



Moving The Goal Posts

Modifying the NZEWS

Alex Psirides

27th July 2018



HEALTH QUALITY & SAFETY
COMMISSION NEW ZEALAND
Kupu Taurangi Hauora o Aotearoa



SCORE	RRT	3	2	1	0	1	2	3	RRT
ZONE	BLUE	RED	ORANGE	YELLOW	WHITE	YELLOW	ORANGE	RED	BLUE
Resp Rate	<5	5-8		9-11	12-20		21-24	25-35	>35
SpO ₂		≤91	92-93	94-95	≥96				
Supplemental O ₂			YES		NO				
Temp			<35.0	35.0-35.9	36.0-37.9	38.0-38.9	≥39.0		
Sys BP	<70	70-89	90-99	100-109	110-219			≥220	
Heart Rate	<40		40-49		50-89	90-110	111-129	130-139	≥140
Level of Consciousness					Alert			Voice or Pain	Unresponsive or fitting



Contents lists available at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation



Clinical paper

Longitudinal analysis of one million vital signs in patients in an academic medical center[☆]

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1.15 million vital signs

42,430 admissions

27,722 patients

18 months

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ABSTRACT

Background: Recognition of critically abnormal vital signs has been used to identify critically ill patients for activation of rapid response teams. Most studies have only analyzed vital signs obtained at the time of admission. The intent of this study was to examine the association of critical vital signs occurring at any time during the hospitalization with mortality.

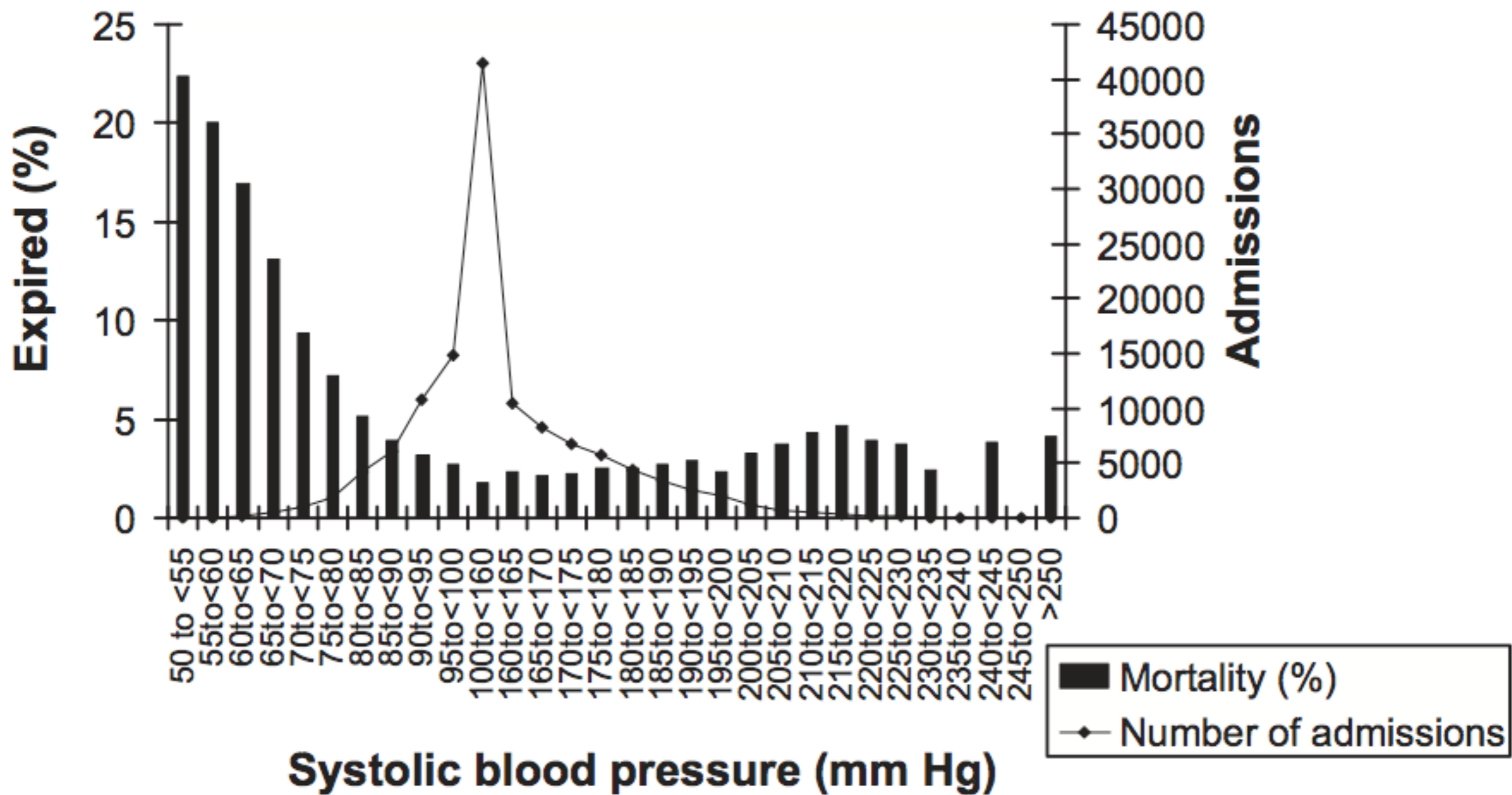
Methods: All vital sign measurements were obtained for hospitalizations from January 1, 2008 to June 30, 2009 at a large academic medical center.

