thus the incredibly tight schedule this entailed placed enormous pressure on the Health system that effectively cut out the possibility of full or comprehensive clinician consultation.

Another consideration is that the Cerner software was evaluated by the NSWHealth panel for its functionality compared to iSoft and Epic, but seemingly never for its performance or usability within NSW hospitals, according to one informant. That suggests that the panel making the selection failed to pay attention to a fundamental characteristic of software, that is, time and space are interchangeable - what runs in more space will require less time and what runs in less space will require more time for a defined functionality. An appropriate performance assessment would have indicated the necessary computing power needed to run the Cerner software or alternatively indicated satisfactory performance could never be achieved. Ultimately, they apparently looked at less than one-third of the problem space of functionality, performance and usability, and furthermore complaints from clinicians indicate they even got the functionality part wrong.

Some other possible explanations for selecting an inadequate system might be

that the panel had a poor capacity to understand the elaborate workflow demands of a very complex process, especially for areas of the organisation they were less familiar with. This would not be surprising given that this has more often than not proven equally insurmountable for other industries or IT professionals. Alternatively, it might be that they did not have available IT advisors who were aware of current advances in software engineering, and therefore could not appraise reliably the match between software function and user requirements. Whatever the explanation, it does seem that the User Experience has been ignored at a time when it should have been paramount to avoid a failed implementation.

An alternative question can be posed – What would have had to exist for a different decision to be made? For the committee to have made a different decision then a number of different criteria would have had to been brought into play. The two most likely alternatives would be to delay adoption until some later point in time, as we have seen with one American hospital group (quoted earlier), and the other would be to build a custom designed system. The latter solution could have used a private contractor or a collaborative open source strategy. The barriers to adopting any of these directions are yet to be explored. However, it should be pointed out that arguably one of the most successful hospital information systems, known as VISTA, has been built over many years by the Veterans Affairs Administration of the US Government. One version of it is available as open source code project. The highly rated Epic system is technologically related to this system in that it is written in the same language and database system called CACHE. Both systems are derived from a very early technology known as MUMPS.

The committee would have had to have a culture of valuing user requirements and usability much more highly and to have been prepared to assess in more depth the effectiveness of the Cerner methodology to satisfy the rollout of a system to their own disparate community. In fact, they would have had to appreciate the non-determinism of the problem they were trying to solve which would indicate the need for an incremental and flexible implementation strategy. The question remains as to whether that would have been a reasonable expectation at the time of selection (c 2006).

### **The Problems Caused by Non-Determinism**

The problem of designing a satisfactory Clinical Information System is that it is non-deterministic, that is, it is not possible to know all requirements in advance, because of the variety of the users it has to satisfy is effectively a Complex System. This means that it has the following types of behaviour:

- There is no central control,
- The users are self-organising communities each of which work for local optimisation,
- Each user exercises autonomous behaviour which is inherently non-deterministic,
- Each community is an Open System where people, organisations and ideas are being cycled in and out continuously,
- Users have a limited view so that no-one can see all parts at once,
- There are multiple levels of granularity for tasks and functions with blurred boundaries,
- A system will have emergent properties, that is, a system in which functions emerge without it being planned, resulting in the whole being more than the sum of the parts,

- There is implicit knowledge in the system where members operate with both tacit and undocumented knowledge.

The consequences, for the design of a deterministic solution of data processing imposed on such a complex system as an ED, is that it will have an intrinsically difficult journey to be accepted no matter what its design. Furthermore, this will be made insurmountable if the clinicians are not brought in to engage fully in the definition and assembly of the final system they are supposed to use. Hence, a simple mistake in the design of the rollout of Firstnet is the belief that a single SBB would ever serve the needs of all hospitals in the state.

A counter argument can be made that work procedures need to be standardised across the State to ensure a guaranteed minimum level of care or at least service delivery and a single SBB would assure that status.

