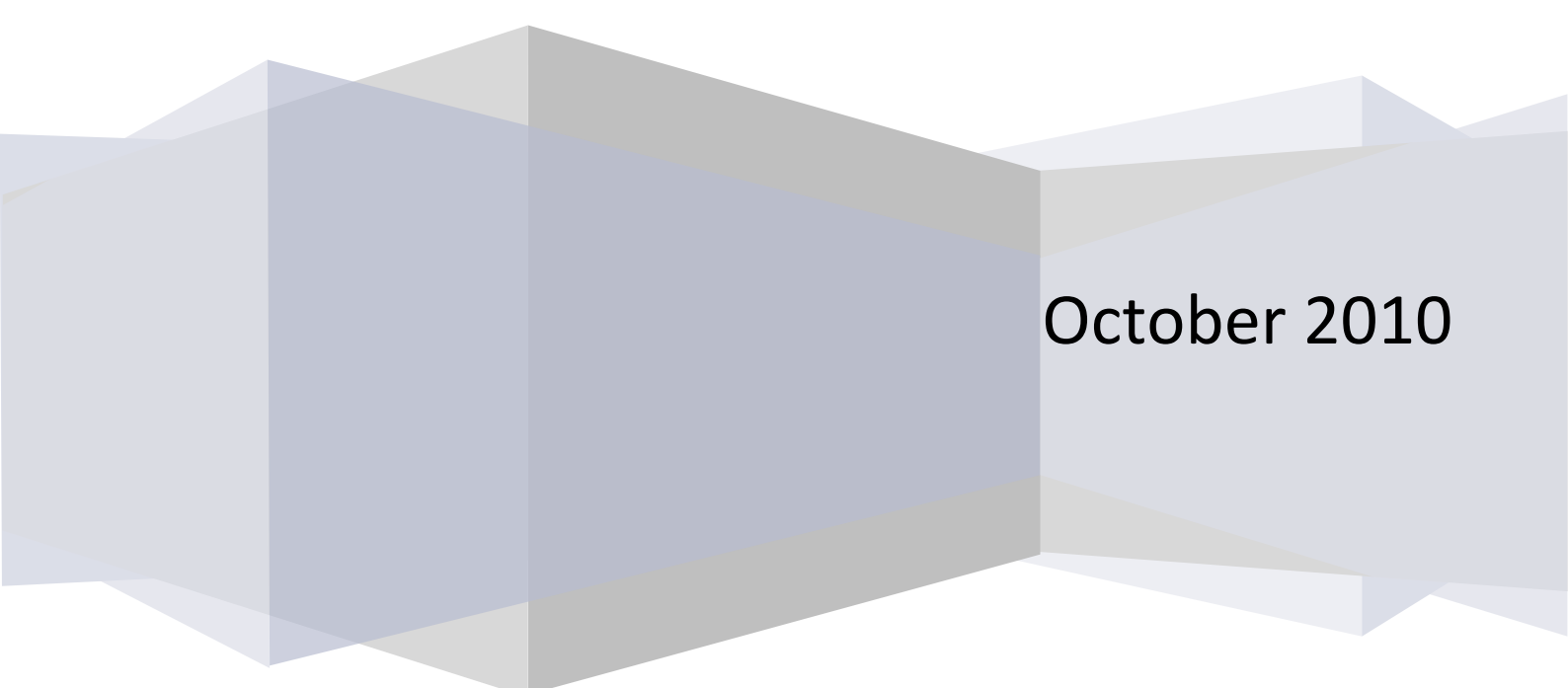


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# Developer's Guide for Observation and Response Charts

Report prepared for the Australian Commission on Safety and Quality  
in Health Care's program for Recognising and Responding to Clinical  
Deterioration

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## 1. GENERAL BACKGROUND

This developer's guide for observation and response charts was prepared as part of the Australian Commission on Safety and Quality in Health Care's (ACSQHC) program for 'Recognising and Responding to Clinical Deterioration'. The work reported in this guide was part of the second phase of a program of research aimed at producing a small number of evidence-based adult observation charts for Australian health services.

The project brief for phase two was to develop three new observation and response charts to complement the observation chart that we have already developed (the Adult Deterioration Detection System or 'ADDS' chart). The four observation and response charts reflect the main types of track and trigger systems that are currently in use in Australia:

1. A multiple parameter system (with a single parameter system with one response category also embedded)
2. A single parameter system with four response categories
3. A single parameter system with two response categories
4. A single parameter system with one response category

We were also required to write this guide, setting out which observation chart elements should be standardised, which elements can be modified to reflect local conditions, and how any modifications should be implemented.

### 1.1. OBSERVATION AND RESPONSE CHARTS

An observation chart is an important tool for recognising when a patient's condition is deteriorating. Despite their importance, there has been little research regarding observation charts, or about how observation charts can be used to improve the recognition of clinical deterioration. The ACSQHC has included observation charts as one of their key initiatives in their Recognising and Responding to Clinical Deterioration program.

As part of this program, the ACSQHC has developed the concept of an 'observation and response chart', and the charts we have developed are examples of these. The purpose of these charts is to support the accurate and timely recognition of clinical deterioration, and prompt action when deterioration is identified. An observation and response chart:

- Is designed according to human factors principles
- Has the capacity to record information about respiratory rate, oxygen saturation, heart rate, blood pressure, temperature and level of consciousness graphically over time
- Includes thresholds for each physiological parameter or combination of parameters that indicate abnormality
- Specifies the physiological abnormalities and other factors that are required to escalate care

- Specifies the responses that are required when care is escalated.

The ACSQHC considers that observation and response charts should be used in all acute health care facilities. This guide has been developed to support the development and use of observation and response charts.

The information provided in the guide is primarily about the **design** of the observation and response charts. The other elements of the observation and response charts – the physiological thresholds that indicate abnormality, other factors that escalate care, and responses required when care is escalated – are all clinical or organisational factors that need to be set locally, or in accordance with state or territory, or other policy frameworks. Where appropriate, this guide does give advice about the way in which these aspects of the observation and response chart should be designed or presented to maximise usability and patient safety.

## 1.2. STRUCTURE OF THE GUIDE

In this guide, we systematically list each essential element of an observation chart designed to trigger responses to patient deterioration, specifying minimum design requirements and discussing common design errors. The minimum design requirements were, in part, based on the usability principles developed for the previous human factors research project, and these are reproduced in Appendix A (1). In considering each element, we list two types of potential modifications; those that are unlikely to affect patient safety, and those that should be avoided due to the increased risk of compromising patient safety. Note that the new observation and response charts described in this guide have yet to be tested empirically, either under experimental conditions or in clinical settings: clinical testing of the charts will be conducted in 2010-11, with experimental testing also planned. This testing is a critical part of the chart development process that must be completed before an observation chart can be regarded as safe for clinical use. This guide will be updated as needed once this testing is complete.

The guide will discuss the following chart areas in turn:

- Chart title area
- Patient identification label area
- Other charts in use area
- General instructions area
- Modifications area
- Interventions area
- Observations area
- Scoring guide area
- Additional response criteria
- Actions required area
- Clinical reviews area
- Additional observations area

We do not discuss the binding margin or the coloured strip, as these features are prescribed by the relevant Australian standards for paper-based health care records (2).

### 1.3. RECOMMENDED READING

This guide is not intended to be an exhaustive review of the research already undertaken in this area. Anyone wishing to understand the empirical research and national guidance underlying this design guide, or anyone intending to modify one of the Commission's observation and response charts, must first read the following documents (most of which are available for free download from the ACSQHC website):

1. Australian Commission on Safety and Quality in Health Care. National consensus statement: Essential elements for recognising and responding to clinical deterioration. Sydney, New South Wales, Australia: Australian Commission on Safety and Quality in Health Care 2010.
2. Horswill MS, Preece MHW, Hill A, Watson MO. Paper-based patient chart design information sheet. Sydney, New South Wales, Australia: Australian Commission on Safety and Quality in Health Care 2010.
3. Preece MHW, Horswill MS, Hill A, Watson MO. The development of the Adult Deterioration Detection System (ADDS) chart. Sydney, New South Wales, Australia: Australian Commission on Safety and Quality in Health Care 2010.
4. Horswill MS, Preece MHW, Hill A, Christofidis MJ, Karamatic R, Hewett D, et al. Human factors research regarding observation charts: Research project overview. Sydney, New South Wales, Australia: Australian Commission on Safety and Quality in Health Care 2010.
5. Preece M, Horswill M, Hill A, Karamatic R, Hewett D, Watson M. Heuristic Analysis of 25 Australian and New Zealand Adult General Observation Charts. Sydney, New South Wales, Australia: Australian Commission on Safety and Quality in Health Care 2009.
6. Horswill MS, Preece MHW, Hill A, Watson MO. Detecting abnormal vital signs on six observation charts: An experimental comparison. Sydney, New South Wales, Australia: Australian Commission on Safety and Quality in Health Care 2010.
7. Horswill MS, Preece MHW, Hill A, Christofidis MJ, Watson MO. Recording patient data on six observation charts: An experimental comparison. Sydney, New South Wales, Australia: Australian Commission on Safety and Quality in Health Care 2010.
8. Preece MHW, Horswill MS, Hill A, Karamatic R, Watson MO. An online survey of health professionals' opinions regarding observation charts. Sydney, New South Wales, Australia: Australian Commission on Safety and Quality in Health Care 2010.

9. Chatterjee MT, Moon JC, Murphy R, McCrea D. The "OBS" chart: An evidence based approach to re-design of the patient observation chart in a district general hospital setting. *Postgraduate Medical Journal*. 2005;81:663-6.
10. Standards Australia International. Australian Standard: Paper-based health care records. Strathfield, New South Wales, Australia: Standards Australia International 1999. Report No.: AS 2828—1999.

