Improving Performance of Rapid Response Teams

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What do we know about deteriorating patients and RRT/MET?
## Incidence of antecedent factors 8-48 hours prior to death – non ICU patients (total deaths = 778)

<table>
<thead>
<tr>
<th>Antecedent Factor</th>
<th>Total Deaths</th>
<th>Deaths with DNR orders</th>
<th>Deaths without DNR orders</th>
</tr>
</thead>
<tbody>
<tr>
<td>No patients with 8-48 h antecedents</td>
<td>418</td>
<td>367</td>
<td>52</td>
</tr>
<tr>
<td>Airway threatened</td>
<td>6 (1.4)</td>
<td>4 (1.1)</td>
<td>2 (3.8)</td>
</tr>
<tr>
<td>Respiratory rate &lt; 5</td>
<td>1 (0.2)</td>
<td>1 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Respiratory rate &gt; 36</strong></td>
<td>69 (16.5)</td>
<td>63 (17.2)</td>
<td>6 (11.5)</td>
</tr>
<tr>
<td>Pulse rate &lt; 40</td>
<td>7 (1.7)</td>
<td>4 (1.1)</td>
<td>3 (5.8)</td>
</tr>
<tr>
<td><strong>Pulse rate &gt; 140</strong></td>
<td>39 (9.3)</td>
<td>35 (9.5)</td>
<td>4 (7.7)</td>
</tr>
<tr>
<td>Systolic BP &lt; 90</td>
<td>115 (27.5)</td>
<td>99 (27.0)</td>
<td>16 (30.8)</td>
</tr>
<tr>
<td>Sudden fall in GCS &gt; 2</td>
<td>20 (4.8)</td>
<td>18 (4.9)</td>
<td>2 (3.8)</td>
</tr>
<tr>
<td>Repeated / prolonged seizure</td>
<td>5 (1.2)</td>
<td>5 (1.4)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>‘Worried’ only</strong></td>
<td>90 (21.5)</td>
<td>83 (22.6)</td>
<td>7 (13.5)</td>
</tr>
<tr>
<td>One or more antecedents (- worry): n (%)</td>
<td>187 (45.2)</td>
<td>164 (44.7)</td>
<td>25 (48.1)</td>
</tr>
</tbody>
</table>

Nursing Confidence to summons help for patient when needed

- Descriptive study of 32 registered nurses
- Uncertainty – “am I doing the right thing?”
- Afraid of feeling “like an idiot if call unnecessary”
- “Ask more experienced RN to confirm findings or concerns first”
- Medical staff not always present, or “they are just as uncertain as I am”

ICU Liaison Nurse

• Skilled, Experienced, Qualified ICU nurse.
• Provides outreach support and advice from ICU to hospital ward staff.
• Responds to hospital medical emergency crisis e.g. cardiac arrest code
• Usually one liaison nurse per shift for whole of hospital

Medical Emergency Team
PROCESS

• Response to in patient situation
• Ward Nurse/Doctor detects patient deterioration (may ring ICU Liaison Nurse direct)
• Ring Hospital switchboard operator to summons MET Team (Dedicated phone number)
• MET team arrive within 15 minutes of call
• Assess patient needs, order tests, stabilise
• Involve treating medical doctor in decision making…transfer if required.
• Educate nursing staff and reassure
MET RESULTS – Austin Hospital

500 bed hospital.
4 months pre MET (May-Aug 1999)
4 months post MET (Nov - Feb 2001)

Cardiac Arrest calls:
Pre MET (1999) = 63
Post MET (2001) = 22 (P<0.001)

Mortality post cardiac arrest:
Pre MET (1999) = 37
Post MET (2001) = 16 (P<0.001)

AFFERENT LIMB

RAPID RESPONSE SYSTEM

EWS
+
Alert

Patient Clinical Parameters
+
Assessment

Track
RAPID RESPONSE SYSTEM

AFFERENT LIMB

Patient Clinical Parameters + Assessment

EWS + Alert

Trigger

RRT CCON CCOT MET
RAPID RESPONSE SYSTEM

AFFERENT LIMB

Patient Clinical Parameters + Assessment + Alert

EWS

RRT CCON CCOT MET

EFFERENT LIMB

Stabilize + Plan

Trigger

Intervention
Model 1, 2006: Maroondah Hospital
MET Criteria (example)

