

'Between the flags': implementing a rapid response system at scale

Clifford Hughes,¹ Charles Pain,² Jeffrey Braithwaite,³ Kenneth Hillman⁴

¹Clinical Excellence Commission, Sydney, Australia

²Health Systems Improvement, Clinical Excellence Commission, Sydney, Australia

³Centre for Clinical Governance Research, Australian Institute of Health Innovation, University of New South Wales, Sydney, Australia

⁴Simpson Centre for Health Services Research, University of New South Wales, Sydney, Australia

Correspondence to

Professor Jeffrey Braithwaite, Faculty of Medicine, University of New South Wales, Sydney, NSW 2052, Australia; j.braithwaite@unsw.edu.au

Received 15 January 2014

Revised 28 March 2014

Accepted 31 March 2014

ABSTRACT

While many hospitals are implementing rapid response systems (RRSs) to attend to deteriorating patients in a systematic way, there is little documented evidence on system-wide approaches to adopting RRSs. Here, we report on an initiative which enrolled 220 hospitals in New South Wales, Australia. The 'between the flags' approach was modelled on Australia's surf lifesaving experience, where qualified lifesavers perform thousands of rescues each year. Patients in hospitals who are identified as being 'between the flags' are given special attention, just like beach goers.

RAPID RESPONSE: A HOSPITAL-WIDE SUCCESS STORY

The confronting evidence on the scale of iatrogenic harm dating from the 1980s¹ has created much pressure on acute hospitals to make them safer for patients. Despite the growth of an impressive patient safety industry² with many activities including incident reporting, root cause analysis and hand hygiene initiatives, there seems to have been limited impact on the incidence of mortality or reductions in the rates of adverse events.³

Aside from celebrated success stories in specialised areas, such as central line infections in intensive care⁴ and checklists in theatres,⁵ one hospital-wide initiative stands out. Rapid response systems (RRSs), first developed in the early 1990s,⁶ have been gradually adopted as a safety net in many hospitals around the world. When a seriously ill and at-risk patient is identified, an appropriately trained clinical team is triggered for urgent consultation, bypassing the often slow and rigid hospital referral systems.

RRSs are unique in several ways. They were developed from the bottom up by clinicians. They are a specific response to the serious yet common problem of undetected deteriorating patients and they operate across the entire hospital.

Until now, there have been few mandated large-scale implementations of RRSs at a jurisdictional level, leaving individual hospitals largely to go it alone with designing and implementing their own systems. Yet RRSs have reduced mortality and cardiac arrests by about one third.^{7 8}

LIFESAVING ON THE BEACH AND IN THE WARD

Analogously, in Australia, volunteer lifesavers have, over the decades, refined a simple but effective system for dramatically reducing the risks for beach goers in the face of challenging ocean conditions that can deteriorate without warning, as can patients in our care. Qualified lifesavers stake out a safe section of the beach with two red and yellow flags ([figure 1](#)). They then patrol that area and react immediately if anyone seems to be getting into trouble or drifting outside the flags. Thousands of rescues occur each year.⁹

Building on the principle of early recognition of danger signals based on simple vital sign measurement, the New South Wales (NSW) health system in Australia has designed and implemented a multi-element standardised trigger and escalation system for its 220 hospitals. This new system is called 'Between the Flags' (BtF). It was designed by the Clinical Excellence Commission (CEC), a body responsible for patient safety and quality of care. The system has the support of government and management, and implementation occurred under the direction and advice of clinicians working with the CEC.

Vital sign charts at the end of patients' beds, or their electronic equivalent, are used in acute hospitals around the world. In NSW hospitals, these have been redesigned and standardised so that vital signs can be tracked over time and clinicians can more easily see whether these are normal or abnormal. These standard adult general observation (SAGO) charts

To cite: Hughes C, Pain C, Braithwaite J, et al. *BMJ Qual Saf* Published Online First: [please include Day Month Year] doi:10.1136/bmjqs-2014-002845



Figure 1 Swim between the flags campaign. Courtesy of Surf Life Saving Australia.

are the foundation of the BtF system; there are also analogous age-group specific charts for children and a maternity chart.