Results: There were 1.15 million individual vital sign determinations obtained in 42,430 admissions on 27,722 patients. Critical vital signs were defined as a systolic blood pressure <85 mm Hg, heart rate >120 bpm, temperature <35 °C or >38.9 °C, oxygen saturation <91%, respiratory rate ≤12 or ≥24, and level of consciousness recorded as anything but "alert". The presence of a solitary critically abnormal vital sign was associated with a mortality of 0.92% vs. a mortality of 23.6% for three simultaneous critical vital signs. Of those experiencing three simultaneous critical vital signs, only 25% did so within 24 h of admission. The Modified Early Warning Score (MEWS) and VitalPAC Early Warning Score (IEWS) were validated as good predictors of mortality at any time point during the hospitalization.

Conclusions: The simultaneous presence of three critically abnormal vital signs can occur at any time during the hospital admission and is associated with very high mortality. Early recognition of these events presents an opportunity for decreasing mortality.

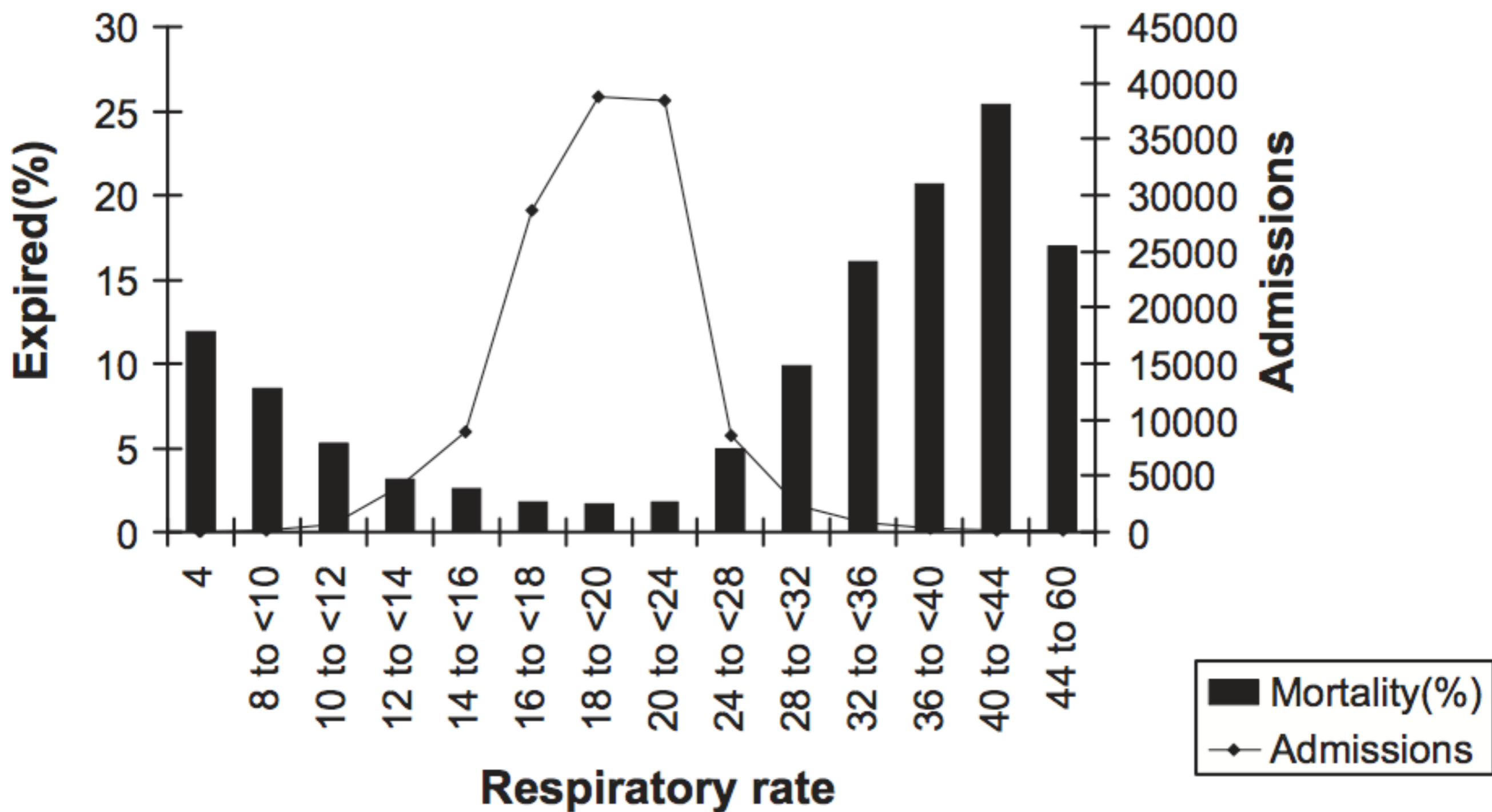
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a **Systolic Blood Pressure Prevalence and Mortality**