**MET Call Parameters**
**Ring 555**

**AIRWAY:**
Threatened

**BREATHING:**
Respiratory Rate < 8 or > 30/min.  
$\text{SpO}_2$ < 92% (on or off O$_2$)

**CIRCULATION:**
Heart rate < 50 or > 120/min.  
Systolic BP < 90 or > 180mmHg

**NEUROLOGICAL:**
Seizures or falling GCS > 2 points

**OTHER:**
Worried about patient  
Parent Unit cannot attend  
Urine output < 30ml/hr (2hrs) or,  
> 500ml/hr (2hrs)  
BGL < 3.0mmol/L or > 20.0mmol/L  
Temperature: < 35.0° C or > 39.5° C  
Metabolic derangement
# MET Criteria (Maroondah)

## Maroondah Hospital – Medical Emergency Team

<table>
<thead>
<tr>
<th>Medical Emergency Team MET Call</th>
<th>AIRWAY</th>
<th>BREATHING</th>
<th>CIRCULATION</th>
<th>NEUROLOGICAL</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIAL 555 and state MET Call</td>
<td>Threatened e.g. stridor</td>
<td>An acute change in breathing, or:</td>
<td>Respiratory Rate: &lt; 8 or &gt; 30 /min.</td>
<td>Seizures or falling GCS &gt; 2 points</td>
<td>Worried about patient</td>
</tr>
<tr>
<td>YOUR WARD &amp; the PARENT UNIT</td>
<td></td>
<td>O₂ Saturation: &lt; 92%</td>
<td>Heart Rate: &lt; 50 or &gt; 120/min.</td>
<td></td>
<td>Parent Unit cannot attend patient</td>
</tr>
<tr>
<td></td>
<td></td>
<td>An acute change in HR or BP, or:</td>
<td>Systolic BP: &lt; 90 or &gt; 180mmHg</td>
<td></td>
<td>Urine Output: &lt; 30 mls/hr for 2 hrs &gt; 500 mls/hr for 2 hrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Temperature: &lt;35.0° or &gt; 39.5° C</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BGL: &lt; 3.0mmol/L or &gt; 20.0mmol/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Metabolic Derangement</td>
</tr>
</tbody>
</table>
MARKETING MET (Maroondah)
Maroondah Hospital MET Calls - commenced 23 October 2006
Change in staff behaviour  
(Maroondah Hospital)

Criteria for MET Call Present at the time of ICULN Referral.

Instances

<table>
<thead>
<tr>
<th>Month</th>
<th>Yes</th>
<th>No</th>
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</thead>
<tbody>
<tr>
<td>Nov</td>
<td>17</td>
<td>11</td>
</tr>
<tr>
<td>Dec</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Jan</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Feb</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>Mar</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

Legend:
- Blue: No
- Red: Yes
Model 2 2009: Gold Coast Hospital.
Clinical Team Coordinator

- Critical care trained nurses based in Emergency Department
- Selection criteria
  - Excellent clinical assessment skills
  - Excellent communication skills
  - Excellent problem solving skills
  - Excellent teaching skills
- Pilot non-ED CTCs = 2009 – mid-2010
- Confirm ED model = mid 2010

CTC Role

- Roam the hospital from 2 pm – 8 am
- Handover on vulnerable patients/wards
- Carry pager
  - PM shift, respond to calls as requested
  - Night duty, medical calls triaged by CTC
- Member of MET/Resuscitation and other emergency response teams
- Trouble shoot clinical problems/questions
Typical activity (one month)

- Total calls for help = 1231 (Av. 41/day)
- Medical = 692 (56%)
- Surgical = 398 (32%)
- Other = 141 (12%)
- Additional tasks discovered on rounds = 113
Primary Reason for Review

- Pulse = 53
- Blood Pressure = 54
- Respiratory = 52
- Temperature = 46
- Blood sugar = 42
- Conscious level = 19
- Urine output = 51
- Pain = 85
- Sedation = 26
- Seizure = 7
- IV Orders = 52
- Meds Review = 154
- Fall = 20
- Other = 232
Outcome of Pt. Review