#### 1.4. A WORD OF WARNING ABOUT THE NEW OBSERVATION CHARTS

This guide discusses four observation and response charts: an updated version of the ADDS chart originally developed in 2009, and three new charts developed in 2010. The four observation charts discussed in this guide were constructed using the design principles developed in the initial research project surrounding the application of human factors principles to observation chart design. Although we employed a team of six evaluators to conduct a full heuristic analysis on the three new charts, **each chart should be regarded as no more than a draft at this stage**. Therefore, there are a number of points that need to be considered by anyone who intends to use any of the three charts, or who is contemplating making modifications to their own hospital's existing chart:

1. Public hospitals and health services will need to ensure that any actions they take to change their existing observation chart are consistent with any decisions or programs about observation charts that may have been established by the state or territory health department. For example, in NSW, use of the Between the Flags Standard Adult General Observation Chart was required in most facilities at the time this guide was published.
2. Private hospitals that belong to certain ownership groups may also be required to use particular observation charts. These requirements should be identified as part of the process of planning to develop or review an existing observation chart.
3. The evidence from the human factors research to date indicates that the original ADDS chart performed better than selected examples of common chart types, in supporting timely and accurate identification of deterioration. Changing the design of the ADDS chart (which we did to develop the four charts discussed in this guide) may reduce these benefits and increase risks to patient safety. Similarly, further modifying these charts may also increase risk to patients.
4. The new charts have not yet been tested in simulation experiments or used in a clinical environment. The ACSQHC, The University of Queensland and Queensland Health accept no liability or responsibility for the charts or their use. A retrospective validation study is currently underway in one hospital in Queensland, and preliminary results indicate that the original ADDS chart is more effective than some existing charts in detecting deterioration and triggering an appropriate escalation of care. Results of research about the performance of the ADDS and other charts will be made public as they become available.

5. The thresholds included in the new charts as indicating abnormal or deteriorating vital signs have been taken from existing observation charts and need to be reviewed to ensure that they are appropriate for specific clinical settings. Similarly, the required actions included in the new charts are **placeholders only**, and will need to be modified as appropriate.

## 1.5. A WORD OF WARNING ABOUT MAKING MODIFICATIONS THAT DECREASE PATIENT SAFETY

This report is intended as an introductory guide to some of the common issues in paper-based observation chart design, and is not an exhaustive account of every situation that a chart developer may encounter.

You need to understand the limitations of any new chart, and the risks taken in its design (given that all paper-based charts will require compromises). It may be impossible to produce an observation chart that conforms to all facets of user-friendly design. For instance, a small font size may be unavoidable when producing a very compact observation chart. Designing a chart therefore involves making trade-offs between competing priorities (e.g., average font size vs. compact chart size). In making any trade-off, there should be careful consideration of the relative importance of the competing design principles, what the alternative chart design would actually look like, and the impact that the difference may have on the risk of harm to patients.

To minimise the potential for patient harm as a result of implementing an untested chart, we would urge all chart developers to have a human factors expert with specific expertise in visual design as part of the design team. If engaging such an expert is unfeasible, we would strongly urge those charged with implementing a new chart to consider using one of the new observation and response charts disseminated by the ACSQHC or another chart that has had the benefits of human factors design.

**Although we discuss certain design modifications and how such modifications ought to look in this guide, we do not endorse modifying the charts unless the individuals making the modifications demonstrate empirically that the modifications made will not have a detrimental impact on patient safety.** Furthermore, a chart's performance in the clinical environment should also be monitored (e.g. a clinical trial or auditing of outcomes), and a formal process needs to be put in place for reviewing a chart's effectiveness over time (i.e., it should not be done on an ad hoc basis).

## 2. CHART TITLE AREA

All observation charts should include the name of the health care facility on the top of the form (2). However, the name of the facility or organisation should not be formatted in an overly prominent fashion. This information is of little relevance to the chart's main role as a tool to detect patient deterioration, and any attention drawn to the name or logo of the facility or organisation is attention drawn away from more important information on the chart. Similarly, a large amount of space

should not be devoted to the facility name. The size and positioning of the box containing the chart title and facility name should not be changed (see Figures 1 and 2).

(Affix patient identification label here)

**Observation and Response Chart**

IRN: \_\_\_\_\_  
 Family name: \_\_\_\_\_  
 Given names: \_\_\_\_\_  
 Date of birth: \_\_\_\_\_ Sex:  M  F

**Other Charts in Use**

Alcohol Withdrawal     Insulin Infusion     Pain/Epidural/Patient Controlled Analgesia  
 Anticoagulant     Neurology    \_\_\_\_\_  
 Fluid Balance     Neurovascular    \_\_\_\_\_

**General Instructions**

- You must record appropriate observations:
  - On admission
  - At a frequency appropriate for the patient's clinical state.
- You must record a full set of observations:
  - If the patient is deteriorating or an observation is in a shaded area
  - Whenever you are concerned about the patient.
- When graphing observations, place a dot (•) in the centre of the box which includes the current observation in its range of values and connect it to the previous dot with a straight line. For blood pressure, use the symbol indicated on the chart.
- Whenever an observation falls within a shaded area, you must initiate the actions required for that colour, unless a modification has been made (see below).
- If observations fall within two or more different coloured areas for the same time period, the actions required for the darker colour apply.

**Modifications**

If abnormal observations are to be tolerated for the patient's clinical condition, write the acceptable ranges (where a response will not be triggered) below, and tick the box overleaf. Modifications must be reviewed at least every 48 hours.

Respiratory Rate	<input type="text"/>	to	<input type="text"/>	Doctor's name (please print)	<input type="text"/>
O <sub>2</sub> Saturation	<input type="text"/>	to	<input type="text"/>	Designation	<input type="text"/>
Systolic BP	<input type="text"/>	to	<input type="text"/>	Signature	<input type="text"/>
Heart Rate	<input type="text"/>	to	<input type="text"/>	Date	<input type="text"/>
Temperature	<input type="text"/>	to	<input type="text"/>	Time	<input type="text"/>
Consciousness	<input type="text"/>	to	<input type="text"/>		
Urine Output	<input type="text"/>	to	<input type="text"/>		

**Interventions**

If you administer an intervention, record here and note letter in intervention row over page in appropriate time column.

A	<input type="text"/>
B	<input type="text"/>
C	<input type="text"/>
D	<input type="text"/>
E	<input type="text"/>

OBSERVATION AND RESPONSE CHART

Figure 1: Location of the chart title area (denoted by the shaded box)

**Observation and Response Chart**

Facility: \_\_\_\_\_

Figure 2: Close-up of a chart title area

## 2.1. POTENTIALLY HARMLESS MODIFICATIONS

- Changing the chart title, provided that the title remains succinct, clear, and descriptive
- Changing the “Facility: \_\_\_\_\_” prompt to the name of the health care facility or organisation, provided that the font formatting is retained
- Moving the main title, such as “Adult Deterioration Detection System (ADDS) Chart”, downwards, to be preceded by the name of an umbrella organisation (e.g., name of state health department)
- If space permits, including a black and white logo

## 2.2. POTENTIALLY HARMFUL MODIFICATIONS

- Including a coloured logo
- Including a logo at the expense of de-emphasizing the main title of the chart
- Changing the font formatting (different font, different size, capitalisation, etc.)
- Including a list of health care facilities with corresponding tick-boxes (e.g., a list of 3 hospitals in a health service area)

## 3. PATIENT IDENTIFICATION LABEL AREA

All observation charts should include space for a patient identification label on the top-right of the principal face of the form (2). With the particular page-layout of the observation and response charts, we consider it essential to have three areas for attaching a patient identification label. There is space for one label on each side of the A3 page without folding. The third space ensures that a label is visible on each of the outside pages when the A3 page is folded over (see Figures 3 and 4). (Note that the inside pages would always be used as a full A3 page – not 2 independent A4 pages – whereas the outside pages have somewhat independent functions.) The size and positioning of these boxes should not be changed.

The relevant Australian Standard (AS 2828) states that the minimum identifying information required is either: the surname, given name(s), and unit record number (if applicable); or the surname, given name(s), date of birth, and sex (1). We consider that it is potentially harmful to include additional identifying information (e.g. address, mobile phone number, or medical officer), because any such less important information will compete with other information for the user’s attention.

Note that state and territory health department guidelines may prescribe certain features of and within the patient identification label area (3).



(Affix patient identification label here)

URN:

Family name:

Given names:

Date of birth: Sex:  M  F

**Figure 4:** Close-up of a patient identification label area

### 3.1. POTENTIALLY HARMLESS MODIFICATIONS

- Changing the “URN:” prompt to a locally used abbreviation (e.g., UMRN)
- Changing the “Family name:” prompt to “Surname:” or “Last name:”

### 3.2. POTENTIALLY HARMFUL MODIFICATIONS

- Changing the font formatting (different font, different size, capitalisation, etc.)
- Removing all prompts (e.g., if a label is not available, staff should not have to rely on their memory to know what patient information to record)
- Adding additional identifiers
- Adding unnecessary or non-standard abbreviations (e.g., there is no need to abbreviate “Date of birth” to “DOB” as there is ample space to accommodate the full term)
- Changing Sex to a write prompt (i.e., “Sex: \_\_\_\_\_”)

## 4. OTHER CHARTS IN USE AREA

An observation chart may include an area listing other charts that are being used concurrently with the observation chart for a particular patient. In the observation and response charts, we have placed this area on the first page on the outside face of the chart. It is the first feature that the chart user encounters (after the chart title and patient identification label; see Figures 5 and 6). The other charts in use area should not be moved to another location on the chart.

