



Patients at Risk of Critical Illness and The Observation Chart



compass



Back to Basics



compass

Patients at Risk of Critical Illness

Underlying issue

- Inadequate oxygen delivery to the tissues for their metabolic demand leading multiple organ dysfunction.

Solution to patients at risk

- Identify early the cause of inadequacy, treat and monitor response to therapy

Improved outcome

- Dependent upon treatment

Patients at Risk of Critical Illness

Oxygen Delivery

Cardiac Output x Arterial Oxygen Content

Provides O₂ for oxidative phosphorylation to provide energy (ATP)

Patients at Risk of Critical Illness

Oxygen Delivery

- Inability to measure in the ward setting
- Unable to delineate absolute number
(needs to match metabolic demand)
- Optimising oxygen delivery has only improved outcome in specific settings
- Surrogate markers in the ward setting:
"vital signs"





DO₂, Vital Signs

Pulse

$$DO_2 = (SV \times HR) \times ([Hb] \times SaO_2 \times 1.39) + PaO_2 \times 0.003$$

Blood pressure

$$DO_2 = BP/TPR \times ([Hb] \times SaO_2 \times 1.39) + PaO_2 \times 0.003$$

Respiratory rate

Neurogenic factors:

Chemical Factors: H⁺, pO₂

Temperature

Indication of infection



Observation of Vital Signs

- Determine cause of inadequacy of oxygen delivery
- Trend of observations: response to treatment
detect early derangement
- Trigger a response to derangement
- Tells a story:
important as we are shift workers and poor at
handover/communication
- Observation chart is a place for measurement (not
only vital signs)