THE FLAGS IN OPERATION: CALLING CRITERIA

Each of the vital signs is graphed separately and in colour coded bands, with two escalation zones for each observation: yellow and red, evoking the beach flag imagery. These can be seen in the chart shown in [figure 2](#). The calling criteria are: respiratory rate/min 6–10 and 25–29 (yellow zone, early warning signs), ≤ 5 and ≥ 30 (red zone, late warning signs); blood oxygen saturation (SpO_2 , %) 91–95 (yellow), ≤ 90 (red); heart rate/min 41–50 and 120–139 (yellow), ≤ 40 and ≥ 140 (red); systolic blood pressure (mm Hg) 91–99 and 180–199 (yellow), ≤ 90 and ≥ 200 (red); consciousness (AVPU scale) verbal (yellow), pain or unresponsive (red); and temperature $\leq 35.5^\circ\text{C}$ and $\geq 38.5^\circ\text{C}$ (yellow), nil criteria (red).

Observations ‘between the flags’ indicate a stable and safe patient. Dangerous levels of vital signs are marked in the red zone on the chart. Whenever a nurse enters a reading in the red zone, an immediate referral must be made to the RRS team. The response occurs with the same urgency that cardiac arrest and surf lifesaving requires, but hopefully well before the patient has arrested or died.

The yellow zone defines patients whose vital signs are out of the normal range, on the cusp of drifting outside the flags, but do not yet require an urgent response. These patients must be monitored, and seen by someone from the admitting or home team within half an hour if the nurse in charge of the ward considers this necessary. However, if the patient in the meantime enters the red zone or if the nurse has concern about the patient, a call for urgent assistance can be made at any time.

The aim is to guarantee that the patient, like the swimmer in the surf, is as safe as possible, no matter what the cause of the deterioration. Thus, whether it is a new situation or related to issues such as a procedural complication or error, the patient’s at-risk status can be recognised early and responded to appropriately. The BtF system ensures that patients are in the safest place and imposes on all healthcare staff a duty of care to watch over them, no matter who their doctor may be.

When the alarm is triggered in the red zone, the response is immediate. No one wastes time phoning treating specialists or tracking down admitting doctors. The rapid response ‘lifesavers’—in the form of appropriate ICU clinicians with advanced life support skills—respond immediately to any part of the hospital. When the yellow zone is in play, thoughtful consideration of early intervention or repeat observation can be critical. To quote a lifesaver on the *Bondi Rescue* TV show, “if we wait until the swimmer raises their hand it is often too late”.

SYSTEMS DESIGN AND UPTAKE

Designers of the BtF programme were conscious that their new system would have to strike a reasonable balance between false positive and false negative calls, particularly in the yellow zone. Too many false positives could overwhelm the system and undermine its credibility. Too many false negatives could similarly undermine confidence in the system by causing it to fail in its main purpose. The problem of oversensitivity (false positives, particularly in the yellow zone) was managed in two ways: (1) through education to improve clinical judgement regarding recognition of deterioration and (2) allowing discretion and consultation with a more senior clinician regarding whether to escalate.

Thresholds for the red zone are based on the well known Medical Emergency Team (MET) criteria, and are well established as being late warning signs.¹⁰ There is no discretion in this zone, and false positives are much less of a problem.

Implementation across NSW has required an organisation-wide effort at multiple levels, a large coalition of partners, and a system designed with sustainability in mind. Patience, faith and perseverance over several years are all hallmarks of successful ‘big change’ projects.^{11–13}