Figure 5: Locations of the other charts in use area (denoted by the shaded box)

Figure 6: Close-up of an other charts in use area

#### 4.1. POTENTIALLY HARMLESS MODIFICATIONS

- Substituting the named charts for charts that are more frequently used with your patients, so long as the alphabetical order is retained
- Slightly increasing the number of blank boxes for writing in the names of less commonly used charts (e.g., four boxes would be acceptable)

#### 4.2. POTENTIALLY HARMFUL MODIFICATIONS

- Including more than nine other charts in this section (including the blank boxes for writing in names of less commonly used charts)
- Changing the “checkbox and name” format for frequently used charts, so that the user must write in the names of all charts in use
- Departing from the alphabetical order used for listing the frequently used charts

- Substituting or removing the two blank boxes for writing in the names of less commonly used charts
- Changing the font formatting (different font, different size, capitalisation, etc.)
- Adding unnecessary or non-standard abbreviations (e.g., there is no need to abbreviate the name of a chart if the full name or a shortened name using whole words can fit in the space)

## 5. GENERAL INSTRUCTIONS AREA

An observation chart should include an area listing succinct instructions about its use. The instructions should specify when observations are to be taken, how to record observations on to the chart, and how the track and trigger system relates to the observations.

For these observation and response charts, we have either placed these instructions on the inside face of the chart when space permits, or on the first page on the outside face when there is not sufficient space on the inside (see Figures 7 and 8). This is because we consider such instructions to be more important for using the chart with all patients, in comparison to other chart features such as the modifications area, interventions area, and clinical reviews (each of which will only be used with a subset of patients). However, the instructions are not as important as the observations area itself, the additional response criteria or the actions required; therefore, these three features take precedence over the instructions if space is in short supply. In addition, we deliberately minimised the need to write on the right-hand-side of the inner A3 page, given that the chart would typically be housed in an A4 folder that only supports writing on the left when the chart is unfolded.

Note that the ACSQHC's Consensus Statement states that observations should be taken on patients at admission or initial assessment, and the Statement recommends that, subsequently, most patients should have a set of observations taken at least once per eight hour shift (4).



## General Instructions

- » You must record appropriate observations:
  - On admission
  - At a frequency appropriate for the patient's clinical state.
- » You must calculate a Total ADDS Score:
  - If the patient is deteriorating or an observation is in a shaded area
  - Whenever you are concerned about the patient.
- » When graphing observations, place a dot (•) in the centre of the box which includes the current observation in its range of values and connect it to the previous dot with a straight line. For blood pressure, use the symbols indicated on the chart.
- » Whenever an observation falls within a shaded area, you must enter the ADDS Score for that vital sign in the appropriate row of the ADDS Scores table, unless a modification has been made (see below).

Figure 8: Close-up of a general instructions area

### 5.1. POTENTIALLY HARMLESS MODIFICATIONS

- Adapting the wording of the instructions to reflect local conditions, provided that the instructions remain succinct, clear, directive, and descriptive of what is required from a chart user for most patients

### 5.2. POTENTIALLY HARMFUL MODIFICATIONS

- Changing the instructions so that they are no longer succinct, clear, directive and descriptive of what is required from a chart user for most patients
- Adding vague qualifications that allow chart users to opt-out of responding appropriately to deterioration
- Writing overly long instructions
- Moving the instructions so that they are not in either of the two locations shown in Figure 7
- Changing the font formatting (different font, different size, capitalization, etc.)
- Overusing font formatting to emphasize particular words or phrases (e.g., one word in three being in bold or underlined)
- Including jargon
- Including abbreviations that could be misinterpreted or not recognised
- Including spelling or grammatical errors
- Not using Australian English spelling

## 6. MODIFICATIONS AREA

The ACSQHC's Consensus Statement states that observation charts should include the facility to document the normal physiological range for an individual patient (i.e., make modifications to the thresholds for initiating actions) (4). In the observation and response charts, we have placed the

modifications area on the first page on the outside face of the chart. It is either the first feature that the chart user encounters (after the other charts in use area) or the second feature, depending on whether the general instructions have to be accommodated on this page (see Figures 9 and 10). The modifications area should not be moved to the inside face of the chart; however, there is a tickbox on the inside face of the chart to show when modifications are in use (see Figure 11).

<b>Adult Deterioration Detection System (ADDS) Chart</b> Facility: _____		(Affix patient identification label here) URN: _____ Family name: _____ Given names: _____ Date of birth: _____ Sex: <input type="checkbox"/> M <input type="checkbox"/> F	
<b>Other Charts In Use</b> <input type="checkbox"/> Alconol Withdrawal <input type="checkbox"/> Insulin Infusion <input type="checkbox"/> Pain/Epidural/Patient Controlled Analgesia <input type="checkbox"/> Anticoagulant <input type="checkbox"/> Neurology <input type="checkbox"/> Fluid Balance <input type="checkbox"/> Neurovascular			
<b>General Instructions</b> » You must record appropriate observations. - On admission - At a frequency appropriate for the patient's clinical state. » You must calculate a Total ADDS Score - If the patient is deteriorating or an observation is in a shaded area - Whenever you are concerned about the patient. » When graphing observations, place a dot (•) in the centre of the box which includes the current observation in its range of values and connect it to the previous dot with a straight line. For blood pressure, use the symbols indicated on the chart. » Whenever an observation falls within a shaded area, you must enter the ADDS Score for that vital sign in the appropriate row of the ADDS Scores table, unless a modification has been made (see below).			
<b>Modifications</b> <small>If abnormal observations are to be tolerated for the patient's clinical condition, write the acceptable ranges (where the ADDS Score will be 0) below. Modifications must be reviewed at least every 72 hours.</small>			
Respiratory Rate	_____ to _____	_____ to _____	Doctor's name (please print) _____ Designation _____ Signature _____ Date: / /    Time: :
O <sub>2</sub> Saturation	_____ to _____	_____ to _____	
O <sub>2</sub> Flow Rate	_____ to _____	_____ to _____	
Systolic BP	_____ to _____	_____ to _____	
Heart Rate	_____ to _____	_____ to _____	
Temperature	_____ to _____	_____ to _____	
Consciousness	_____ to _____	_____ to _____	
4 Hour Urine Output	_____ to _____	_____ to _____	
<b>Interventions</b> <small>If you administer an intervention, record here and note letter in Intervention row over page in appropriate time column.</small>			
A _____ B _____ C _____ D _____ E _____			

ADDS CHART

<b>Observation and Response Chart</b> Facility: _____		(Affix patient identification label here) URN: _____ Family name: _____ Given names: _____ Date of birth: _____ Sex: <input type="checkbox"/> M <input type="checkbox"/> F	
<b>Other Charts In Use</b> <input type="checkbox"/> Alconol Withdrawal <input type="checkbox"/> Insulin Infusion <input type="checkbox"/> Pain/Epidural/Patient Controlled Analgesia <input type="checkbox"/> Anticoagulant <input type="checkbox"/> Neurology <input type="checkbox"/> Fluid Balance <input type="checkbox"/> Neurovascular			
<b>Modifications</b> <small>If abnormal observations are to be tolerated for the patient's clinical condition, write the acceptable targets (where a response will not be triggered) below, and tick the box overleaf. Modifications must be reviewed at least every 72 hours.</small>			
Respiratory Rate	_____ to _____	_____ to _____	Doctor's name (please print) _____ Designation _____ Signature _____ Date: / /    Time: :
O <sub>2</sub> Saturation	_____ to _____	_____ to _____	
Systolic BP	_____ to _____	_____ to _____	
Heart Rate	_____ to _____	_____ to _____	
Temperature	_____ to _____	_____ to _____	
Consciousness	_____ to _____	_____ to _____	
4 Hour Urine Output	_____ to _____	_____ to _____	
<b>Interventions</b> <small>If you administer an intervention, record here and note letter in Intervention row over page in appropriate time column.</small>			
A _____ B _____ C _____ D _____ E _____ F _____ G _____ H _____ I _____ J _____			

OBSERVATION AND RESPONSE CHART

Figure 9: Two alternate locations of the modifications area (denoted by the shaded boxes)



- Changing the instruction about the frequency with which the modifications must be reviewed (e.g., from every 72 hours to every 24 hours)
- Changing the description of what is meant by “acceptable ranges” (e.g., changing the example shown in Figure 8 from “where ADDS Score will be 0” to “where Emergency Call will not be triggered”)

## 6.2. POTENTIALLY HARMFUL MODIFICATIONS

- Changing the instructions so that they are no longer succinct, clear, directive and descriptive of what is required from a chart user for most patients
- Removing the requirement to review the modifications after a specific time period
- Removing any of the fields that the doctor making the modification is required to complete (e.g., do not remove the Time box)
- Adding a section to allow the total ADDS score to be modified (e.g., inserting “no action required for an ADDS score of X to Y”). This modification is potentially extremely harmful as it could effectively shut off the “trigger” arm of the track and trigger system
- Moving the modifications area so that it is not in either of the two locations shown in Figure 9
- Changing the font formatting (different font, different size, capitalization, etc.)
- Overusing font formatting to emphasize particular words or phrases (e.g., one word in three being in bold or underlined)
- Including jargon
- Including abbreviations that could be misinterpreted or not recognized
- Including spelling or grammatical errors
- Not using Australian English spelling

## 7. INTERVENTIONS AREA

An observation chart should include an area where chart users can list interventions administered during a patient’s care to prompt users to record and subsequently review the effectiveness of an intervention in relation to patient’s condition and physiological state (e.g., providing fluids or pain relief). On the observation and response charts, we have positioned the interventions area on the first page on the outside face of the chart (see Figure 12). It is the last feature on this page. The number of rows provided for recording interventions and the placement of the instructions varies depending on the amount of space available (see Figure 13). The interventions area should not be moved to another place on the chart.