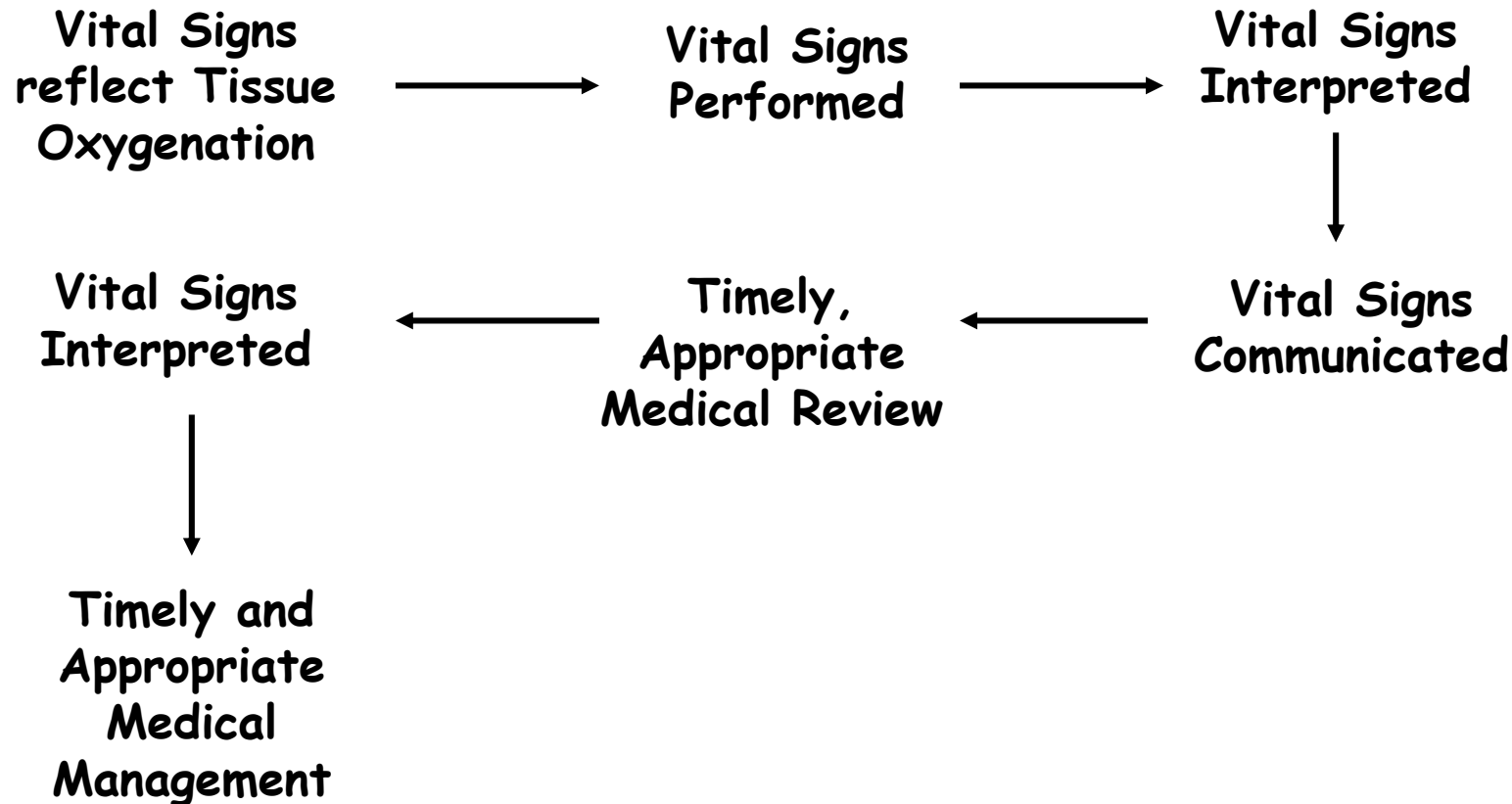


Observations and Florence Nightingale

- But if you cannot get the habit of observation one way or other, you had better give up the [idea of] being a nurse
- There are a great many observations, of much importance, both physiologically and practically, which might be made by nurses, if they were educated to observation, and, indeed, can only be made by nurses or those who are always with the sick.*
- To make strict observations of the sick in the following particulars:
The state of secretions, expectoration, pulse, skin, appetite, intelligence, as delirium or stupor; breathing, sleep, state of wounds, eruptions, formation of matter, effect of diet, or of stimulants and of medications. *

*Notes on Nursing What It Is, and What It Is Not.
Florence Nightingale 1898.

Patients at Risk of Critical Illness



Patients at Risk of Critical Illness

Vital Signs reflect Tissue Oxygenation?

- Surrogate marker
- Relationship between pressure and flow
- Relationship between DO_2 and cellular production ATP



Patients at Risk of Critical Illness

Vital Signs Performed?

62 patients, 1 600 observations

Vital sign frequency (readings/day; IQR)

Overall	4.0	(2.0,5.5)
Blood pressure	5.0	(3.5,6.7)
Heart rate	4.5	(3.2,5.8)
Respiratory rate	1.0	(0. 0,1.6)*
Temperature	4.5	(3.0,5.5)