NSW Health		FAMILY NAME		MRN																																																								
GIVEN NAME																																																												
D.O.B. / /		M.O.																																																										
ADDRESS																																																												
LOCATION																																																												
STANDARD ADULT GENERAL OBSERVATION CHART																																																												
<input type="checkbox"/> Altered Calling Criteria																																																												
ALL OBSERVATIONS MUST BE GRAPHED																																																												
COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE																																																												
<table border="1"> <thead> <tr> <th>Date</th> <th>Time</th> <th>Date</th> <th>Time</th> </tr> </thead> <tbody> <tr><td colspan="4">Respiratory Rate</td></tr> <tr><td colspan="4">SpO₂%</td></tr> <tr><td colspan="4">O₂Lpm</td></tr> <tr><td colspan="4">Key: RA = Room Air, NP = Nasal Prong, FM = Simple facemask, NRB = Non Re-Breather, VM = Venturi Mask</td></tr> <tr><td colspan="4">CIRCULATION</td></tr> <tr><td colspan="4">Blood Pressure (mmHg)</td></tr> <tr><td colspan="4">Heart Rate *</td></tr> <tr><td colspan="4">Rhythm</td></tr> <tr><td colspan="4">Rhythm</td></tr> <tr><td colspan="4">DISABILITY</td></tr> <tr><td colspan="4">Neurological</td></tr> <tr><td colspan="4">Enter appropriate letter: A = Alert, V = Rousable by voice (conduct GCS), P = Rousable only by pain (conduct GCS), U = Unresponsive</td></tr> <tr><td colspan="4">Initials</td></tr> </tbody> </table>					Date	Time	Date	Time	Respiratory Rate				SpO ₂ %				O ₂ Lpm				Key: RA = Room Air, NP = Nasal Prong, FM = Simple facemask, NRB = Non Re-Breather, VM = Venturi Mask				CIRCULATION				Blood Pressure (mmHg)				Heart Rate *				Rhythm				Rhythm				DISABILITY				Neurological				Enter appropriate letter: A = Alert, V = Rousable by voice (conduct GCS), P = Rousable only by pain (conduct GCS), U = Unresponsive				Initials			
Date	Time	Date	Time																																																									
Respiratory Rate																																																												
SpO ₂ %																																																												
O ₂ Lpm																																																												
Key: RA = Room Air, NP = Nasal Prong, FM = Simple facemask, NRB = Non Re-Breather, VM = Venturi Mask																																																												
CIRCULATION																																																												
Blood Pressure (mmHg)																																																												
Heart Rate *																																																												
Rhythm																																																												
Rhythm																																																												
DISABILITY																																																												
Neurological																																																												
Enter appropriate letter: A = Alert, V = Rousable by voice (conduct GCS), P = Rousable only by pain (conduct GCS), U = Unresponsive																																																												
Initials																																																												