The interventions area should be used in conjunction with the Intervention row in the observations area on the inside face of the chart (see Figure 14). Together, these two features allow chart users to track the efficacy of interventions on a patient’s condition (e.g., if pain relief is administered at timepoint 5, does the patient’s self-reported pain decrease at timepoint 6?). If interventions are not

improving a patient's condition (e.g., after administering a prescribed fluid bolus, a patient is still hypotensive), this may signal the patient is deteriorating and further management is required.

<b>Adult Deterioration Detection System (ADDS) Chart</b>		(Affix patient identification label here)	
Facility: _____		URN: _____	Sex: <input type="checkbox"/> M <input type="checkbox"/> F
		Family name: _____	
		Given names: _____	
		Date of birth: _____	
<b>Other Charts In Use</b>			
<input type="checkbox"/> Alcohol Withdrawal	<input type="checkbox"/> Insulin Infusion	<input type="checkbox"/> Pain/Epidural/Patient Controlled Analgesia	
<input type="checkbox"/> Anticoagulant	<input type="checkbox"/> Neurology	_____	
<input type="checkbox"/> Fluid Balance	<input type="checkbox"/> Neurovascular	_____	
<b>General Instructions</b>			
<ul style="list-style-type: none"> <li>» You must record appropriate observations:               <ul style="list-style-type: none"> <li>- On admission</li> <li>- At a frequency appropriate for the patient's clinical state.</li> </ul> </li> <li>» You must calculate a Total ADDS Score:               <ul style="list-style-type: none"> <li>- If the patient is deteriorating or an observation is in a shaded area</li> <li>- Whenever you are concerned about the patient.</li> </ul> </li> <li>» When graphing observations, place a dot (•) in the centre of the box which includes the current observation in its range of values and connect it to the previous dot with a straight line. For blood pressure, use the symbols indicated on the chart.</li> <li>» Whenever an observation falls within a shaded area, you must enter the ADDS Score for that vital sign in the appropriate row of the ADDS Scores table, unless a modification has been made (see below).</li> </ul>			
<b>Modifications</b>			
If abnormal observations are to be tolerated for the patient's clinical condition, write the acceptable ranges (where the ADDS Score will be 0) below. Modifications must be reviewed at least every 72 hours.			
Respiratory Rate	_____ to _____	Doctor's name (please print) _____	
O <sub>2</sub> Saturation	_____ to _____	Designation _____	
O <sub>2</sub> Flow Rate	_____ to _____	Signature _____	
Systolic BP	_____ to _____	Date _____ Time _____	
Heart Rate	_____ to _____	/ / : _____	
Temperature	_____ to _____		
Consciousness	_____ to _____		
4 Hour Urine Output	_____ to _____		
<b>Interventions</b>			
If you administer an intervention, record here and note letter in Intervention row over page in appropriate time column.			
A			
B			
C			
D			
E			

<b>Observation and Response Chart</b>		(Affix patient identification label here)	
Facility: _____		URN: _____	Sex: <input type="checkbox"/> M <input type="checkbox"/> F
		Family name: _____	
		Given names: _____	
		Date of birth: _____	
<b>Other Charts In Use</b>			
<input type="checkbox"/> Alcohol Withdrawal	<input type="checkbox"/> Insulin Infusion	<input type="checkbox"/> Pain/Epidural/Patient Controlled Analgesia	
<input type="checkbox"/> Anticoagulant	<input type="checkbox"/> Neurology	_____	
<input type="checkbox"/> Fluid Balance	<input type="checkbox"/> Neurovascular	_____	
<b>Modifications</b>			
If abnormal observations are to be tolerated for the patient's clinical condition, write the acceptable ranges (where a response will not be triggered) below, and tick the box overleaf. Modifications must be reviewed at least every 72 hours.			
Respiratory Rate	_____ to _____	Doctor's name (please print) _____	
O <sub>2</sub> Saturation	_____ to _____	Designation _____	
Systolic BP	_____ to _____	Signature _____	
Heart Rate	_____ to _____	Date _____ Time _____	
Temperature	_____ to _____	/ / : _____	
Consciousness	_____ to _____		
4 Hour Urine Output	_____ to _____		
<b>Interventions</b>			
If you administer an intervention, record here and note letter in Intervention row over page in appropriate time column.			
A			
B			
C			
D			
E			
F			
G			
H			
I			
J			

Figure 12: Two alternate locations of the interventions area (denoted by the shaded boxes)

Interventions	
If you administer an intervention, record here and note letter in Intervention row over page in appropriate time column.	A
	B
	C
	D
	E

Figure 13: Close-up of an interventions area

**DRAFT**

DO NOT WRITE IN THIS BINDING MARGIN

Date	Time	Respiratory Rate (breaths / min)	O <sub>2</sub> Saturation (%)	O <sub>2</sub> Flow Rate (L / min)	Blood Pressure (mmHg)	Heart Rate (beats / min)	Temperature (C)	Consciousness	4 Hour Urine Output (mL)	Pain Score	ADDS Scores
	± 37	± 37	± 93	± 5	± 120	± 70	± 36.6	Alert	± 800	Write	
	31-35	31-35	90-92	1-5	120s	70s	36.1-37.5	To Voice	120-199	Write	
	21-30	21-30	85-89	± 5	150s	60s	35.1-36.0	To Pain	80-119	Write	
	9-20	9-20	± 94	± 5	180s	50s	34.1-35.0	Alert	± 200	Write	
	5-8	5-8	± 93	± 5	190s	40s	33.1-34.0	Alert	± 90	Write	

Modifications in use

Usual/target systolic BP: mmHg

Signature: \_\_\_\_\_

Circle the column showing the patient's usual systolic BP

Emergency call

**Adult Deterioration Detection System (ADDS)**

If any observation is in a shaded area, add up the Total ADDS Score and take the action required for that score.

Score 0	0
Score 1	1
Score 2	2
Score 3	3
Score 4	4
Score 5	5

Emergency call if:

- Any observation is in a purple area
- Airway threat
- Respiratory or cardiac arrest
- New drop in O<sub>2</sub> saturation < 90%
- Sudden fall in level of consciousness
- Seizure
- You are seriously worried about the patient but they do not fit the above criteria

**Actions Required**

**Total ADDS Score 1-3**

- Record observations at least once every 4 hours
- Carry out appropriate interventions as prescribed
- Manage fever, pain or distress
- Review O<sub>2</sub> delivery
- Consider informing Team Leader

**Total ADDS Score 4 - 5**

- Ward doctor to review patient within 30 minutes
- Request review, and note on the back of this form
- Notify Team Leader
- Record observations at least once every 30 minutes
- If patient must leave ward area, Nurse must accompany patient

**Total ADDS Score 6 - 7**

- Registrar to review patient within 30 minutes
- Request review, and note on the back of this form
- Registrar to ensure consultant is notified
- Ward doctor to attend
- If patient must leave ward area, Intern and Nurse must accompany patient

**Total ADDS Score ≥ 8**

- Consider Emergency call
- Registrar to review patient within 10 minutes
- Request review, and note on the back of this form
- Registrar to ensure Consultant is notified
- If patient must leave ward area, Registrar and Nurse must accompany patient

Intervention: E.g. A

Figure 14: Location of an Intervention row in the observations area (denoted by the shaded box)

### 7.1. POTENTIALLY HARMLESS MODIFICATIONS

- Adding to or subtracting from the number of rows in the table for noting interventions

### 7.2. POTENTIALLY HARMFUL MODIFICATIONS

- Changing the instructions so that they are no longer succinct, clear, directive and descriptive
- Changing the font formatting (different font, different size, capitalization, etc.)
- Changing the formatting of the table (thicker lines, more columns, narrower rows, etc.)

## 8. OBSERVATIONS AREA

With regards to detecting patient deterioration, the most important part of an observation chart is the area in which the observations are displayed. In the following subsections, we address the main design problems to which chart developers must pay careful attention.

### 8.1. NUMBER OF VARIABLES

We consider it to be extremely problematic to include more than nine variables in the observations area (excluding the Intervention row, and counting systolic and diastolic blood pressure as one overall entity). We adopt this position because chart users can only effectively interpret a finite amount of information. If extra variables are included on the observations area, then these less important variables will conflict with the more important variables for a user's attention. Further, the addition of these variables to the chart would almost certainly come at the expense of clutter or the use of unacceptably small fonts. Given that the original research conducted on the ADDS chart showed that it outperformed four existing charts with its nine variables, we consider nine variables to be a sensible upper limit until evidence to the contrary is produced.

The ACSQHC's Consensus Statement states that the physiological parameters that should be measured when recognising deterioration are respiratory rate, oxygen saturation, heart rate, blood pressure, temperature, and level of consciousness (4). Therefore, these six variables cannot be removed from the observation and response charts.

Therefore, with a limit of nine variables within the observations area, there is capacity to include three additional variables. We included O<sub>2</sub> flow rate, urine output, and pain on the observation and response charts because these variables are arguably capable of signalling deterioration in a majority of patients. If other chart developers would like to replace one of these three variables with different variables, the new variables must have been shown to be capable of signalling deterioration in most patients, or to be a strong signal of deterioration in a significant proportion of patients. Otherwise, they should not be integrated into the observations area. There is capacity to include additional observations on the back of the chart (see Section 13).