The SBB has caused the IT experienced EDs to restrict their use of IT in their care of patients, as cited previously in a case where clinical notes are no longer entered electronically but managed on paper. The hospitals without a history of CISs are generally the smaller rural hospitals which have a serious lack of personnel and so cannot afford to release staff to do the extra data entry required to use Firstnet (op cit). Finally, the doctors who do use Firstnet have a reduced trust and value in the system due to the limited entry of data and the known risks of losing data from the System. These sorts of limitations on the efficiency of the software breed ‘workarounds’ that further restrict the value of either the data or the workflow processes intended to regulate the quality of the data. For example, when logging in takes an unacceptable amount of time staff have been known to use the one login identifier for all staff in order that each person doesn't have to login separately. This compromises the accuracy of the electronic record as it does not record the true person who completed the record details.

A second counter argument is that if every hospital could define its own version of the software there would be an innumerable number of different systems increasing maintenance costs and restricting the supply of a universal set of information necessary for proper health administration.

This second argument alludes to the case of creating a permissive situation in which each clinician anarchically creates their own requirements, driving up the cost of implementation and maintenance to unsustainable levels. This is a fantasy argument put up by the detractors of clinical engagement in IT design. The clinicians are keen to accept any technology that will enable them to do their work more effectively. Senior clinicians are experienced at managing expectations and defining operational requirements for the staff of their own departments. It is not a credible argument that clinicians cannot bring to a design meeting a set of requirements acceptable to their own staff. The biggest hurdle at such a hypothetical meeting is not the ability of senior clinicians to speak for their own colleagues and accept an agreed common solution, but rather for a given software system to be able to satisfy a reasonable set of demands, from people experienced in the use of IT. Herein is a hint at what might have been a significant pressure to complete the rollout of Firstnet so fast that clinicians would not be consulted, that is, it might well have never been capable of delivering to a specification that a group of reasonably experienced clinicians might specify.

### **What are the reasons for the mixed attitudes to FirstNet?**

Cerner is an enigmatic organisation. It is commercially successful and has been able to win large contracts in the USA, UK and Australia. Yet, in all these countries it is subjected to a surprising amount of unrelenting criticism, so it is important to understand this contrastive situation.

In my conversations with clinicians using Firstnet it seems that the positive attitude comes from people who are looking for functional solutions to generic problems, in particular, gaining access to data previously inaccessible. This is a common request from clinicians whose patients receive services across hospital departments or specialty services, which is self-evidently the vast majority of patients. We see this in NSW from the clinicians who are justifiably pleased to get direct access to pathology results and discharge summaries, but as we have asserted previously this is secondary gain.

Usually, the greatest pressure for solutions that serve multiple needs outside the ED come from those people with the least experience in the operational aspects of ED software requirements. Their appreciation for Cerner software is effectively the equivalent of a ‘Hawthorn’ effect. They are happy because something has changed and they can do something not previously available to them, that is, the secondary gain serves them well. However in these circumstances it is not the Cerner software per se that they are appreciating but rather the advantages of ANY IT system that is able to provide for their needs. Effectively they confuse the IT effect from the Cerner effect.

The negative criticism comes from the clinicians and IT specialists who have already experienced the benefit of the introduction of clinical information systems, prior to the introduction of Firstnet, and therefore have a much more informed set of demands and expectations about the specific functionality of a clinical information system. They assess the Cerner software in terms of its advances in technical functionality, performance and usability, and the resulting systemic effect on the workflow of fellow workers. Almost all have found Firstnet wanting on these criteria.

Secondary gain is important in the tension between the supporters and opponents of this system, because of its capacity to become the primary criteria for judging the value of the system, when its primary purpose is not accurately appreciated. Secondary gain is the gain that some parts of the enterprise obtain when another essential part is put at a disadvantage or deficit. In these circumstances the process is clear; the primary activity of using Firstnet in EDs causes pain and distress whilst some secondary gain is obtained in better patient tracking and access to pathology reports. However, the real danger is that that the gain becomes a structurally embedded advantage where the damage is ignored because of the benefit of the secondary gain. In the case of a dysfunctional clinical information system the secondary gain ensures the non-primary users of that system have some reward without them recognising their gain is produced from a system outside of their organisational area that is damaging to the primary user group. The separation enables the beneficiaries of the secondary gain to ignore or remain ignorant of the problems with the primary context. If this gain becomes too embedded for the beneficiaries then the dysfunctional situation will remain for many years without recourse for the penalised community. Hence it is important for the dysfunctional system to be restrained quickly, as once it becomes embedded it is hard to reverse the situation. Fundamentally, the primary users are left with damaged work processes that fail to fulfil their basic needs, violate their sense of responsibility to their patients, which in this case is the slowing of progress rates through EDs and the removal of the advantages of computerised clinical notes, the importance of which has been