Page 2 of 4

NSW Health		FAMILY NAME		MRN																																																																																																																								
GIVEN NAME																																																																																																																												
D.O.B. / /		M.O.																																																																																																																										
ADDRESS																																																																																																																												
LOCATION																																																																																																																												
STANDARD ADULT GENERAL OBSERVATION CHART																																																																																																																												
<input type="checkbox"/> Altered Calling Criteria																																																																																																																												
ALL OBSERVATIONS MUST BE GRAPHED																																																																																																																												
COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE																																																																																																																												
<table border="1"> <thead> <tr> <th>Date</th> <th>Time</th> <th>Date</th> <th>Time</th> </tr> </thead> <tbody> <tr><td colspan="4">EXPOSURE</td></tr> <tr><td colspan="4">Temperature (°C)</td></tr> <tr><td colspan="4">Pain</td></tr> <tr><td colspan="4">Assess pain level at rest and with movement. Enter R for at rest, M for movement</td></tr> <tr><td colspan="4">Severe (7-10)</td></tr> <tr><td colspan="4">Moderate (4-6)</td></tr> <tr><td colspan="4">Mild (1-3)</td></tr> <tr><td colspan="4">No pain</td></tr> <tr><td colspan="4">Initials</td></tr> <tr><td colspan="4">Date</td></tr> <tr><td colspan="4">Time</td></tr> <tr><td colspan="4">BGL</td></tr> <tr><td colspan="4">Date</td></tr> <tr><td colspan="4">Bowel</td></tr> <tr><td colspan="4">Date</td></tr> <tr><td colspan="4">Weight</td></tr> <tr><td colspan="4">Daily</td></tr> <tr><td colspan="4">Date</td></tr> <tr><td colspan="4">Time</td></tr> <tr><td colspan="4">SG</td></tr> <tr><td colspan="4">pH</td></tr> <tr><td colspan="4">Leuk</td></tr> <tr><td colspan="4">Blood</td></tr> <tr><td colspan="4">Nitrite</td></tr> <tr><td colspan="4">Ketones</td></tr> <tr><td colspan="4">Bilirubin</td></tr> <tr><td colspan="4">U/Bil</td></tr> <tr><td colspan="4">Protein</td></tr> <tr><td colspan="4">Glucose</td></tr> </tbody> </table>					Date	Time	Date	Time	EXPOSURE				Temperature (°C)				Pain				Assess pain level at rest and with movement. Enter R for at rest, M for movement				Severe (7-10)				Moderate (4-6)				Mild (1-3)				No pain				Initials				Date				Time				BGL				Date				Bowel				Date				Weight				Daily				Date				Time				SG				pH				Leuk				Blood				Nitrite				Ketones				Bilirubin				U/Bil				Protein				Glucose			
Date	Time	Date	Time																																																																																																																									
EXPOSURE																																																																																																																												
Temperature (°C)																																																																																																																												
Pain																																																																																																																												
Assess pain level at rest and with movement. Enter R for at rest, M for movement																																																																																																																												
Severe (7-10)																																																																																																																												
Moderate (4-6)																																																																																																																												
Mild (1-3)																																																																																																																												
No pain																																																																																																																												
Initials																																																																																																																												
Date																																																																																																																												
Time																																																																																																																												
BGL																																																																																																																												
Date																																																																																																																												
Bowel																																																																																																																												
Date																																																																																																																												
Weight																																																																																																																												
Daily																																																																																																																												
Date																																																																																																																												
Time																																																																																																																												
SG																																																																																																																												
pH																																																																																																																												
Leuk																																																																																																																												
Blood																																																																																																																												
Nitrite																																																																																																																												
Ketones																																																																																																																												
Bilirubin																																																																																																																												
U/Bil																																																																																																																												
Protein																																																																																																																												
Glucose																																																																																																																												

Page 3 of 4

Figure 2 New South Wales (NSW) standard adult observation chart with 'yellow' and 'red' zones. Courtesy of the Clinical Excellence Commission.

Uptake across the system following an extended preparation period was surprisingly rapid. New charts were delivered to each facility before Christmas 2009 with a projected starting date of 15 January 2010. Many wards began using the charts on delivery. Junior staff, both medical and nursing, were at first sceptical of 'extra paperwork' but rapidly embraced the concept now that they had authority to call for help earlier and with better outcomes. Early results based on our experience with the system to date suggest a small increase in 'yellow zone calls' but a dramatic decrease in red zone or cardiac arrest calls.

BtF challenges long established hierarchies in healthcare, empowering whoever is on the spot to make the call that saves lives. Consider the entirely avoidable tragedy of Sydney teenager, Vanessa Anderson, whose death in November 2005 triggered the inquiry which stimulated the state-wide adoption of the BtF system in early 2010. Vanessa, whose skull was fractured by a golf ball, died of respiratory arrest in hospital due to overprescribed painkillers and a failure to recognise her deteriorating condition.^{14 15}

THE FUTURE

RRSs have been shown to have a considerable impact in preventing cardiac arrests and deaths.^{7 8} What is new is the successful implementation of the novel, multi-element BtF system at scale in over 220 hospitals in a large health jurisdiction.

In 2011, Surf Life Saving Australia reported 4605 rescues and 20 drowning deaths on beaches they patrolled.¹⁶ Not a single drowning was recorded between the flags. That kind of result is worth chasing.

Contributors All authors contributed to the writing of the paper and are integrally involved in the design and execution of the 'Between the Flags' project.

Competing interests CH is the CEO and CP was a director of the Clinical Excellence Commission at the time of writing. This did not create any conflicts of interest.