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#### 8.1.1 POTENTIALLY HARMLESS MODIFICATIONS

- Substituting any of O<sub>2</sub> flow rate, urine output, or pain with O<sub>2</sub> delivery, blood glucose or another variable that has been shown to signal deterioration in a significant proportion of patients, provided that these variables are maintained in logical groupings (see Figures 15 and 16, and Section 8.3 below)
- Substituting the AVPU consciousness scale for another simple consciousness scale (i.e., not the Glasgow Coma Scale), so long as the new scale to be used is selected based on clinical evidence of its efficacy
- Omitting O<sub>2</sub> flow rate, urine output, or pain



## 8.2. LABELS USED FOR VARIABLES

The labels used for the variables on the observation and response charts were in part determined by health professionals' preferred terminology and in part determined by preferencing full words over abbreviations (5, 6). Full words are likely to be immediately understood by all chart users, whereas abbreviations run the risk of being misunderstood or not recognised (especially by less experienced or relief staff). The labels used for the six variables specified in the ACSQHC Consensus Statement should not be changed.

We also included the unit of measurement for each variable in the label area, where applicable. This is good practice for clinical forms and also acts as an extra prompt for users' recognition of the variable (e.g. "Respiratory Rate (breaths / min)" is arguably hard to misinterpret). The unit of measurement for each variable should not be removed. Where new variables are added to the observation and response charts, these conventions should be applied.

---

### 7.2.1 POTENTIALLY HARMLESS MODIFICATIONS

- Including "Blood Glucose (mmol / L)" or "Blood Sugar (mmol / L)", but **not** "BGL" or "BSL"
- Changing "4 Hour Urine Output" to "Urine Output"

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### 7.2.2 POTENTIALLY HARMFUL MODIFICATIONS

- Changing the terms used for each of the six variables included on the observation and response charts that have been specified in the ACSQHC Consensus Statement (e.g., changing Blood Pressure to BP)
- Including an abbreviation for any other new variable included
- Not including the unit of measurement for any other new variable included, where applicable

## 8.3. ORDER OF VARIABLES

In the observation and response charts, variables are ordered both in terms of their importance to detecting deterioration and in logical groups. Respiratory rate is always the first of the variables, followed by two other breathing-related variables, O<sub>2</sub> saturation and O<sub>2</sub> flow rate (if it is used). The charts then include the circulatory variables (blood pressure and heart rate), followed by temperature, consciousness, urine output and pain.

Where additional variables are added to the observation and response chart, they should be included in a logical position on the chart. Oxygen flow rate has been positioned under oxygen saturation as it fits logically in this position. However, urine output and pain have been added at the

bottom of the chart, as they are less important in identifying potential deterioration compared to the other variables in the chart. If one of these variables is replaced by blood glucose, for example, it should also be added at the bottom of the chart.

---

#### 8.3.1. POTENTIALLY HARMLESS MODIFICATIONS

- Adding additional variables below consciousness (up to a limit of nine variables per chart)
- Positioning O<sub>2</sub> flow rate below other breathing-related variables
- Positioning heart rhythm below other circulatory variables

---

#### 8.3.2. POTENTIALLY HARMFUL MODIFICATIONS

- Inserting new variables in positions that are not related to their importance in detecting deterioration or logical connection to other variables in the chart (for example, blood glucose should not be inserted in the chart above consciousness)

### 8.4. GRAPHING OBSERVATIONS

In line with the ACSQHC's Consensus Statement, we graph all observations (except pain) in the observation and response charts (4). We require that chart users use dots linked via lines to plot observations, rather than writing numbers, as trend lines are easier to interpret quickly than numbers written in rows (see Figure 17).

At the time when the initial heuristic analysis was conducted, many existing charts used graphs in which multiple variables were plotted together on the same graph area, which was considered problematic because of the visual clutter generated (potentially making deterioration harder to detect). In our charts, each variable is plotted on a separate graph to avoid this problem (minimising the chances of a user confusing two data points for different variables). **Chart developers should not reverse this decision.**

Pain is written as a number because plotting pain properly using a 10- or 11-point scale would require 10 or more rows, for which sufficient space was not available.

---

#### 8.4.1. POTENTIALLY HARMLESS MODIFICATIONS

- Graphing pain if pain is measured on a scale with up to 6 points

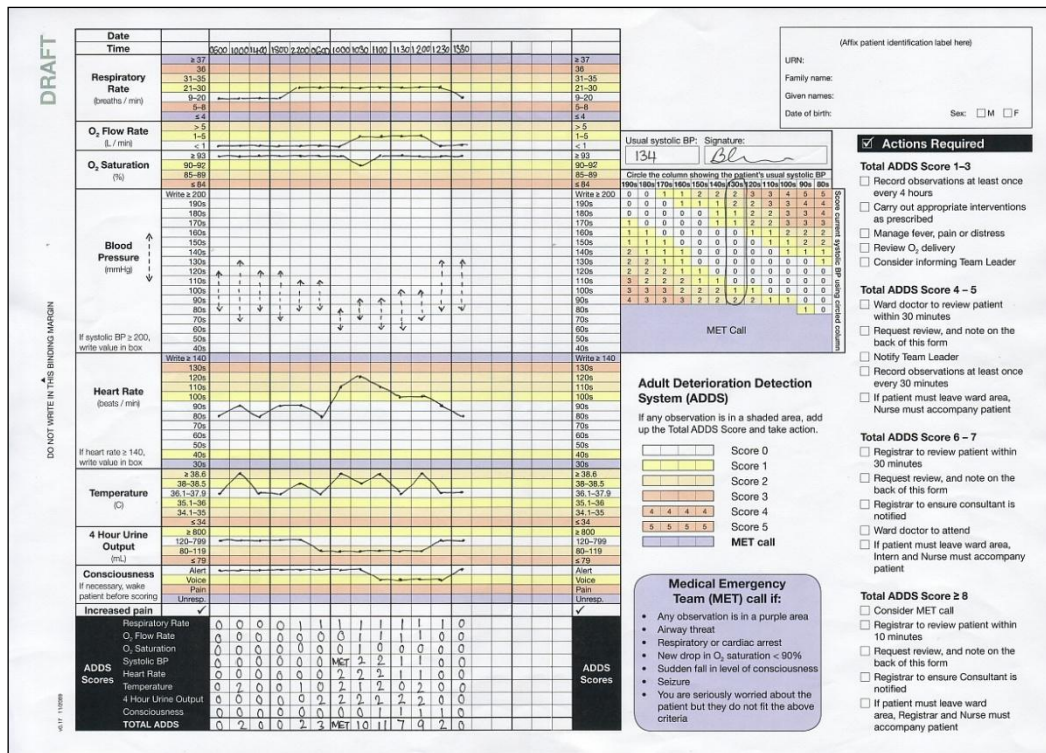


Figure 17: A example of how observations are graphed on the original ADDS chart

## 8.5. TABLE LAYOUT

The observations area is set out as a table (see Figure 18). The table contains 18 columns for writing observations, two scales (one on either side of the columns for writing observations), and variable label areas on the far left-hand-side. Two rows at the top are provided for recording the date and time.

The variable label area is formatted consistently. All of the labels are emphasized with a larger font size than the units of measurement and scale labels, and with bold formatting (including the date and time rows). All of the units of measurement and additional notation share the same formatting. Finally, the format required for plotting blood pressure is demonstrated by the included symbol. No deviations from this layout should occur.

There are two columns for listing the scales for each variable, one on the left and one on the right. This arrangement is thought to reduce row-shift errors (i.e., users accidentally jumping into the wrong row when recording data or reading data in the observations area). The right-hand-side scale also helps left-handed chart users, who may cover the right-hand-side scale with their left hand when writing. Within the scales, the values are always aligned to be as close to the columns for recording observations as possible (i.e., right-aligned in the left-hand-side scale and left-aligned in the right-hand-side scale). Finally, all values are formatted the same as one another, and, importantly, are distinct from the variable labels. This formatting should not be changed.

There are 18 columns for recording observations (i.e. the charts can be used for 6 days, assuming 8-hourly monitoring). Every third column is denoted by a thicker vertical line to reduce column-shift errors (users accidentally jumping into the wrong column when recording data or reading data in the observations area). This formatting should not be changed.

For each variable, its area is sectioned-off from other variables by thicker horizontal lines. The table as a whole is also bordered by a thicker lines. Again, this formatting should not be changed.

Date																					
Time																					
<b>Respiratory Rate</b> (breaths / min)	≥ 36																			≥ 36	
	30–35																			30–35	
	25–29																			25–29	
	20–24																			20–24	
	15–19																			15–19	
	10–14																			10–14	
	5–9																			5–9	
<b>O<sub>2</sub> Saturation</b> (%)	≤ 4																			≤ 4	
	≥ 95																			≥ 95	
	90–94																			90–94	
	85–89																			85–89	
<b>O<sub>2</sub> Flow Rate</b> (L / min)	≤ 84																			≤ 84	
	> 5																			> 5	
	1–5																			1–5	
<b>Blood Pressure</b> (mmHg)  Score systolic BP  If systolic BP ≥ 200, write value in box	< 1																			< 1	
	Write ≥ 200																			Write ≥ 200	
	190s																			190s	
	180s																			180s	
	170s																			170s	
	160s																			160s	
	150s																			150s	
	140s																			140s	
	130s																			130s	
	120s																			120s	
	110s																			110s	
	100s																			100s	
	90s																			90s	
	80s																			80s	
	70s																			70s	
	60s																			60s	
	50s																			50s	
	40s																			40s	
	<b>Heart Rate</b> (beats / min)  If heart rate ≥ 140, write value in box	Write ≥ 140																			Write ≥ 140
		130s																			130s
120s																				120s	
110s																				110s	
100s																				100s	
90s																				90s	
80s																				80s	
70s																				70s	
60s																				60s	
50s																				50s	
40s																			40s		
30s																			30s		
<b>Temperature</b> (C)	≥ 39.1																			≥ 39.1	
	38.1–39.0																			38.1–39.0	
	37.1–38.0																			37.1–38.0	
	36.1–37.0																			36.1–37.0	
	35.1–36.0																			35.1–36.0	
<b>Consciousness</b> If necessary, wake patient before scoring	≤ 35.0																			≤ 35.0	
	Alert																			Alert	
	To Voice																			To Voice	
	To Pain																			To Pain	
<b>Urine Output</b> (mL / hour)	Unresp.																			Unresp.	
	≥ 30																			≥ 30	
<b>Pain Score</b> None (0) – Worst (10)	≤ 29																			≤ 29	
	Write																			Write	
<b>Intervention</b>	E.g. 'A'																			E.g. 'A'	