* $p < 0.0001$

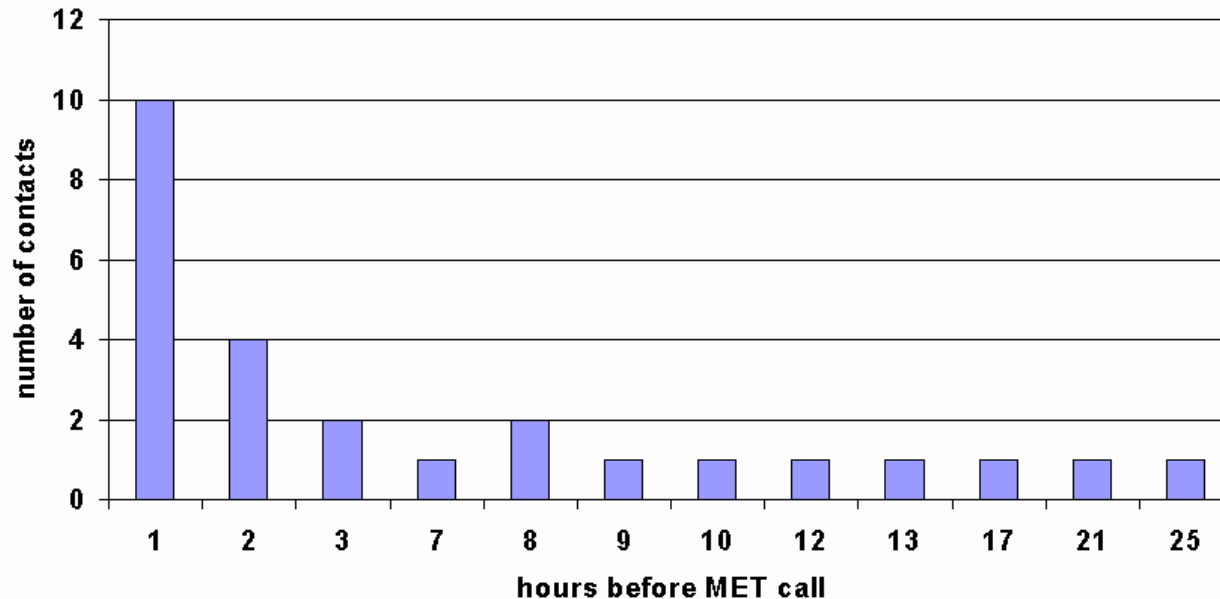
Van Leuvan C, Mitchell I. Crit Care and Resuscitation 2008

Patients at Risk of Critical Illness

Vital Signs Interpreted?

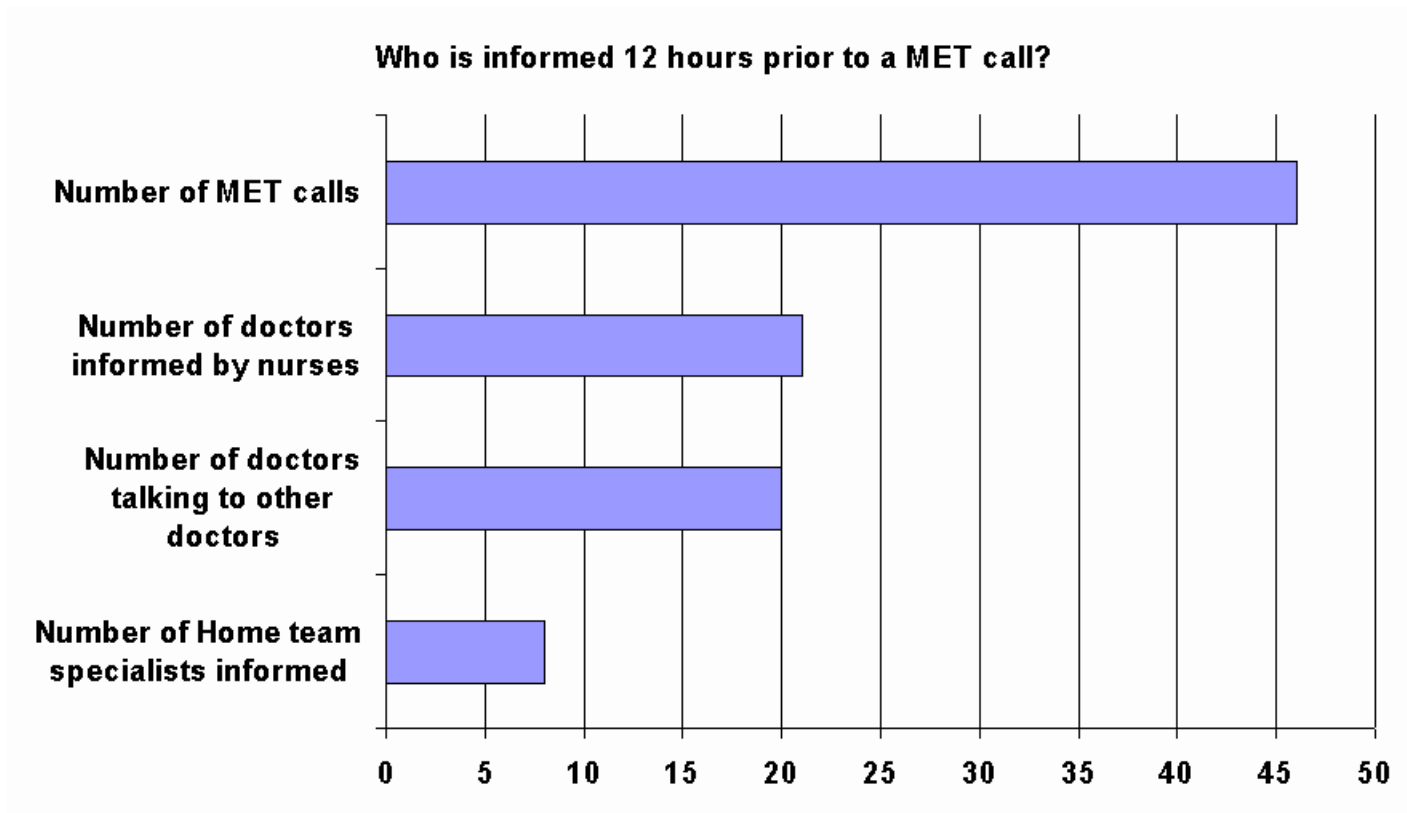
- Long delays before doctors contacted
- 40% MET calls preceded by MET criteria but not acted upon