Funding KH and JB receive competitive funding from the National Health and Medical Research Council, the Australian Research Council, the NSW Cancer Institute and other sources for their research in patient safety, translational research and implementation science.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Kohn LT, Corrigan JM, Donaldson MS, *et al.* *Medicine I. To err is human: building a safer health system.* National Academies Press, 2000.
- 2 Braithwaite J, Coiera E. Beyond patient safety Flatland. *J R Soc Med* 2010;103:219–25.
- 3 Pain C, Johnson J, Amalberti R, *et al.* In safe hands: releasing the potential of clinical teams. *8th International Organisational Behaviour in Healthcare Conference. Patient Centred Health Care Teams: Achieving Collaboration, Communication and Care.* Ireland: Trinity College Dublin, 2012.
- 4 Pronovost P, Needham D, Berenholtz S, *et al.* An intervention to decrease catheter-related bloodstream infections in the ICU. *N Engl J Med* 2006;355:2725–32.
- 5 Haynes AB, Weiser TG, Berry WR, *et al.* A surgical safety checklist to reduce morbidity and mortality in a global population. *N Engl J Med* 2009;360:491–99.
- 6 DeVita MA, Hillman K, Bellomo R. Medical emergency teams: implementation and outcome measurement. Springer, 2007.
- 7 Chan PS, Jain R, Nallmothu BK, *et al.* Rapid response teams: a systematic review and meta-analysis. *Arch Intern Med* 2010;170:18–26.
- 8 Chen J, Bellomo R, Flabouris A, *et al.* The relationship between early emergency team calls and serious adverse events. *Crit Care Med* 2009;37:148–53.
- 9 Surf Life Saving Australia. Annual Report 2012/2013, 2013.
- 10 Lee A, Bishop G, Hillman KM, *et al.* The medical emergency team. *Anaesth Intensive Care* 1995;23:183–6.
- 11 Braithwaite J, Westbrook M, Nugus P, *et al.* A four-year, systems-wide intervention promoting interprofessional collaboration. *BMC Health Serv Res* 2012;12:99.
- 12 Benn J, Burnett S, Parand A, *et al.* Studying large-scale programmes to improve patient safety in whole care systems: challenges for research. *Soc Sci Med* 2006;69:1767–76.
- 13 Braithwaite J, Mannion R. Managing change. In: Walshe K, Smith J, eds. *Healthcare management.* 2nd edn. Milton Keynes, UK: Open University Press, 2011:429–53.
- 14 Milovanovich C, NSW Deputy State Coroner. Inquest into the death of Vanessa Anderson. Westmead File No. 161/2007. Sydney: Westmead Coroner's Court, 24 January 2008.
- 15 Travaglia JF, Lloyd JE, Braithwaite J. Another inquiry into public hospitals? *Med J Aust* 2008;188:437–8.
- 16 Surf Life Saving Australia. Coastal drowning toll reduced. [Media Release] 28 February 2011. <http://sls.com.au/content/summer-coastal-drowning-toll-reduced> (accessed 3 Apr 2014).

**BMJ Quality
& Safety**

'Between the flags': implementing a rapid response system at scale

Clifford Hughes, Charles Pain, Jeffrey Braithwaite, et al.

BMJ Qual Saf published online April 16, 2014

doi: 10.1136/bmjqs-2014-002845

Updated information and services can be found at:

<http://qualitysafety.bmj.com/content/early/2014/04/16/bmjqs-2014-002845.full.html>

These include:

References

This article cites 9 articles, 1 of which can be accessed free at:

<http://qualitysafety.bmj.com/content/early/2014/04/16/bmjqs-2014-002845.full.html#ref-list-1>

P<P

Published online April 16, 2014 in advance of the print journal.

Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Notes

Advance online articles have been peer reviewed, accepted for publication, edited and typeset, but have not yet appeared in the paper journal. Advance online articles are citable and establish publication priority; they are indexed by PubMed from initial publication. Citations to Advance online articles must include the digital object identifier (DOIs) and date of initial publication.

To request permissions go to:

<http://group.bmj.com/group/rights-licensing/permissions>

To order reprints go to:

<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:

<http://group.bmj.com/subscribe/>