emphasised in Garling's Report (op cit).

### **Is Patient Safety Compromised?**

There is probably no definitive way of assessing this question but some valid inferences may be possible. In a number of cases we know senior clinicians have shutdown the use of Firstnet within a few days of it coming on-line. This means that clinical staff have determined very rapidly that its performance was unsatisfactory, but for what reason? The most obvious reasons are that it:

1. disrupted work processes so severely that work could not be completed in a sufficiently short period of time, or
2. risked patient safety.

Perhaps the first cause includes also a concern to shortcut the possibility of the second effect occurring. There is also evidence from a number of institutions that the system doubled the delay in the first clinical interview for patients, and, some institutions have ceased recording patient notes electronically and reverted to recording them on paper. This seems like a particularly retrograde step as a common benefit for clinical information systems has always been its delivery of clinical notes at any time without needing to find the location of the paperwork. Hence, one of the most significant advances brought about by computerised health records – permanent and immediate access to clinical notes – has been entirely sacrificed in these hospitals.

Whilst we have no explicit reports of patient safety being compromised, there is fair evidence to suggest that clinicians have believed that in some cases it has an unacceptably high risk of doing so.

### **What is the problem with Cerner and Cerner software?**

When information systems don't work or they are heavily criticised one of the typical defences available to the software company is that it is not the software but rather it is the social and workflow systems in which it is placed, which is not an unreasonable response, but does it apply in this case?

On examination of the reports from around the world, the most common complaint is that it takes far too long to get Cerner to produce the required reports. This is a remarkable complaint because once the data is in the information system there is a wide range of tools available from alternative suppliers for producing reports. This fact combined with the number and type of organisations making this complaint would lead us to believe that there is a systemic problem at Cerner - they are just not geared up to producing reports from their software, seemingly regardless of the need for NSWHealth to purchase separately a reporting module.

If we consider the user interface software, firstly, the most substantial complaint is that it is organised in a rigidly hierarchical manner that does not fit the Australian hospital workflow and which makes it highly inefficient for data retrieval. This is clearly a software engineering design problem where the software does not allow flexible and variable design of user interfaces. The era of rigidly designed user interfaces that do not allow any variation for user preferences or a capacity to model the users needs is long gone. It began to fade with the emergence of windows technologies and widgets and has now reached the point where there does not have to be a particularly rigid screen design for all users. The fact that on any modern computer a user can connect to a remote information system via the web, resize their

web browser and move their windows around their screen are all evidence of a new generation of thinking about the nature of user interfaces not to say complete information systems. It appears that Cerner software engineers have not kept up with the move of technology to new ways of thinking about serving user needs. But it must also be said that the IT departments in the Health Services may have failed to keep up with this trend by not identifying the limitation of the Cerner software and by continuing to promote its implementation in the face of rising criticism and user disaffection.

On two different and distinct issues the software engineering strength of Cerner is questioned – on the adaptability of the software to provide tailored interfaces and workflows for different users, and the efficiency at which the design of the software supports report generation for varying needs of a large health organisation. But there also seems to be a confounding factor in this question. There is no doubt that the Firstnet software performs a satisfactory function at least for patient service tracking, but, it is the unresponsiveness of Cerner to requests that has bedevilled many users both here and in the UK. There are the comments from a former Cerner insider that the USA organisation is unresponsive to the Australian organisation. It may be that some of the problem lies at the heart of the management strategies and structure of Cerner USA. It is possible that software engineering activities are of themselves strangled by a management that exploits the disadvantage a client is positioned in once they sign a large contract and are committed to a very public process of implementing a large-scale technology adoption.