When was the FIRST contact made prior to the MET-call by a nurse?



Patients at Risk of Critical Illness

Vital Signs Communicated?



Patients at Risk of Critical Illness

Timely, Appropriate Medical Review?

- Reports of long delays for medical review
- Registrars/Consultants often not contacted



Patients at Risk of Critical Illness

Timely and Appropriate Medical Management

NCEPOD: "An acute problem" 2005

- Reviewed 100 unplanned ICU admissions
- 50 had suboptimal management prior to admission



Early Recognition of the Deteriorating Patient

Aim:

To develop a process that enables the early recognition of the deteriorating patient to potentially improve outcome

Early Recognition of the Deteriorating Patient

Hypothesis

Installing a modified early warning score (MEWS) into a general ward would:

- Reduce unplanned admissions to ICU
- Increase documentation of observations
- Decrease the time for an appropriate medical review

The MEWS would have with specific scores triggering a timely appropriate medical review

Early Recognition of the Deteriorating Patient

Study Design

A prospective, controlled, before and after intervention trial



Early Recognition of the Deteriorating Patient

Study population

All patients ≥ 18 years admitted to four general wards during the two study periods

Exclusions

Those admitted for palliative care

Readmissions

Ethics

Waived the need for consent

Early Recognition of the Deteriorating Patient

Three Study Periods

1. Control Period: Feb-June 2006

Study of two wards under normal operating conditions



Early Recognition of the Deteriorating Patient

Study Periods

2. Preparation Period: Sept 2006-Feb 2007

- Focus groups
- Information sessions
- Interdisciplinary education program "COMPASS"
- Design of new general observation



Early Recognition of the Deteriorating Patient

Study Periods

3. Intervention Period: Feb-June 2007

Study of two wards after introduction:
Education, observation chart and MEWS



Early Recognition of the Deteriorating Patient

Data Collection

All patients

- Demographic and logistic data
(age, gender, admission diagnosis, ward, interventional history, planned ICU admission)
- All patients were followed up either to death or hospital discharge
- Outcome data
(length of hospital stay, survival, and whether an unplanned admission to ICU or call of the medical emergency team cardiac had occurred)

Early Recognition of the Deteriorating Patient

Data Collection

A priori subgroup

25% patients randomly selected

- frequency of observations
- time from when the observations deteriorated to an appropriate medical review
- whether appropriate medical management had been implemented

Power Calculation

Would need 400 patients to detect a 50% increase in documentation rate of respiratory rate

Early Recognition of the Deteriorating Patient

Primary outcome

- The frequency of measurement of vital signs



Early Recognition of the Deteriorating Patient

Secondary Outcome

- Incidence of unplanned ICU admissions
- Incidence of in-hospital deaths
- Incidence of attendance of the MET
- Time for appropriate medical review
- Frequency of appropriate medical management
- Duration of hospital stay.