**Figure 18:** The table layout with the two scales (denoted by the purple shaded boxes) and the variable label areas (denoted by the blue-green box) highlighted

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### 8.5.1. POTENTIALLY HARMLESS MODIFICATIONS

- Changing the values of rows for a particular variable, so that the thresholds match local policy (including inserting or deleting rows in a sensible manner; see Appendix B for alternative ranges for O<sub>2</sub> Flow Rate)
  - However, the values in each row must be mutually exclusive (e.g., **not** O<sub>2</sub> Saturation: ≥95; 90-95; 85-90; ≤85) and must not erroneously exclude certain values (e.g., **not** O<sub>2</sub> Saturation: >95, 90-94, 85-89, <84)
  - The total number of rows that can be included is finite, therefore compromises may have to be made to an extent (e.g., all row heights for graphed variables may have to be **slightly** decreased to include an extra row for one variable)
  - The formatting of the new rows must match that of existing rows **exactly**

---

### 8.5.2. POTENTIALLY HARMFUL MODIFICATIONS

- Inserting a large number of extra rows (e.g., so that it becomes very hard to see any increasing or decreasing trends because each row is shorter vertically)
- Deleting the “s” after values in the blood pressure and heart rate areas
- Deleting or altering any “Write” prompts
- Changing the use of “≥” to “>” or changing the use of “≤” to “<” without ensuring the values are still mutually exclusive and do not exclude certain values
- Changing the font formatting (different font, different size, capitalization, vertical orientation, etc.)
- Changing the formatting of the table (thicker lines, more columns, narrower rows, etc.)

## 8.6. USE OF COLOUR

The observation and response charts all use colour to signal where observations cross particular thresholds of abnormality. Also, across all charts, we used purple to signal that an emergency call is required. We chose an intuitive colour progression where possible (e.g. the four-level single parameter chart uses white, yellow, orange, red, and purple). In charts that use more than one fill colour (excluding white), progressively denser colours are used to signal progressively more serious abnormalities, to facilitate interpretation by colour-blind chart-users. We also avoided using more than five colours (including white space), because using many colours will lead to a chart looking “busy”. All of the colours used can be discerned by a red-green colour-blind individual. In addition, each colour (apart from the brighter orange on the two-level single parameter chart) has been tested for low-light legibility. Therefore, there is no need to change these colours. CMYK percentages for each of the standard colours are given below (excluding white and black).

**Table 1:** CMYK percentages for each of the standard colours in the observation and response charts (ORCs)

	CMYK (%)			
	Cyan	Magenta	Yellow	Black
<b>ORC Yellow</b>	0	0	29	0
<b>ORC Orange</b>	0	10	19	0
<b>ORC Red</b>	0	27	18	0
<b>ORC Purple</b>	16.2	23.4	0	0

#### 8.6.1. POTENTIALLY HARMLESS MODIFICATIONS

- Changing the colours of rows for a particular variable, so that the thresholds match local policy (including inserting or deleting rows in a sensible manner)

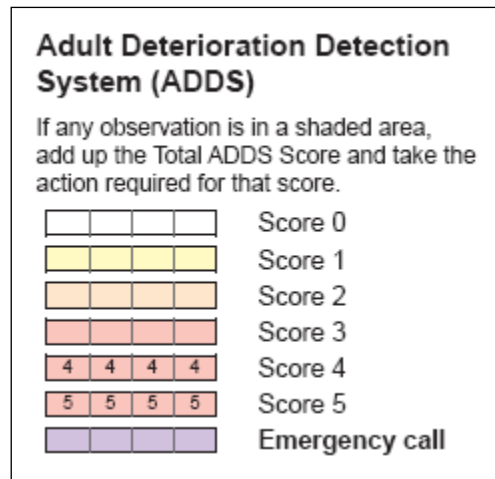
#### 8.6.2. POTENTIALLY HARMFUL MODIFICATIONS

- Using colour schemes other than those present on the charts
- Introducing green (as red-green colour-blindness is the most common type of colour-blindness)

## 9. SCORING GUIDE AREA (FOR CHARTS THAT INCLUDE SCORING SYSTEMS ONLY)

Observation charts that incorporate scoring systems (e.g., early warning scores) should include a scoring guide or key. This feature should be positioned as close to the observations area as possible (see Figures 19 and 20): When there are two or more pieces of information on a chart that users need to compare, they should be positioned close to one another on the page whenever possible. The number of rows in the scoring guide varies depending on the number of scores that need to be explained (bearing in mind that a 0 or ‘normal’ row should always be included to eliminate confusion). The scoring guide area should not be moved to another part of the chart.





**Figure 20:** Close-up of a scoring guide area

### 9.1. POTENTIALLY HARMLESS MODIFICATIONS

- Adding to or subtracting from the number of rows needed to explain the scoring system (e.g., if no score of 5 is possible, then deleting the “Score 5” row)
- Replacing the “Emergency call” prompt with a more specific prompt that reflects local policy (e.g., “MET call”)

### 9.2. POTENTIALLY HARMFUL MODIFICATIONS

- Changing the instructions so that they are no longer succinct, clear, directive and descriptive
- Changing the font formatting (different font, font size, capitalization, etc.)
- Changing the formatting of the table (thicker lines, more columns, narrower rows, etc.)
- Moving the scoring guide area so that it is not in either of the two locations shown in Figure 19

## 10. ADDITIONAL RESPONSE CRITERIA AREA

All of the observation charts that we have developed include a separate space for listing additional response criteria in a succinct manner (e.g., certain emergency situations such as respiratory or cardiac arrest). This feature should be positioned as close to the observations area as possible, and, ideally, between the observations area and the actions required area: When there are two or more pieces of information on a chart that users need to compare, they should be positioned close to one another on the page (see Figures 21 and 22). If the chart has a graded response (e.g., in the 4-level single parameter chart), criteria are listed in order of importance, with the most important additional response criteria (i.e., those that required an emergency call) listed at the top of the page.

DRAFT

DO NOT WRITE IN THIS BINDING MARGIN

Date																												
Time																												
Respiratory Rate (breaths / min)	≥ 36																							≥ 36		<input type="checkbox"/> Modifications in use	(Affix patient identification label here) URN: Family name: Given names: Date of birth:                      Sex: <input type="checkbox"/> M <input type="checkbox"/> F	
	30-35																							30-35				
	25-29																							25-29				
	20-24																							20-24				
	15-19																							15-19				
O <sub>2</sub> Saturation (%)	≤ 4																							≤ 4		<b>Emergency Call</b> <b>Response Criteria</b> • Any observation is in a purple area • Airway threat • Respiratory or cardiac arrest • Sudden fall in level of consciousness • New drop in O <sub>2</sub> saturation < 90% • Seizure • You are worried about the patient but they do not fit the above criteria		
	≤ 95																							≤ 95				
	90-94																							90-94				
	85-89																							85-89				
	≤ 84																							≤ 84				
O <sub>2</sub> Flow Rate (L / min)	Write ≥ 200																							Write ≥ 200		<b>Clinical Review</b> <b>Response Criteria</b> • Any observation is in a red area • New or unrelenting chest pain • New or unrelenting shortness of breath • Increased or unexpected fluid or blood loss • You are worried about the patient but they do not fit the above criteria		
	190s																							190s				
	180s																							180s				
	170s																							170s				
	160s																							160s				
Blood Pressure (mmHg)	150s																							150s		<b>Actions Required</b> • Place Emergency call • Registrar to review patient within 10 minutes • Registrar to ensure Consultant is notified		
	140s																							140s				
	130s																							130s				
	120s																							120s				
	110s																							110s				
	100s																							100s				
	90s																							90s				
	80s																							80s				
	70s																							70s				
	60s																							60s				
Heart Rate (beats / min)	Write ≥ 140																							Write ≥ 140		<b>Senior Nurse Review</b> <b>Response Criteria</b> • Any observation is in an orange area • You are worried about the patient but they do not fit the above criteria		
	130s																							130s				
	120s																							120s				
	110s																							110s				
	100s																							100s				
Temperature (C)	38.1-39.0																							38.1-39.0		<b>Increased Surveillance</b> <b>Response Criteria</b> • Any observation is in a yellow area • You are worried about the patient but they do not fit the above criteria		
	37.1-38.0																							37.1-38.0				
	36.1-37.0																							36.1-37.0				
	35.1-36.0																							35.1-36.0				
	≤ 35.0																							≤ 35.0				
Consciousness (if necessary, wake patient before scoring)	To Voice																							To Voice		<b>Actions Required</b> • Senior Nurse must review patient • Senior Nurse must contact Medical Officer to discuss whether a Clinical Review is required • Record observations at least once every 1 hour • Review O <sub>2</sub> requirement • Manage fever, pain, fluids, blood loss or distress		
	To Pain																							To Pain				
Urine Output (mL / hour)	Urinep.																							Urinep.				
	≤ 30																							≤ 30				
Pain Score (None (0) – Worst (10))	Write																							Write				
	None (0) – Worst (10)																							None (0) – Worst (10)				
Intervention	E.g. A																							E.g. A				