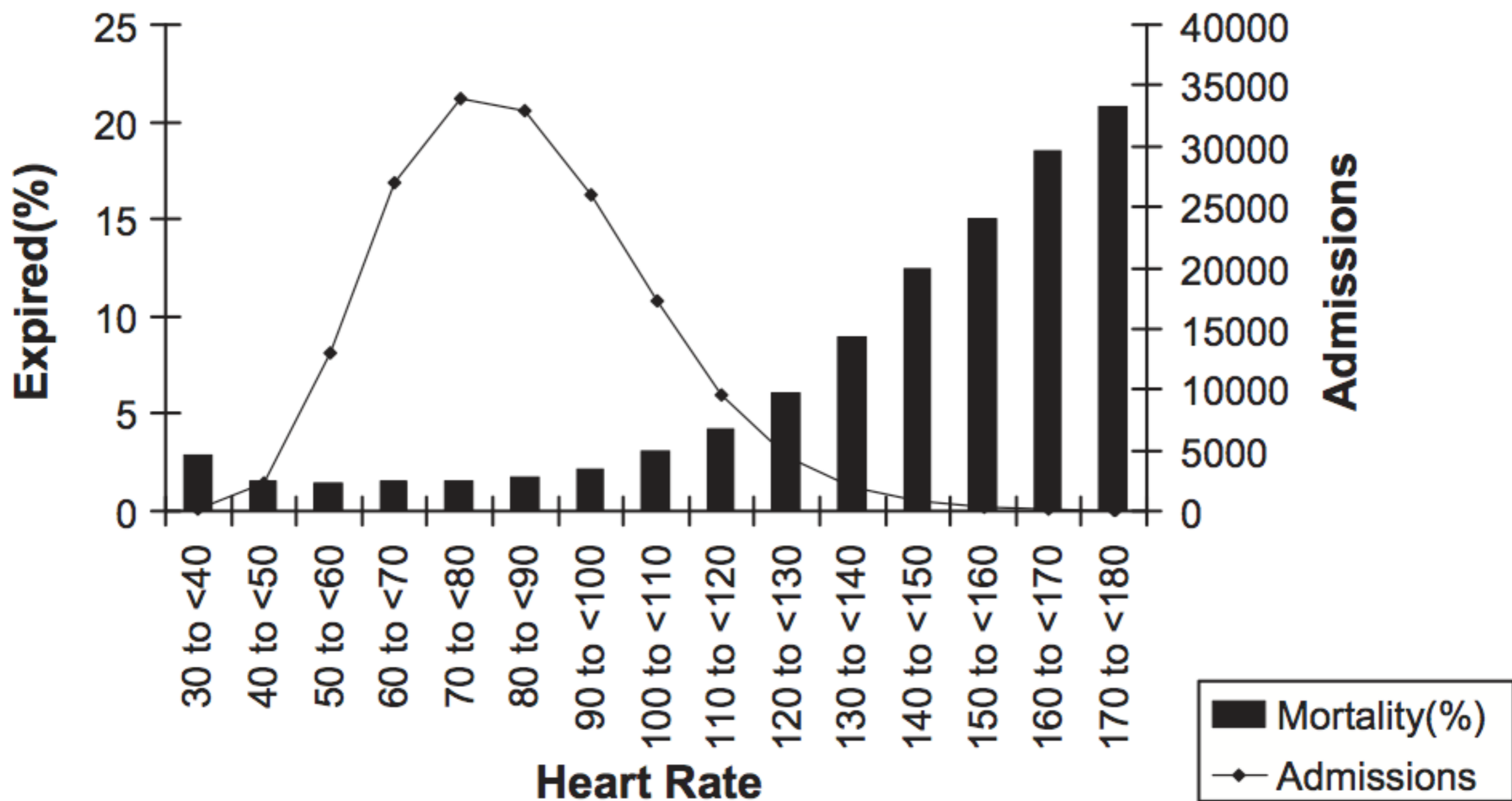


b

Respiratory Rate Prevalence and Mortality

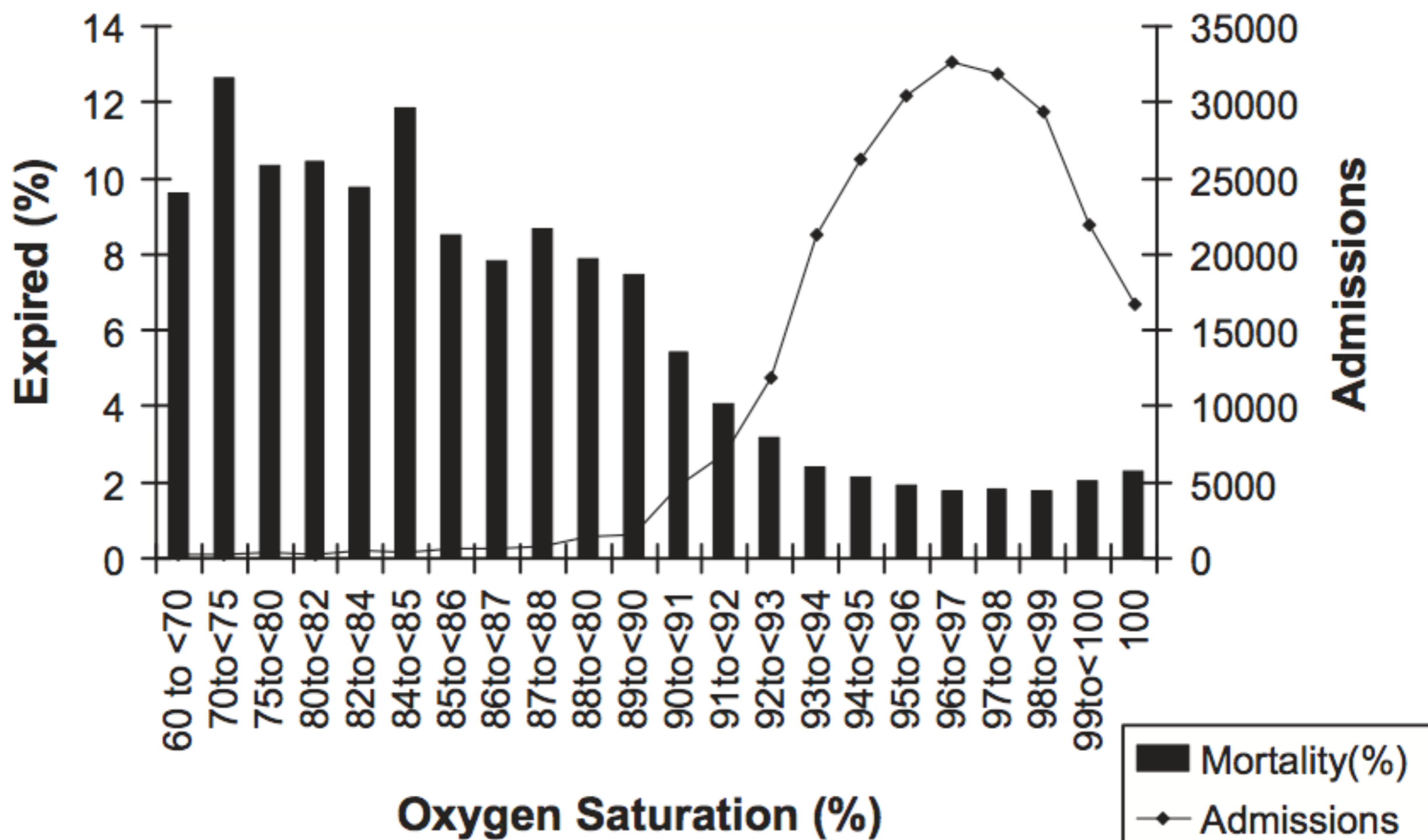


C Heart Rate Prevalence and Mortality



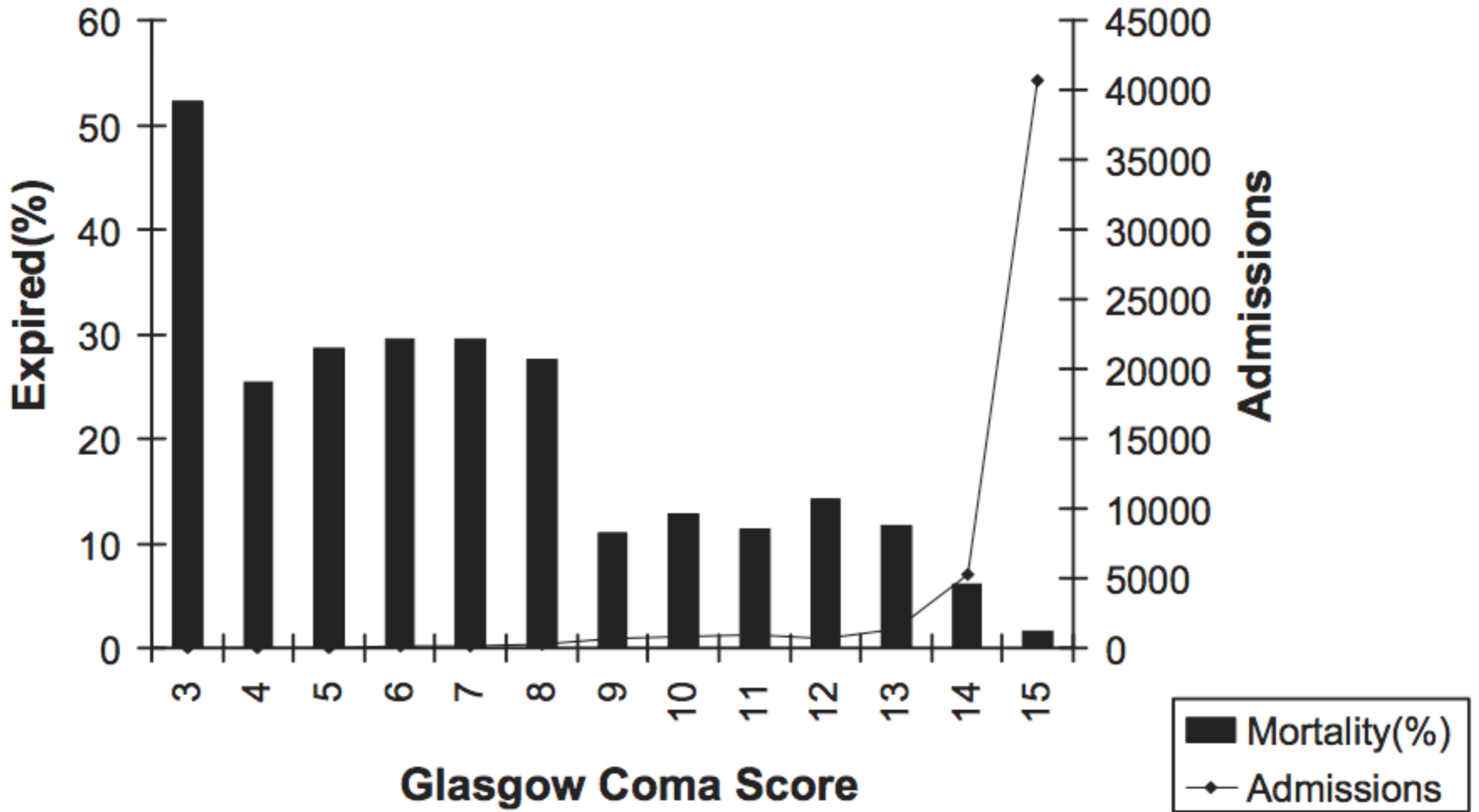
d

Oxygen Saturation Prevalence and Mortality



f

Glasgow Coma Score and Mortality



1 Million Vital Signs

- Mortality for *critically abnormal vital sign(s)*:
 - 0.92% for a solitary parameter
 - 23.6% for 3 simultaneous parameters
- Of those with 3 simultaneous critical signs, only 25% did so within 24 hours of admission



Clinical paper

ViEWS—Towards a national early warning score for detecting adult inpatient deterioration[☆]