Intervention

1. Interdisciplinary Education: **COMPASS**

DVD, manual, online quiz, 3 hours face-to-face
Back to basics physiology & meaning of vital signs
Be able to communicate in a succinct manner

2. Redesign observation chart

3. Modified Early Warning Score

- Triggers:
 - medical review
 - change in frequency of observations
 - who is to escort patient off ward



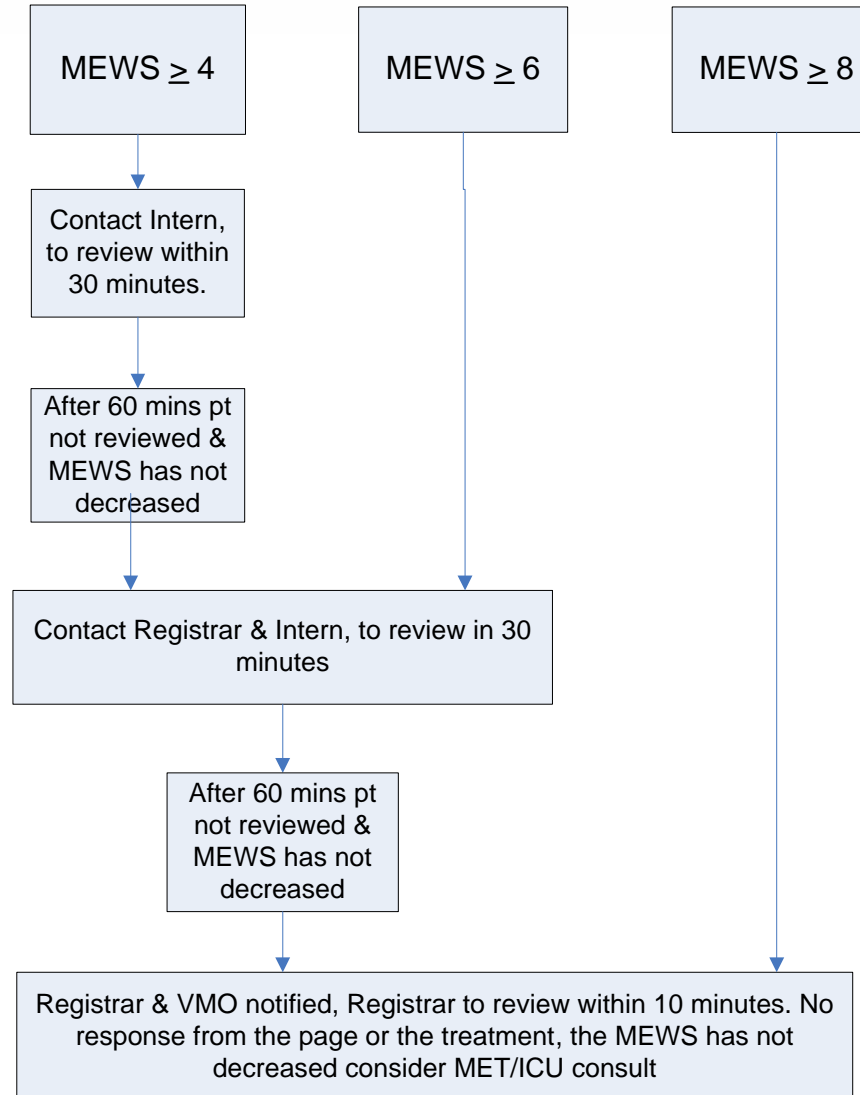
The Canberra Hospital
General Observation Chart

