Hospital safety and hospital acquired infection

Anthony Morton MSc(Appl), MD, MS
Infection Management Services, Princess Alexandra Hospital, Brisbane, QLD

Abstract

The current practices of target setting and comparing institutions via 'league tables' regarding their infection control systems are considered to of limited use. An alternative method of monitoring, known as PDCA, is discussed; P (plan), D (do or implementation of the system), C (check or surveillance) and A (act or feedback of results). To successfully implement such a method in our hospitals, it must be established from the 'bottom-up' and be seen to be both evidence-based and tailored for the individual institution's specific needs.

Introduction

When comparing institutions, current practice is to set targets and collect data, usually annually, for example with league tables. In our view, this is a flawed approach that is, at least in part, responsible for recent lack of improvement in hospital safety in spite of a great deal of activity for this purpose [1].

An analogy

I take grandchildren to Akido lessons each week. Children are frequently involved in physical games; learning how to fall safely is important and Akido teaches them, among other things, this valuable skill. The Akido teachers take great care as they patiently help the children learn how to fall safely. Under their watchful eyes, the children learn the *system* of safe falling.

Imagine how you, as a parent, would feel if the teachers came out and said: "OK, today your target is to fall safely 90% of the time – go ahead and practise falling". The object is to learn the system of falling safely so that it *always* happens. Some children would probably be tempted to learn some trick that made them appear to fall safely without properly mastering the system of safe falling. Someone might break an arm. And how on earth could this setting targets help the children learn the system of safe falling?

Think what your response would be if the teachers lined all the children up and told them to fall a number of times so that the number of unsafe falls could be counted for each child and they could be ranked in a league table. You would want your child to learn the system of falling safely, not to be compared to see if he or she is better or worse than other children. In addition, perhaps your child was having a rough day and fell badly 50% of the time (and risked injury) or was having a good day and did not fall badly at all. In either case, he or she may be rewarded or not rewarded on outcomes that depended largely on what is really random variation. Perhaps your child might be more or less experienced than other children and therefore, to make comparisons fair, some form of risk-adjustment would be required to weight the outcomes in an attempt to obtain a 'level playing field'. However, in the end, you would want to know if such a comparison improved your child's ability to master the system of safe falling. It is very difficult to see how it could do so.

Targets and comparisons of hospitals

This simple analogy is directly applicable to the problem of hospital safety. Targets reward those who know how to work within a system, not those who strive to make it a better one [2]. They encourage short-term quick-fix behaviour, not change to implement safe systems based on evidence [3, 4]. A good example is the UK's National Health Service (NHS) setting targets for MRSA bacteraemia [5]. An example of the practice of collecting data and using them for making comparisons has recently been reported in *Australian Infection Control* [6]. The NHS mandated reporting of MRSA bacteraemia in 2001 and has set targets of a yearly 20% reduction for 3 years. However, Spiegelhalter [5] has shown that "recent annual changes in MRSA rates have been dominated by chance variability" and "reliable annual reporting of reductions in MRSA rates in individual trusts is not generally feasible".

In Victoria, VICNISS collects ventilator associated pneumonia (VAP) data for Victorian hospitals and reports the results back to the individual participating hospitals "in order to make comparisons with the Victorian State aggregate VAP rate"[6]. This surveillance has been received indifferently by Victorian ICU directors and only a minority currently participate. The diagnosis of VAP is difficult as there are conditions other than VAP that produce fever, leucocytosis and pulmonary infiltrates in ventilated patients.

What can be done?

Modern quality improvement (QI) was begun about 150 years ago by Florence Nightingale. Walter Shewhart, in the 1920s and 1930s, revolutionised QI when he described the cycle subsequently named after him – the Shewhart PDCA cycle [2]. This stands for P (plan), D

(do or implementation of the system), C (check or surveillance) and A (act or feedback of results).

Plan

The first thing to do is always ensure that the *system* has been planned properly. The central role of the system in hospital practice has been emphasised by a number of experts in hospital quality and safety [7-10]. Brennan, Gawande, Thomas and Studdert [1] stress the importance of employing evidence-based practice when planning and implementing safe systems.

Thus, the first thing to do when attempting to reduce MRSA bacteraemia is to understand what constitutes evidence-based practice for preventing MRSA transmission and for optimising the care of intravenous devices. Unfortunately, there is still much to be learned and it is important to work towards filling the gaps. Mathematical modelling [11] will have an important role in doing this as it has the ability to isolate and quantify the system attributes that are of the greatest importance. Central authorities should be encouraging this activity.

The same principles apply to VAP. It is almost certain that the majority of ICUs have gone to great lengths to achieve systems of care of ventilated patients that employ evidence-based practice. However, optimising systems requires both leadership and teamwork on the ward together with strong management participation. Thus, rather than issuing targets and doing judgmental surveillance, central authorities should first be forming collaborations with hospital staff to ensure that their hospital systems conform to evidence-based practice. Friedman, Russo and Richards [6] describe how they do this using a "ventilator bundle".