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ABSTRACT

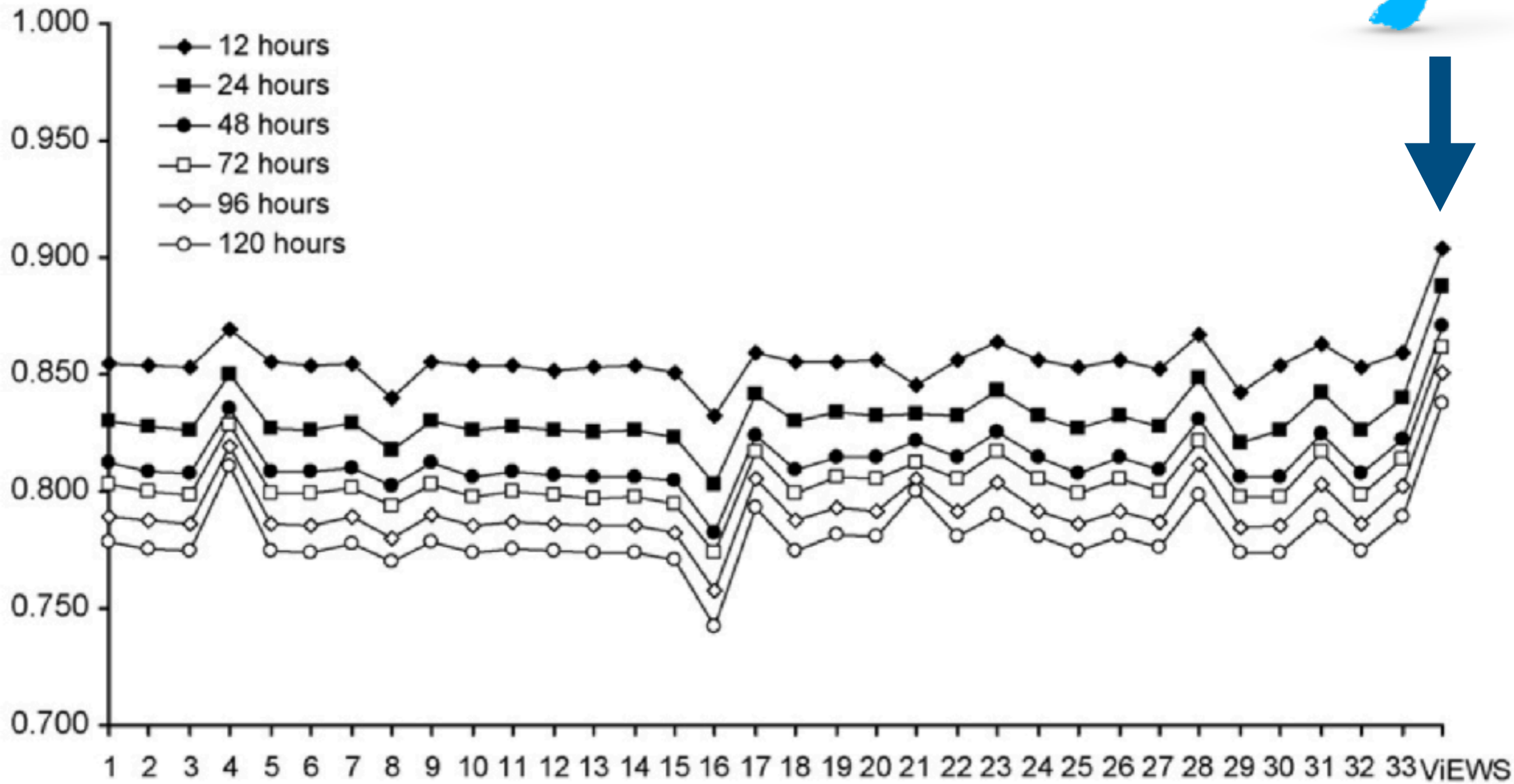
Aim of study: To develop a validated, paper-based, aggregate weighted track and trigger system (AWTTS) that could serve as a template for a national early warning score (EWS) for the detection of patient deterioration.