• Total calls referred to doctor = 690
• Total calls managed by CTC only = 654

• Assessment of priority (1217 identified)
  – Urgent = 14 (1.2%)
  – Semi Urgent = 74 (6%)
  – Non Urgent = 1129 (92.8%)
Model 3: Early Warning Score

Observation chart for the National Early Warning Score (NEWS)

<table>
<thead>
<tr>
<th>NEWS Key</th>
<th>NEWS</th>
<th>D.O.B.</th>
<th>ADMISSION DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE</td>
<td>TIME</td>
<td>DATE</td>
<td>TIME</td>
</tr>
<tr>
<td>RESP RATE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-29</td>
<td>2</td>
<td>5-29</td>
<td>2</td>
</tr>
<tr>
<td>25-24</td>
<td>1</td>
<td>25-24</td>
<td>1</td>
</tr>
<tr>
<td>12-20</td>
<td>3</td>
<td>12-20</td>
<td>3</td>
</tr>
<tr>
<td>9-11</td>
<td></td>
<td>9-11</td>
<td></td>
</tr>
<tr>
<td>SpO₂</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>94-97</td>
<td>2</td>
<td>94-97</td>
<td>2</td>
</tr>
<tr>
<td>92-93</td>
<td>1</td>
<td>92-93</td>
<td>1</td>
</tr>
<tr>
<td>88-91</td>
<td>3</td>
<td>88-91</td>
<td>3</td>
</tr>
<tr>
<td>Inspired O₂</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>%</td>
<td>1</td>
<td>%</td>
<td>1</td>
</tr>
<tr>
<td>TEMP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39°</td>
<td>2</td>
<td>39°</td>
<td>2</td>
</tr>
<tr>
<td>38°</td>
<td>1</td>
<td>38°</td>
<td>1</td>
</tr>
<tr>
<td>37°</td>
<td>3</td>
<td>37°</td>
<td>3</td>
</tr>
<tr>
<td>36°</td>
<td></td>
<td>36°</td>
<td></td>
</tr>
<tr>
<td>NEW SCORE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less Than Systolic BP</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>BLOOD PRESSURE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>140</td>
<td>3</td>
<td>140</td>
<td>3</td>
</tr>
<tr>
<td>130</td>
<td>2</td>
<td>130</td>
<td>2</td>
</tr>
<tr>
<td>120</td>
<td>1</td>
<td>120</td>
<td>1</td>
</tr>
<tr>
<td>110</td>
<td></td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>HEART RATE</td>
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</tr>
<tr>
<td>140</td>
<td>3</td>
<td>140</td>
<td>3</td>
</tr>
<tr>
<td>130</td>
<td>2</td>
<td>130</td>
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</tr>
<tr>
<td>120</td>
<td>1</td>
<td>120</td>
<td>1</td>
</tr>
<tr>
<td>110</td>
<td></td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>Level of Consciousness</td>
<td>Alert</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alert</td>
<td>3</td>
<td>Alert</td>
<td>3</td>
</tr>
<tr>
<td>V / P / O</td>
<td></td>
<td>V / P / O</td>
<td></td>
</tr>
<tr>
<td>BLOOD SUGAR</td>
<td></td>
<td></td>
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<tr>
<td>TOTAL NEW SCORE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain Score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Score</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

National Early Warning Score: July 2012
Please see next page for explanatory text about this chart.

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Training for Innovation
NHS
**Response to Early Warning Score**