DRAFT

DO NOT WRITE IN THIS BINDING MARGIN

Date																												
Time																												
Respiratory Rate (breaths / min)	≥ 37																							≥ 37		<input type="checkbox"/> Modifications in use	(Affix patient identification label here) URN: Family name: Given names: Date of birth:                      Sex: <input type="checkbox"/> M <input type="checkbox"/> F	
	31-35																							31-35				
	21-30																							21-30				
	4-20																							4-20				
	≤ 4																							≤ 4				
O <sub>2</sub> Saturation (%)	≤ 93																							≤ 93		<b>Adult Deterioration Detection System (ADDS)</b> If any observation is in a shaded area, add up the Total ADDS Score and take the action required for that score: □ □ □ □ □ Score 0 □ □ □ □ □ Score 1 □ □ □ □ □ Score 2 □ □ □ □ □ Score 3 □ □ □ □ □ Emergency call		
	85-89																							85-89				
	≤ 84																							≤ 84				
	≤ 8																							≤ 8				
	1-5																							1-5				
O <sub>2</sub> Flow Rate (L / min)	Write ≥ 200																							Write ≥ 200		<b>Actions Required</b> <b>Total ADDS Score 1-3</b> • Record observations at least once every 4 hours • Carry out appropriate interventions as prescribed • Manage fever, pain or distress • Review O <sub>2</sub> delivery • Consider informing Team Leader		
	190s																							190s				
	180s																							180s				
	170s																							170s				
	160s																							160s				
Blood Pressure (mmHg)	150s																							150s		<b>Total ADDS Score 4-5</b> • Ward doctor to review patient within 30 minutes • Request review, and note on the back of this form • Notify Team Leader • Record observations at least once every 30 minutes • If patient must leave ward area, Nurse must accompany patient		
	140s																							140s				
	130s																							130s				
	120s																							120s				
	110s																							110s				
	100s																							100s				
	90s																							90s				
	80s																							80s				
	70s																							70s				
	60s																							60s				
Heart Rate (beats / min)	Write ≥ 140																							Write ≥ 140		<b>Total ADDS Score 6-7</b> • Registrar to review patient within 30 minutes • Request review, and note on the back of this form • Registrar to ensure consultant is notified • Ward doctor to attend • If patient must leave ward area, Intern and Nurse must accompany patient		
	130s																							130s				
	120s																							120s				
	110s																							110s				
	100s																							100s				
Temperature (C)	38.6																							38.6		<b>Total ADDS Score ≥ 8</b> • Registrar Emergency call • Registrar to review patient within 10 minutes • Request review, and note on the back of this form • Registrar to ensure Consultant is notified • If patient must leave ward area, Registrar and Nurse must accompany patient		
	38.0-38.5																							38.0-38.5				
	36.1-37.9																							36.1-37.9				
	35.1-36.0																							35.1-36.0				
	34.1-35.0																							34.1-35.0				
Consciousness (if necessary, wake patient before scoring)	Alert																							Alert				
	To Voice																							To Voice				
4 Hour Urine Output (mL)	≥ 300																							≥ 300				
	100-299																							100-299				
Pain Score (None (0) – Worst (10))	Write																							Write				
	None (0) – Worst (10)																							None (0) – Worst (10)				
Intervention	E.g. A																							E.g. A				



- Replacing the “Emergency call” and other generic prompts with more specific prompts (e.g., “MET call”)

## 10.2. POTENTIALLY HARMFUL MODIFICATIONS

- Removing the “Any observation is in a ... area” prompt (i.e., it is providing an extra prompt for action)
- Changing the wording so that it is no longer succinct, clear, directive and descriptive
- Changing the font formatting (different font, different size, capitalisation, etc.)
- Changing the formatting of the table cell or bubble
- Removing the “staff worry” criterion
- Overusing font formatting to emphasize particular words or phrases (e.g., one word in three being in bold or underlined)
- Including jargon
- Including abbreviations that could be misinterpreted or not recognised
- Including spelling or grammatical errors
- Not using Australian English spelling

## 11. ACTIONS REQUIRED AREA

All of the observation charts that we have developed include a space to list actions required by staff if a patient is deteriorating. All of the actions themselves are placeholders and each facility needs to review their own systems and resources and identify their own actions. Any action plans on the chart should be clearly worded and appropriately directive and descriptive, without requiring users to refer to other sources of information. This feature should be positioned as close as possible to the observations and the additional response criteria areas, as all three features will need to be used in tandem (see Figure 23).





## 12. CLINICAL REVIEW AREA

All of the observation charts include a series of fields in which to document a clinical review. This feature is located on the back page (outside face) of the chart, as it will likely be the least used feature. All other features of the chart are more important or are likely to be more frequently used. We included this feature so that the attending doctor's review can be documented on the same form as the abnormal observations. We also designed the review as a time-saving table, so that busy clinicians do not have to write their impressions in sentences into the case notes.

### 12.1. POTENTIALLY HARMLESS MODIFICATIONS

- Changing the designations to reflect local policy (e.g., changing "Registrar" to "Medical Officer")

### 12.2. POTENTIALLY HARMFUL MODIFICATIONS

- Changing the font formatting (different font, different font size, capitalisation, etc.)
- Changing the clinical review table formatting (thicker lines, more columns, narrower rows, etc.)
- Minimising the amount of information required (e.g., do not remove the Time prompts)

## 13. ADDITIONAL OBSERVATIONS AREA

Given that some chart developers will want to include extra observations on modified versions of the new charts, we propose that other chart developers be allowed to use the additional observations area to accommodate other observations (e.g., blood glucose level, bowels, weight, or a urinalysis). As far as possible, the formatting of this second observations area must conform to that of the inside pages (but without the requirement to use colour); that is, the recommendations made in Section 8 should also be followed in formatting this area of a chart. See Figures 24 and 25 for an example of how this could be done.

(Affix patient identification label here)

URN: \_\_\_\_\_  
 Family name: \_\_\_\_\_  
 Given names: \_\_\_\_\_  
 Date of birth: \_\_\_\_\_ Sex:  M  F

**Clinical Reviews**

**Review requested** Date: / / Time: : :  Ward doctor  Registrar  Emergency  
 Reason:  ADOIS  Other Specify: \_\_\_\_\_

**Review undertaken** Date: / / Time: : :  

	✓	Not examined	Normal	Abnormal	If abnormal, give details
Airway					
Breathing					
Circulation					
Neurology					
Skin					
ENT					
Bones / joints					

 Management  
 Management changed Specify: \_\_\_\_\_  
 No change, observe

Doctor's name (please print) \_\_\_\_\_ Designation \_\_\_\_\_ Signature \_\_\_\_\_

NHS.uk/DOCS/SHL/N/BLUK/LON/CO

**Additional Observations**

Date										
Time										
Blood Glucose Level (mmol / L)										
Weight (kg)										
Bowels										
Urinalysis	Specific gravity									
	pH									
	Leukocytes									
	Blood									
	Nitrite									
	Ketones									
	Bilirubin									
	Urobilinogen									
Protein										
Glucose										

**Figure 24:** An example of the additional observations area, including blood glucose level, weight, bowels and urinalysis

Additional Observations										
Date										
Time										
Blood Glucose Level (mmol / L)										
Weight (kg)										
Bowels										
Urinalysis	Specific gravity									
	pH									
	Leukocytes									
	Blood									
	Nitrite									
	Ketones									
	Bilirubin									
	Urobilinogen									
Protein										
Glucose										

**Figure 25:** A close-up of the additional observations area

## 14. OTHER CONSIDERATIONS

Chart developers should evaluate all the conditions under which it is expected that clinicians enter and interpret data on the chart. Note that the issues listed below are only a subset of potential considerations, and requirements will vary depending upon the environment and the population of clinicians who will use a particular chart.

### 14.1. CHART USERS

Other chart developers should carefully consider **who** will be using the observation chart and under what conditions. It is critical to design charts that take into account the training, skills, competence, motivation, and workplace culture of those who will use it. Chart design may have to accommodate clinicians with a wide range of experience and expertise. A chart should also be simple enough so that even a fatigued clinician can use it with minimal errors. You also need to take into account variability of eyesight in the healthcare workforce (e.g., can the chart be read under poor lighting conditions by staff who have poor eyesight?).

### 14.2. ENVIRONMENT

Practical issues may affect the usability of a chart. For example, other changes may also be required to the work environment (e.g. new clipboards or folders).

### 14.3. TRAINING

Well designed charts should require minimal training in order to use. We designed the original ADDS chart so that only a minimum of additional explanation was required by users. We demonstrated that non-clinicians and medical students could follow the instructions on the ADDS chart and record or interpret data with minimal training (training was approximately 10 minutes in length). Other chart developers should include tests of this nature in their chart development processes.

However, no chart should be implemented without an appropriate supporting training program. At a minimum, effective training should target how to record and interpret patient data, and how to manage patient deterioration appropriately.

Finally, do not rely on training to reduce errors that are caused by poor design.

## 15. REFERENCES

1. Preece M, Horswill M, Hill A, Karamatic R, Hewett D, Watson M. Heuristic analysis of 25 Australian and New Zealand adult general observation charts. Sydney, New South Wales, Australia: Australian Commission on Safety and Quality in Health Care 2009.
2. Standards Australia International. Australian Standard: Paper-based health care records. Strathfield, New South Wales, Australia: Standards Australia International 1999. Report No.: AS 2828—1999.
3. Queensland Health data management policy: Queensland Health clinical form design standard guidelines: Queensland Health 2003. Report No.: QHEPS Number 19006.
4. Australian Commission on Safety and Quality in Health Care. National consensus statement: Essential elements for recognising and responding to clinical deterioration. Sydney, New South Wales, Australia: Australian Commission on Safety and Quality in Health Care 2010.
5. Preece MHW, Horswill MS, Hill A, Karamatic R, Watson MO. An online survey of health professionals' opinions regarding observation charts. Sydney, New South Wales, Australia: Australian Commission on Safety and Quality in Health Care 2010.
6. Preece MHW, Horswill MS, Hill A, Watson MO. The development of the Adult Deterioration Detection System (ADDS) chart. Sydney, New South Wales, Australia: Australian Commission on Safety and Quality in Health Care 2010.