A colleague has proposed that the explanation may have a much more pragmatic base, that the higher the “turnover” of roll-outs positively effects the stock price. Thus, the commercial strategy of Cerner might be to get into an organisation and complete their implementation as rapidly as possible. This motivation could then be used to drive a corporate culture that gives minimal attention to “solution quality” and maximal attention to notional rollouts, leaving a trail of disaffected users. Certainly, the Cerner stock price has been climbing over the last few years suggesting the effectiveness of this commercial strategy. Whatever the explanation the ultimate consequence of Cerner's behaviour is to lower confidence in the usability of their products and the competency of their staff to overcome these shortcomings.

### **The Importance of Good Software**

There is a salient point to be made about the nature of delivered software with respect to the whole process of change management in the introduction of new IT infrastructure. In these situations, there is always a great deal of noise and attention given to the processes of systems review, workflow redesign, and staff training. In many ways, this is paying attention to the smoke rather than the fire.

The actual design and operation of the software is fundamental to the successful introduction of information technology. It is a necessary condition that the software works in a fashion that optimally fits the activities and workflow of the recipient organisation, and this fit is the single largest determinant of a successful system wide implementation. Like any foundation if it is not properly designed and constructed the edifice above it will collapse no matter the amount of attention and detail put into it. The delivered software is the foundation of any clinical information system. It would appear that in this case this understanding has not been fully grasped by authorities in NSWHealth.

The task of creating better software foundations for clinical information systems across the whole of our system is dependent on conducting research and development into how these systems can be built and in what manner they should operate in the Australian clinical setting. Without optimal design and implementation there will be no cost efficiencies and productivity gains delivered by IT, but rather, it will contribute to the spiralling expense. We can only hope that Government will support investment in engineering R&D for clinical information systems needed to create the desired improvements in productivity, cost reduction and patient safety.

### **Bureaucracy, Incumbency and Coercive Co-operation**

The clinicians in the hospitals direct their criticism not only at the software but also at the role and services provided by NSWHealth IT Services. It is clear they feel very disappointed by the lack of attention to their requirements and we have seen at least two instances where this would appear to have been planned. In particular, the stone walling and “divide & conquer” strategies that the clinicians perceive were used at least on some occasions to repel their requests and criticisms need a deeper explanation. But identifying responsibility for a failed IT implementation requires much more than finger pointing, but rather needs a study of the broader issues that direct the behaviour of all parties.

There appear to be competing demands driving each of the three groups implied in:

- Dedicated clinicians driven by an intense commitment to the Hippocratic oath. It would seem that they are drip-fed with it as a professional neonate until they reach professional maturity, and so they have an extraordinarily strong motivation to do the very best for their patients’ well-being and safety. Hence, they are especially hostile to technology that makes that task more difficult or increases the risk to their patients. It is the intensity of this hostility which so often is invalidly disparaged as self indulgence by the IT community and vendors to justify ignoring their requests.
- The bureaucracy, on the other hand, beginning with the Minister, needs to satisfy a chain of command that above all else needs to be seen not to fail. Hence once an initiative is taken it is pushed through at all costs with all effort. At the same time, it has responsibility for preserving the “Intellectual Property” of the organisations they represent, that is hospitals and Area Health Services and to ensure such groups do not lose direct access to what is rightfully theirs, that is their own clinical records.
- The role of the software vendor is defended as constrained to having a responsibility to their shareholders, and by implication to do the least to obtain the most.

The result of these opposing motivations leads to different objectives that if not managed to create a cohesive force produces an environment of continuous and unfettered conflict. In this case, a closer analysis might reveal an unsuccessful relationship between the users and bureaucracy, that is founded in a relationship between the bureaucracy and the vendor which can be called “coercive co-operation”. This notion is that, once a contract is signed the bureaucracy enters into an obligatory co-operation with the vendor, which limits the capacity of the bureaucracy to defend

itself against errant behaviour by the vendor. Furthermore, there are other pressures on the bureaucracy to enter this relationship: these are the structural requirement of the bureaucracy to “deliver results”, and the personal motivation of the individuals to do their jobs well. These forces may be given extra power if the bureaucrats have a negative perception of their internal clients, such as the hospital clinicians.