<table>
<thead>
<tr>
<th>NEWS SCORE</th>
<th>FREQUENCY OF MONITORING</th>
<th>CLINICAL RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Minimum 12 hourly</td>
<td>• Continue routine NEWS monitoring with every set of observations</td>
</tr>
<tr>
<td>Total: 1-4</td>
<td>Minimum 4-6 hourly</td>
<td>• Inform registered nurse who must assess the patient;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Registered nurse to decide if increased frequency of monitoring and/or escalation of clinical care is required;</td>
</tr>
<tr>
<td>Total: 5 or more or 3 in one parameter</td>
<td>Increased frequency to a minimum of 1 hourly</td>
<td>• Registered nurse to urgently inform the medical team caring for the patient;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Urgent assessment by a clinician with core competencies to assess acutely ill patients;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Clinical care in an environment with monitoring facilities;</td>
</tr>
<tr>
<td>Total: 7 or more</td>
<td>Continuous monitoring of vital signs</td>
<td>• Registered nurse to <strong>immediately</strong> inform the medical team caring for the patient – this should be at least at Specialist Registrar level;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Emergency assessment by a clinical team with critical care competencies, which also includes a practitioner/s with advanced airway skills;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Consider transfer of Clinical care to a level 2 or 3 care facility, i.e., higher dependency or ITU;</td>
</tr>
</tbody>
</table>
Model 4: Abu Dhabi, Automation of EWS into an Electronic Medical Record
Automation of EWS into an Electronic Medical Record

- Utilizing the UK National Early Warning Score
- Embedding scoring tool and calculation in electronic record
- Automatic alert to inform nurse they must call doctor and follow guidelines of the protocol.
<table>
<thead>
<tr>
<th>MEWS Vital Signs</th>
<th>2/7/2015 14:28 UAE</th>
<th>08:03 UAE</th>
<th>22:00 UAE</th>
<th>1/7/2015 14:06 UAE</th>
<th>06:22 UAE</th>
<th>30/6/2015 20:43 UAE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEWS Score</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Temperature Axillary degC</td>
<td>37.2</td>
<td>↑</td>
<td>37</td>
<td>↑</td>
<td>37</td>
<td>↑</td>
</tr>
<tr>
<td>Temperature Oral degC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature Tympanic degC</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Peripheral Pulse Rate</td>
<td>92</td>
<td></td>
<td>90</td>
<td>94</td>
<td>84</td>
<td>85</td>
</tr>
<tr>
<td>Heart Rate Monitored</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory Rate br/min</td>
<td>21</td>
<td>↑</td>
<td>20</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Blood Pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBP/DBP Non-Invasive mmHg</td>
<td>122/69</td>
<td></td>
<td>116/69</td>
<td>110/78</td>
<td>106/66</td>
<td>105/68</td>
</tr>
<tr>
<td>Mean Arterial Pressure, Non-Invasive mmHg</td>
<td>87</td>
<td>85</td>
<td>89</td>
<td>79</td>
<td>80</td>
<td></td>
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<tr>
<td>SpO2 %</td>
<td>99</td>
<td></td>
<td>99</td>
<td>99</td>
<td>98</td>
<td>95</td>
</tr>
<tr>
<td>Oxygen Therapy</td>
<td>Nasal cannula</td>
<td>Nasal cannula</td>
<td>Nasal cannula</td>
<td>Nasal cannula</td>
<td>Nasal cannula</td>
<td>Nasal cannula</td>
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<tr>
<td>Oxygen Flow Rate L/min</td>
<td>2</td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
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<tr>
<td>pH</td>
<td></td>
<td></td>
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<tr>
<td>MEWS AVPU Scale</td>
<td></td>
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<tr>
<td>MEWS Temperature Axillary Score</td>
<td>0</td>
<td></td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>MEWS Temperature Oral Score</td>
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<tr>
<td>MEWS Temperature Tympanic Score</td>
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<tr>
<td>MEWS Peripheral Pulse Rate Score</td>
<td>0</td>
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<td>0</td>
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<tr>
<td>MEWS Heart Rate Monitored Score</td>
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<td></td>
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<td></td>
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<td></td>
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<tr>
<td>MEWS Respiratory Rate Score</td>
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<td></td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>MEWS Blood Pressure Score</td>
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<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MEWS SPO2 Score</td>
<td>0</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MEWS AVPU Score</td>
<td>2</td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
Early Warning Signs

Name: TWMEDZZZ, TWMEDZZZ
Date: 18 August 2015 07:24:57 UAE
MRN: TW10-213-058
Date of Birth: 06 July 1981
Age: 34
Location: TW Tawam Hospital; PIMU: 06

Early Warning Signs Parameters:

16/08/15 07:23 Temperature Axillary = 40 C (H) [greater than 39 C] Score = 2
16/08/15 07:23 Peripheral Pulse Rate = 130 bpm (H) [greater than 130 bpm] Score = 3
16/08/15 07:23 Oxygen Saturation = 90 % (L) [between 89% and 93%] Score = 2
16/08/15 07:23 Respiratory Rate = 25 br/min (H) [between 19 - 25 br/min] Score = 1
16/08/15 07:23 Systolic Blood Pressure = 180 mmHg [between 101 - 179 mmHg] Score = 0
16/08/15 07:23 MEWS AVPU Score = 1 Score = 1

Early Warning Score = 9.00

Next steps to complete:

- Notify Charge Nurse STAT
- Activate Rapid Response Team (Adult) STAT or Activate Action Plan
- Notify responsible physician on site to attend
- Responding physician to ensure Consultant is notified
  If no response in 15 minutes, call code BLUE
- Recommend this assessment is repeated continuously
Benefits of online Early Warning Scoring system

- 129 staff surveyed using survey monkey.
- 92% of nursing staff prefer the electronic early warning system.
- 75% of nursing staff feel their electronic scores are more accurate than paper.
- 85% of nursing staff feel more empowered to follow the cascade call based on the electronic alerts than on paper.

Personal correspondence: Frances Beadle, Tawam Hospital, United Arab Emirates: www.cerner.com/uploadedFiles/Content/About_Cerner/SEHA_Introduction_Automated_EarlyWarning_Scoring_Systems_Alerts_FINAL.pdf
Model 5: SEHA Abu Dhabi.
Model 5 – The best of the best!

- Establish ICON (Intensive Care Outreach Nurse) in 4 major Abu Dhabi Hospitals.
- Similar role to CTC and ICU Liaison Nurse.
- Utilize iPad to access all patient EMRs and EWS alerts
- 0700 report of all EWS alertss of previous 24 hours for immediate analysis and follow up (hospital-wide and system-wide).
CONCLUSIONS

- Signs of patient deterioration are well known and can be monitored by ward staff or electronic medical records.
- Sick patients in hospital wards require rapid and expert response from specialist clinicians.
- Ward nurses and junior doctors may lack knowledge and confidence to recognise and manage patient deterioration.
- The CTC/ICON is an efficient and capable resource to respond to clinician uncertainty in hospital wards.
- Automation of alerts and functions is the ideal but not always available. Hybrid models are necessary.
- A RRS model selected must be contextualised to ensure correct “fit for purpose” considering setting, technology, clinical capacity and staff and executive engagement.
References:

Thank you, Any Questions...??
Motor neuron

4) Carries message from control center to effector organ dictating response
Benefits of the CTC Vs ICON

Emergency Department – CTC Clinical Team Co-ordinator.
- Broad skills in less controlled environments. eg behavioural management
- Knowledge of ward skill mix and capability can influence type of patient admitted to ward over night.
- Help with patient flow issues, ie get patients to ward from ED and settle if complex.
- Greater network of medical colleagues

Intensive Care Outreach Nurses (ICON)
- Specialist skills in assessing and managing critically ill patients
- Knowledge of patients that have left ICU and require follow up.
- Help with moving patient from ward and into ICU if required.
- Knowledge of ICU capacity and ICU medical preferences an advantage
Staff Satisfaction CTC

- 80 nursing and 14 medical qualitative survey responses

Medical comments:
- Medical teams value handover from CTC in the morning.
- Knowing that patients have been unwell overnight means I can attend to their issues promptly.
- Improvement in number of jobs being left over from one shift to the next.
- Great help in filtering out non-urgent/inappropriate ward jobs overnight.
- Provides great assistance on night shifts. Less busy, less stressful and better supported.
- The ongoing monitoring of unstable and critical patients on the wards is another fail-safe mechanism with a positive impact on patient care.

Nursing Comments:
- The CTC's are teaching both nursing and medical staff how to communicate essential clinical information at patient reviews and between shifts;
- The CTC are filling some of the gaps in patient care that exist between the medical team’s.
- Valuable back up person when emergency codes are called.
- The best assistance is from the nurses who are critical care trained, eg ICU, ED.
- Helpful in trouble shooting complex equipment issues
- Teaching inexperienced staff basic assessment and problem solving skills is excellent.