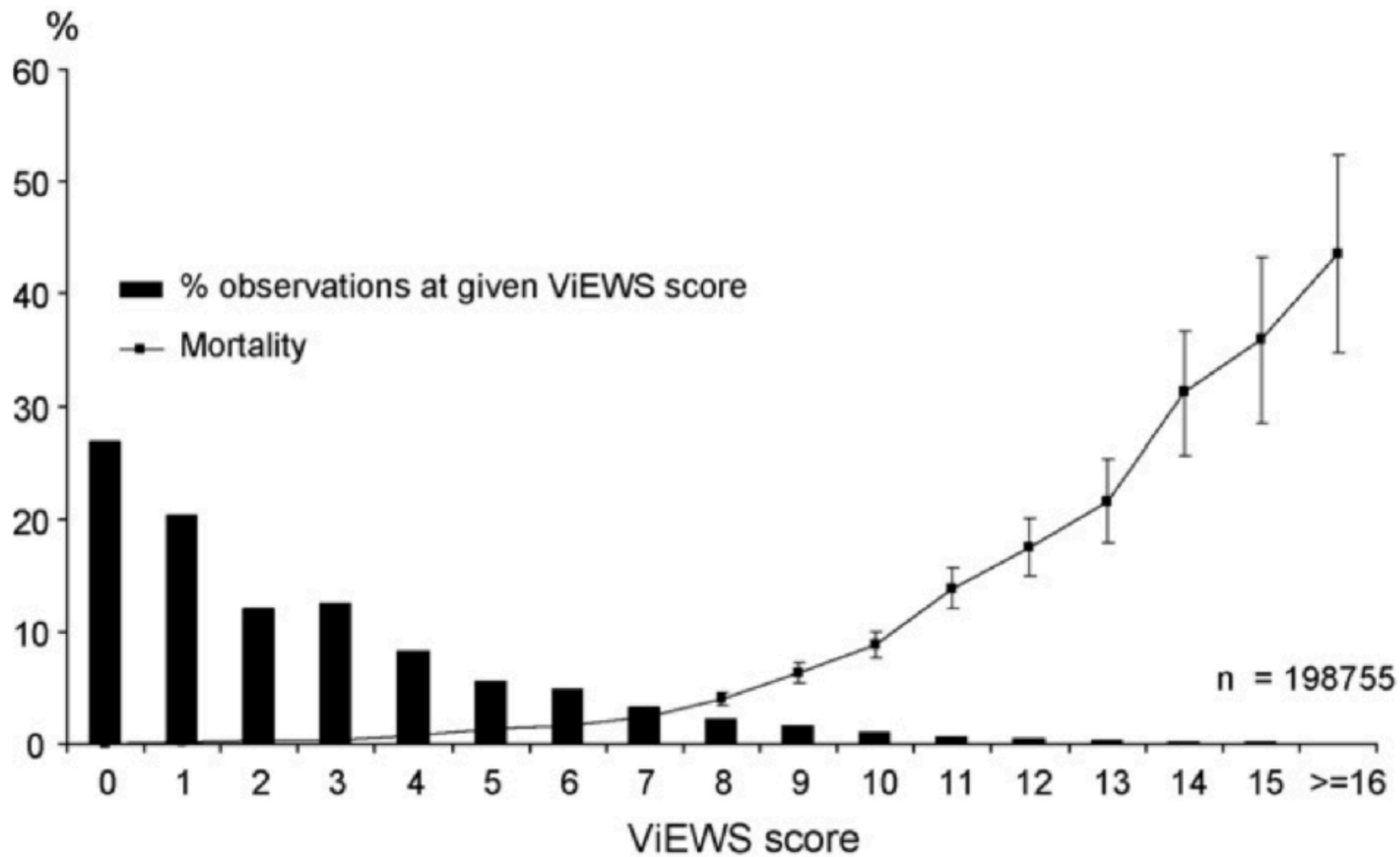
Materials and methods: Using existing knowledge of the relationship between physiological data and adverse clinical outcomes, a thorough review of the literature surrounding EWS and physiology, and a previous detailed analysis of published EWSs, we developed a new paper-based EWS – VitalPAC™ EWS (ViEWS). We applied ViEWS to a large vital signs database ($n = 198,755$ observation sets) collected from 35,585 consecutive, completed acute medical admissions, and also evaluated the comparative performance of 33 other AWTTSs, for a range of outcomes using the area under the receiver-operating characteristics (AUROC) curve.

Results: The AUROC (95% CI) for ViEWS using in-hospital mortality with 24 h of the observation set was 0.888 (0.880–0.895). The AUROCs (95% CI) for the 33 other AWTTSs tested using the same outcome ranged from 0.803 (0.792–0.815) to 0.850 (0.841–0.859). ViEWS performed better than the 33 other AWTTSs for all outcomes tested.

Conclusions: We have developed a simple AWTTS – ViEWS – designed for paper-based application and demonstrated that its performance for predicting mortality (within a range of timescales) is superior to all other published AWTTSs that we tested. We have also developed a tool to provide a relative measure of the number of “triggers” that would be generated at different values of EWS and permits the comparison of the workload generated by different AWTTSs.

AUROC





NZEWS	% Patients within NZEWS range	% Mortality within 24 hours of NZEWS range
0	27	<1
1 to 5	59.2	0.3-1.5
6 to 7	8.5	1.8-2.6
8 to 9	3.1	4.1-6.4
10 to 16	2.2	9.0-43.5

Pathophysiology	NZEWS Banding
<i>Nil</i>	<i>Nil</i>
Normal low level response to illness	YELLOW
Acute illness or unstable chronic disease	ORANGE
Likely to deteriorate rapidly	RED
Immediately life threatening critical illness	BLUE