Hughes [12] describes how a system that was producing excessive numbers of surgical site infections (SSIs) was analysed and optimised employing evidence-based practice. When this has been achieved, the system will, barring unforeseen events, perform in a stable, reproducible way. Getting the system right first is the key to hospital safety.

Do and Check

The roles of the central authority and the hospital staff need to be considered. We believe that it is logical for the central authority to undertake process surveillance to ensure that the evidence-based practice system is sustained. Friedman, Russo and Richards [6] describe this process surveillance for VAP. We also believe that, when the hospital's system is corrected and it is performing in a stable, reproducible way, it is the responsibility of the hospital staff to undertake sequential process and outcome surveillance to ensure that this state is maintained. This should help to get prompt warning if some unforeseen problem arises or to observe the response to a system change as new evidence accumulates. It is logical for the central authority to insist that such sequential monitoring occurs, that there is evidence that any change detected by this monitoring is followed up, and that any problem detected is dealt with.

Within-hospital sequential monitoring can take advantage of the modern statistical process control (SPC) methods that are now available [13]. For example, total monthly *Staphylococcus aureus* bacteraemias should be relatively easy to count precisely [14] and to display in Shewhart/EWMA charts or CUSUM charts. As Friedman, Russo and Richards [6] observe, VAP cases cannot be counted with such precision. However, a search for a possible cause would usually be indicated if a hospital, having implemented an evidence-based system, were to observe a *change* in the number of VAP-like syndromes that occur.

There are some adverse events (AEs) and 'near misses' that may be unsuitable for SPC analysis. For example, device-related MRSA bacteraemia occurs relatively infrequently, yet it is of particular importance, so consideration should be given to an independent audit of each case reported. The well-received Scottish surgical audit, where every surgical death is audited independently, appears to have been highly successful [15]. It may prove to be equally useful for analysing serious less common AEs such as device-related MRSA bacteraemia and endophthalmitis as well as unusual patterns of AEs such as unplanned return to operating theatre, unplanned postoperative admission to intensive care, or prolonged postoperative length of stay.

Act

Having a strong feedback mechanism that ensures that process and outcome surveillance results are made known to responsible staff in a timely manner is vital for keeping evidence-based systems on track. St George's Hospital in London [16] takes this feedback a step further by displaying results on the Internet. However, this needs to be done by individual hospitals using their own carefully collected and accurately analysed data, not centrally aggregated data that may be of questionable quality and relevance [17]. To ensure accuracy, such individual hospital data could be audited independently.

Conclusion

Approaches to hospital activity based on targets and comparisons are top-down methods implemented by central authorities for their use. When it comes to improving safety, they are logically and practically unsound. It is only by concentrating on bottom-up approaches that make evidence-based systems the centrepiece that we will make our hospitals safer.

References

1. Brennan T, Gawande A, Thomas E & Studdert D. Accidental deaths, saved lives, and improved quality. N Eng J Med 2005; 353:1405-1409.
2. Deming W. Out of the Crisis. Cambridge: Cambridge University Press, 1982, p.65ff.
3. Pitches D, Burls A & Fry-Smith A. How to make a silk purse from a sow's ear: a comprehensive review of strategies to optimise data for corrupt managers and incompetent clinicians. BMJ 2003; 327:1436-1439.
4. Hitchen. Bid to cut waiting lists has pushed safety down NHS agenda. BMJ 2006; 332:324.

5. Spiegelhalter D. Problems in assessing rates of infection with Methicillin resistant *Staphylococcus aureus*. BMJ 2005; 331:1013-1015.
6. Friedman D, Russo P & Richards M. Surveillance of ventilator-associated pneumonia: the challenges and pitfalls. Aust Infect Cont 2005; 10:122-125.
7. Batalden P & Stoltz P. A framework for the continual improvement of health care. J Qual Improve 1993; 19:424-447.
8. Berwick D. A primer on leading the improvement of systems. BMJ 1996; 312:619-622.
9. Nolan T. Understanding medical systems. Ann Int Med 1998; 128:293-298.
10. Vincent C. Analysis of clinical incidents: a window on the system not a search for root causes. Qual Saf Health Care 2004; 13:242-243.
11. Grundmann H & Hellriegel B. Mathematical modeling: a tool for hospital infection control. Lancet Infect Dis 2006; 6:39-45.
12. www.changechampions.com.au/Infections%20Web/Susan%20Hughes.pdf
13. Montgomery D. Introduction to Statistical Quality Control (5th ed). New York: John Wiley and Sons, 2005.
14. Dreimanis D, Beckingham W, Collignon P & Roberts J. Staphylococcus aureus bacteraemia surveillance: a relatively easy to collect but accurate clinical indicator of serious healthcare associated infections and antibiotic resistance. Aust Infect Cont 2005; 10:127-130.
15. Thompson A & Stonebridge P. Building a framework for trust: critical event analysis of deaths in surgical care. BMJ 2005; 330:1139-1142.
16. www.st-georges.org.uk/
17. Christie B. Published death rates may distort work of Scottish surgical 'heroes'. BMJ 2006; 332:324.