The movement of the bureaucrats to take the position of the vendor would be sealed by the intrinsic juxtaposition if there was created in a contract a restriction on the bureaucrats’ entitlement to analyse and criticise the vendor’s product or service. Hence, the bureaucrat would have little choice but to take sides with the vendor in meetings such as described above, that is they could not take a position to support the users. This would give the vendor significantly greater power than might be otherwise possible, that is they would have the optimal corner position, and this situation is entirely undesirable in terms of achieving a satisfactory outcome for the person who has to actually make the system work, that is the clinician. The fact that the IT Services in this case do not attend effectively to the users cause has reportedly led to clinicians taking their own protective position, that is, boycotting the system. This could be an entirely satisfactory solution for the coercively co-operative partners because they could claim they have performed the function and rolled out the system, and at the same time ignore the extent to which it might have failed to provide an optimal or even satisfactory level of service. At the same time, because the system does not provide reports and information needed by clinicians from data they themselves have entered, the bureaucracy seemingly does not fulfil its obligation to manage the data of organisations they are supposed to represent and serve.

At the same time the vendor, because they can claim a roll out, get an extra leverage of incumbency which they carry over to new sales initiatives with other customers, and further build the dependency of the current customer. With vendor lock-in and incumbency they can continue to take more money for doing less work and provide less service with impunity, if that is their underlying strategy, often with a timeline stretching for up to 10 years.

## **CONCLUSIONS**

As discussed above, Firstnet does not provide a number of important functions for the ED and Area Health Services staff. Reasons for this include:

1. apparent inability of Firstnet to produce reports,
2. failure to suitably negotiate the details of the contract with Cerner,
3. failure of Cerner to respond adequately to requests,
4. poor design of the software particularly for the Australian context,
5. poor engagement with the user community to define needs and to ensure current system functionalities were preserved, and
6. failure to ensure data is appropriately preserved and available as needed,
7. failure of NSWHealth to commit sufficient resources into the commissioning of the system.
8. the constraints imposed by a State Based Build.

It would not be drawing too long a bow if one considered that Cerner held its clients and users in low regard and thereby were limited in their sense of accountability to them. This is evidenced by reportedly failing to include the Report Writer module in the contract and so subsequently costing NSWHealth an extra \$1 million, some systemic failure to provide reports promptly from different customers

in Australia and the UK, poor responsiveness to changes, and stonewalling user complaints.

Whilst clinical staff identify Firstnet as a system built for administrators many hospital and AHS administrative staff are dissatisfied with it as well. As one informant said, Cerner started off in one application area and slowly spread to other applications, but in so doing brought with it a particular way of processing data that does not fit the clinical context. Now, it is essentially as a system built to satisfy the coercive co-operation of two participant parties with service to user needs minimalised and at times inappropriate. Quite simply, clinicians believe it is not suited to Australian conditions and is not flexible enough to be altered to fit them.

### **Lessons Learned**

The lessons learnt from this case study have important messages for the future deployment of clinical information systems in Australia if the productivity benefits expected by clinicians and bureaucrats alike are to be realised.