Modified Early Warning Scores	0	1	2	3	Observation chart number:
Date					
Time					
Resp Rate	≥ 36				
MET RR	31 - 35				
< 5 or > 36	21 - 30				
	9 - 20				
	≤ 8				
RR Score					
Oxygen mode (l/min)	≥ 93				
SpO₂	90 - 92				
	85 - 89				
	≤ 84				
SpO₂ Score					
Temp (°C)	≥ 39.6				
	38.6 - 39.5				
	38 - 38.5				
	37 - 37.9				
	36.1 - 36.9				
	35.1 - 36				
	34.1 - 35				
	≤ 34				
Temp Score					
↔ Blood Pressure & Heart Rate (e)	200				
MET criteria HR < 40 or > 140	190				
SBP < 90	180				
	170				
	160				
	150				
	140				
	130				
	120				
	110				
	100				
	90				
	80				
	70				
	60				
	50				
	40				
Score HR					
Score BP (see back)					
Sedation Score	0				
	1				
	2				
	3				
	4				
Sedation Score					
Urine for 4hrs	> 800				
	120 - 800				
	80 - 119				
	< 80				
Urine Score					
TOTAL MEWS					
Pain					
Bowels					
Initial					

General Observation Chart

60201(1007)

Medical Review





Results



compass

Results

	2006	2007
Patients	1137	975
Male	631	536
Age, years	58.2 (19.6)	57.3 (19.7)
Medical (%)	601 (52.9)	495 (50.8)
Hosp. Stay, (IQR)	4.0 (1.8-8.3)	4.8 (2.2-9.8)*

*p<0.05

Vital Sign Frequency

	2006	2007
Patients	414	315
BP	4.5 (3.2, 6.3)	4.8 (3.6, 6.6)*
HR	4.4 (3.2, 6.2)	4.7 (3.4, 6.4)
RR	2.5 (0.8, 4.4)	4.8 (3.4, 6.8)***
Temp	4.2 (3.1, 5.4)	4.7 (3.5, 6.1)**
SaO ₂	4.2 (3.1, 5.7)	4.8 (3.6, 6.8)***

* p<0.05, **p<0.001, *** p<0.0001

Results

	2006	2007	95% CI
Patients	1137	975	
ICU admissions (%)	21 (1.9)	4 (0.4)	0.07, 0.64 **
Hospital Deaths (%)	22 (1.9)	8 (0.8)	0.19, 0.95 *
MET Calls	24 (2.1)	36 (3.7)	1.05, 3.00 *

*p<0.05 **p<0.001



Results

	2006	2007
Patients	1137	975
Cardiac Arrests	4	0
Resp. Failure	7	1
CVA	0	1
AMI	1	2
Sepsis	2	4
PE	4	2
Acute Renal Failure	1	0



Early Recognition of the Deteriorating Patient

Conclusion

Improved documentation vital signs

Reduction ICU admissions

Improvement hospital outcome



Early Recognition of the Deteriorating Patient

Discussion

- Difficulties interpreting before and after trial
- ? Matched cohorts, ? Regression to mean
- Not designed to detect differences in outcome
- Unclear why patients improved

Project to Program

- New Obs Chart/MEWS/COMPASS to all acute clinical areas in ACT Health
- Governance arrangements completed
- Ongoing Data Collection/Review/Reports to Clinical Areas
- Monthly Newsletter
- Continuing support from ACT Health
- Development specific charts/community

COMPASS Roll Out

Nursing staff

- Calvary Hospital: 468
- The Canberra Hospital: 785

Medical Staff

Interns/RMOs: 70

Undergraduates (2008)

University of Canberra/ACU

Nursing students: 164

Australian National University

Medical students: 94



Ongoing Data Collection*

	2007	2008
MET calls	89	136
Resp rate documentation	65%	94%
Unplanned crit. care transfers	49	41
Time to medical review (MEWS>4)	48 mins	12 mins

*3 months for first group of wards (**surgical**)



Ongoing Data Collection*

	2007	2008
MET Calls	43	50
Missed METs	8	6
Vital Sign Frequency (per day)		
Temperature	4.1	5.6
Heart Rate	5.5	6.5
Resp. Rate	3.8	6.4
SaO ₂	5.6	6.9
Blood Pressure	5.8	6.5

*3 months for second group of wards (**medical**)

Project to Program

- Possible
- Requires ongoing enthusiasm and passion
- Support up and down the food chain
- Does it really make a difference?
- Struggle to get SMOs and JMOs to own the problem (what problem??)



Thanks to...

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