## APPENDIX A: USABILITY PRINCIPLES USED IN THE DEVELOPMENT OF THE OBSERVATION AND RESPONSE CHARTS

A large number of usability principles specific to paper-based observation charts are listed below. These principles were used first in our heuristic analysis of 25 Australian and New Zealand general observation charts, and subsequently in the development of the observation and response charts (1). In order to be relatively concise, only the most applicable rationales are listed for each usability principle. For some principles related to formatting (page margin size, pastel colouring, and font size), Queensland Health’s Clinical Form Design Standard Guidelines were used (3).

Usability principle	Rationale
<b>Page layout</b>	
Minimal space should be used for hospital name or logo	The system should not contain information that is rarely needed
Bureaucratic codes that do not relate to the chart’s clinical usage should not be present	The system should not contain information that is rarely needed
Landscape orientation preferred	Increases the size of the display that a user can simultaneously attend to
Page margins should be: left 2 cm, all others 1 cm	Queensland Health’s Clinical Form Design Standard Guidelines
Should not have mixture of vertically-oriented & horizontally-oriented data points	The system’s graphic design & colour should be carefully considered – chart should not have to be turned during use & vertically-oriented text takes longer to read [28]
Page should be A4 size	The system should match the user’s task in as natural a way as possible
<b>Information layout</b>	
Information should be displayed in decreasing order of importance	Information presented in the top left of a display normally gets more attention
Eight vital signs should all be on 1 side of a page	The aim of any system should be to present exactly the information the user needs at exactly the time & place that it is needed
No redundant or irrelevant information	The system should not contain information that is rarely needed
Two vital signs or track & trigger scores should be clearly separated	Avoid unrelated elements being formatted in a such a way that they seem to belong together
Areas for writing should accommodate 14 point font	Queensland Health’s Clinical Form Design Standard Guidelines
Amount of space devoted to something should not be too big	The system should not contain information that is rarely needed
Labels of the same level of importance should be formatted the same	Avoid related elements being formatted in a such a way that they seem to belong to different categories
Enough time-points for chart to be used for 3 days (assuming 4-hourly monitoring)	The system should match the user’s task in as natural a way as possible (i.e. average length of stay in hospital = 3.3 days) [29]
Important information should be displayed in top left of page	Information presented in the top left of a display normally gets more attention
Basic functionality should be understandable in 1 hour	Basic functionality should be understandable in 1 hour
<b>Recording vital signs</b>	
Data points for 2 vital signs should not be able to be confused	The system should produce minimal errors

Labels should specify unit of measurement	The aim of any system should be to present exactly the information the user needs at exactly the time and place that it is needed
Labels should be clear & descriptive	The system should have a good match between the display of information and the user's mental model of the information
Graph should not be too small or cramped	The system's graphic design and colour should be carefully considered – smaller or cramped graphs may be less legible (i.e. trends flattened)
Thick vertical lines should be placed every 3-4 columns	Reduce the time spent assimilating raw data
Time boxes should accommodate 14 point font	Queensland Health's Clinical Form Design Standard Guidelines
Date boxes should accommodate 14 point font	Queensland Health's Clinical Form Design Standard Guidelines
Information should be displayed as a graph	Bring together lower level data into a higher-level summation
Vertical axis of a graph should be labelled on the left & right of the page	Reduce the time spent assimilating raw data
Labels should provide an example of how data are to be recorded	When users are asked to provide input, the system should describe the required format and, if possible, provide an example
More than 1 vital sign should not be recorded on the same graph or area	The system should produce minimal errors
Graph label formatting should differ from vertical axis values' formatting	The system's graphic design and colour should be carefully considered – graph label should stand out from the graph values
Scale of the vertical axis values should not change	Reduce the time spent assimilating raw data
Vertical axis values should not be misaligned	The system should produce minimal errors
Date should be ruled off every 24 hours	Reduce the time spent assimilating raw data
Chart should not require the use of different coloured pens	Reduce the time spent assimilating raw data
Vertical axis values should be mutually exclusive	The system should produce minimal errors
Labels should not be written vertically with upright letters	The system's graphic design and colour should be carefully considered - vertically-oriented text takes longer to read [28]
<b>Integration of track and trigger systems</b>	
Action instructions should be clear & descriptive	Messages should be phrased in clear language and avoid obscure codes (the user should not have to refer to elsewhere, e.g. the manual). Messages should help the user solve the problem
Chart should include a track & trigger system	Bring together lower level data into a higher-level summation if appropriate
Scoring guide for each vital sign should not be listed on another part of the chart	Users should not have to remember information from one part of the system to another (i.e. avoid mental comparisons)
Action guide for the total score should not be listed on another part of the chart	Users should not have to remember information from one part of the system to another (i.e. avoid mental comparisons)
System should allow for modification of the threshold scores for a particular patient	The system should match the user's task in as natural a way as possible
System should be multiple parameter or aggregated weighted scoring	Bring together lower level data into a higher-level summation if appropriate
Colour scheme should correspond to the system	Automate unwanted workload. The system should allow the user to rely on recognition rather than recall memory
Score for each vital sign should be recorded beside	Information that will be used together should be

the vital sign itself	displayed close together
Basic functionality should be understandable in 1 hour	Basic functionality should be understandable in 1 hour
<b>Language and labelling</b>	
Expressions should be clear	Words, phrases, and concepts used should be familiar to the user. Users should not have to wonder whether different words or actions mean the same thing
Abbreviations should not be able to be misinterpreted	Words, phrases, and concepts used should be familiar to the user
No spelling or grammatical errors	Words, phrases, and concepts used should be familiar to the user
Australian English spelling	Words, phrases, and concepts used should be familiar to the user
<b>Cognitive and memory load</b>	
Information should not need to be compared over different areas of the 1 page	Users should not have to remember information from one part of the system to another (i.e. avoid mental comparisons)
Writing should not be required when chart could provide response options to circle	The system should allow the user to rely on recognition rather than recall memory
Information should not need to be transcribed or compared over 2 pages	Users should not have to remember information from one part of the system to another (i.e. avoid mental comparisons)
<b>Use of fonts</b>	
Text no smaller than 11 point font	The system's graphic design and colour should be carefully considered – 10 point font can be less legible [30]
Oh's/zero or el's/one should not look very similar	Users should not have to wonder whether different words or actions mean the same thing
Capitalisation should be used sparingly	Avoid over-using upper-case text, it attracts attention, but is slower to read than mixed-case text [31-32]
Text size should not be misleading (e.g. important information very small & vice versa)	The system should have a good match between the display of information and the user's mental model of the information.
Should not use more than 1 font type	The system's graphic design and colour should be carefully considered – may slow reading as user must 'switch' between fonts
Should not use compressed font (e.g. Arial Narrow)	The system's graphic design and colour should be carefully considered – crowding the letters in words slow reading [32-33]
Text should not be too big	The system's graphic design and colour should be carefully considered – larger fonts (12 & 14 point) can be less legible [34]
Serifs should not be used	The system's graphic design and colour should be carefully considered – serifs slow reading of short pieces of text [35]
<b>Use of colour</b>	
Colour should be used in a meaningful way	Reduce the time spent assimilating raw data
Colours should be distinguishable to colour-blind users	If colour is to be used, the system requires redundant cues so that colour-blind users are able to use the system with ease
Redundant cues should be included, i.e. scheme can be used without the colours	If colour is to be used, the system requires redundant cues so that colour-blind users are able to use the system with ease
Pastel colours preferred	Queensland Health's Clinical Form Design Standard Guidelines

Should not be more than 5 colours in chart as a whole (including white space, text, logos) Colour choice should not be potentially deceptive (e.g. green = bad)	Adapted from: avoid more than 7 colours (on a webpage), or the display will look too “busy” The system should have a good match between the display of information and the user’s mental model of the information
Should not be more than 5 colours in vital signs’ area (including white space)	Adapted from: avoid more than 7 colours (on a webpage), or the display will look too “busy”
<b>Photocopying legibility</b>	
Chart should be reproduced legibly at a range of photocopier settings, especially vital signs’ data and labels	The system should match the user’s task in as natural a way as possible
<b>Low light legibility</b>	
Chart should be legible in realistic low-light levels	The system should match the user’s task in as natural a way as possible

## APPENDIX B: ALTERNATIVE RANGES AND SCORING METHODS FOR O<sub>2</sub> FLOW RATE

The following are some suggested ranges and scoring systems for O<sub>2</sub> Flow Rate. Note that none of these systems has been empirically evaluated. They were based on suggestions by staff at The Prince Charles Hospital, after 6 months of experience with early warning scoring systems.

Alternative 1:

<b>O<sub>2</sub> Flow Rate range</b>	<b>ADDs Score</b>
< 1 L / min	ADDs score 0
1 L / min	ADDs score 1
2-5 L / min	ADDs score 2
6-10 L / min	ADDs score 3
>10 L / min	ADDs score 4

Alternative 2:

<b>O<sub>2</sub> Flow Rate range</b>	<b>ADDs Score</b>
0-2 L / min	ADDs score 0
3 -5 L / min	ADDs score 1
6 -10 L / min	ADDs score 2
>10 L / min	ADDs score 4

Alternative 3:

<b>O<sub>2</sub> Flow Rate range</b>	<b>ADDs Score</b>
0-2 L / min (nasal prongs)	ADDs score 0
>2 L / min (nasal prongs)	ADDs score 1
Hudson mask	ADDs score 2
Non-rebreather mask	ADDs score 3