1. Productivity does not come automatically with the installation of a clinical information system – it must be fit for purpose for any gain to be made.
2. A policy of one model fits all across a large health service will have serious shortcomings – the variation in IT experience across a large range of different hospitals requires a variation in the nature of the roll-out. Reducing the functionality for experienced users produces a loss of productivity and potentially patient safety.
3. Once an information system is installed in a large bureaucratic environment, the user is at the mercy of the quality of service provided by the supplier. Any dissatisfaction cannot be remedied easily, if at all. At the same time, the only action available to the user is to boycott the system. The user community, but not individual users, has two needs to be satisfied, namely unfettered access to data, and similarly to the code. The former to process their own data in anyway they wish to determine and the latter to change the processing to any form they wish. These requirements will only be satisfied when data is decoupled from its storage technology and likewise the decoupling of data presentation from data processing and storage. Whilst using open source code is the optimal strategy for any user to fulfil these requirements, any contract should at least have a provision that enables the user to gain access to the data in their own suitable form and code as needed.
4. Separation of bureaucratic data collection needs from clinical needs is self-deluding and leads to a dysfunctional CIS. The information collected at the point of care is the fundamental data of a health service from which all other data about patient care is derivative. Putting the best effort into collecting the information for the best clinical care will also provide the best administrative data. The bureaucrats need to spend their best efforts at satisfying the clinical needs for information systems to get the best results for their own administrative needs.
5. We can also look to successful broad scale implementations to contrast the situation we have in NSW. Examples of the most successful large organisational IT implementations are Kaiser Permanente in the western USA, Intermountain Healthcare from Utah, and the Department of Veterans Affairs of the US government. Both systems are hall marked by long incremental development times over many years and clinician role at the centre of system design and adoption.

## A WAY FORWARD

Any way forward will have its own difficulties and will not provide instant rectification of the current situation. The very first change has to be to adopt a more representative view of the nature of the problem and the tasks to be achieved to solve them. There are two fundamental tenets that are required, namely:

- The problem of defining a CIS for ED is non-deterministic, that is, the range of things that can change within a single workplace cannot be totally predicted in advance and the range of system variables across 200 hospitals are likewise, but more so. This provides the critical requirement that any CIS has to be changeable promptly and at the will of each independent clinician community. In this point Garling was misled by NSWHealth providing a trivialising case of the ED work, leading him to an unworkable proposal. (14.211).
- The whole point of the exercise is that the user requirements are paramount as reinforced by Garling. Clinical Information Systems if they are going to work effectively have to be built to serve the work processes of the clinicians, otherwise they will work inefficiently or be boycotted entirely, and subsequently waste money and increase health costs rather than lower them. Administrative service derived from clinical work will be far more effective and comprehensive if the clinicians are using effective CISs rather than ineffective ones.

A good solution will provide both a short term and long term strategy. The most severe critics of Firstnet assert that it is irredeemable and a risk to patient safety. This argues for it being withdrawn from the coalface of work. At the same time, there are a large number of hospitals that will benefit from an effective ED clinical information system. The first stage of work should be to design a context adaptable user interface that uses some standard storage strategies for the backend which might well be a Cerner module or not as the case may be. This strategy gives credence to the notion that incremental development provides the most effective method of getting clinicians committed to the technology and allows them to customise the system to their workflow. This work should be carried out in association with the Australian Medical Software industry. Secondly, the software code should be open source so that there is no vendor lock-in for AHSs and NSWHealth and so that we escape the unhealthy coercive co-operation that currently mars the Firstnet rollout. Concomitantly, as a colleague proposed, “we need to develop a serious framework for assessing suitability of software for clinical use and run various choices against the framework. The issues will be application specific, hospital size specific, technology specific, workflow specific etc.”

The longer term strategy should focus on supporting research and development in the software engineering of clinical information systems in collaboration with the Australian Medical Software industry, as that is the only way we will find effective methods of coping with the non-determinism of the problem. Among other things, there is a strong expectation that IT will assist in the cost reduction of delivering health services to an ageing population. However, this will not be achieved using the current model of buying large over-priced and under-scoped systems from overseas, but rather they will increase the costs significantly. At the same time, Australian technologists are among the best in the world and can provide better and more appropriate solutions to this critical national problem. The government should support them for all our benefit.

**What should a Clinical Information System look like? (to be continued in the next essay – Ockham’s Razor of Design for Clinical Information Systems)**

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<sup>8</sup> <http://www.e-health-insider.com/news/item.cfm?ID=2592>

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<sup>11</sup> Gio Weiderhold, <http://infolab.stanford.edu/pub/gio/2009/CS207-4.pdf>

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