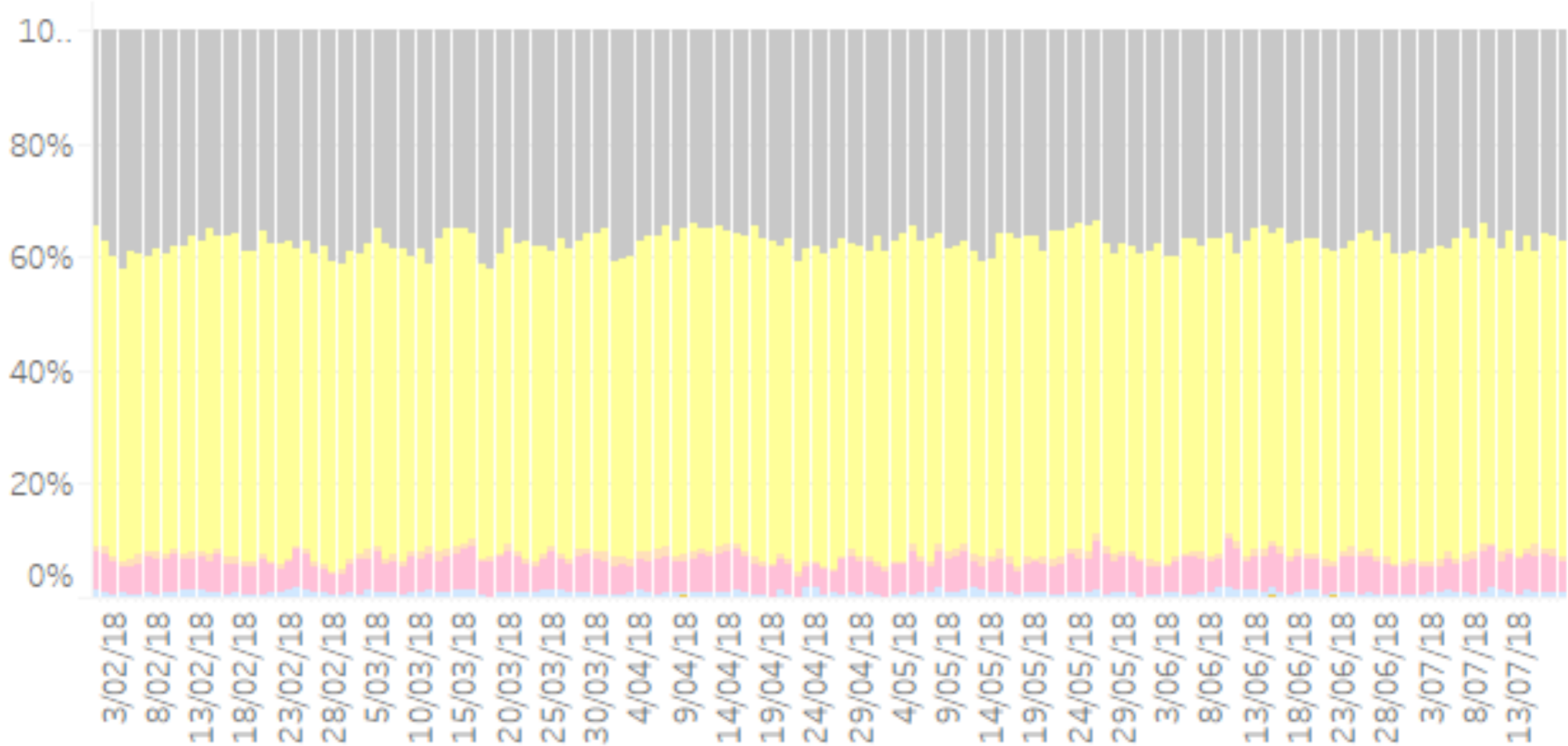
94.7% of acute patients scored 7 or less

Canterbury

District Health Board

Te Poari Hauora o Waitaha

CDHB NZEWS Working Group



3500 EWS sets per day

Modification to ADDS score – registrar or consultant only

If abnormal observations are to be tolerated for the patient's clinical condition, medical staff can modify the scoring threshold for the vital sign/observation parameter(s) of concern.

- Indicate that modifications to the ADDS score have been made by ticking the box next to the appropriate parameter over page (e.g. Modification to ADDS (tick)).
- If change no longer applies, draw a line through the modification and initial the 'cancel modifications to ADDS' box

Date / time <small>dd/mm/yy 24 hour format</small>	Vital sign <small>(e.g. BP / HR)</small>	99777 cardiac arrest call	Score 3	Score 2	Score 1	Score 0	Score 1	Score 2	Score 3	99777 cardiac arrest call	Doctor initial	Review date / time <small>dd/mm/yy 24 hour format</small>	Cancel Modifications to ADDS (Doctor initial)
Clinical reason													
Clinical reason													
Clinical reason													
Clinical reason													
Clinical reason													

Modification to Early Warning Score (EWS) Triggers

The EWS can be changed to prevent chronic disease incorrectly triggering escalation.

All modifications must be made in line with hospital policy and regularly reviewed by the primary team.

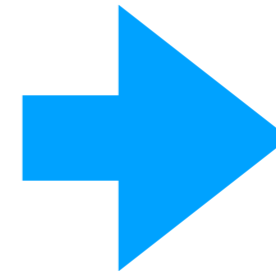
Ignore any modification that is not signed and dated.

Vital sign (use abbreviation)	Accepted values and modified EWS	Date and time	Duration (hours)	Name and contact details
		/ / :		
Reason:				
		/ / :		
Reason:				
		/ / :		
Reason:				
NOT FOR CPR	<input type="checkbox"/>	NOT FOR MET	<input type="checkbox"/>	/ / :

Any treatment limitations must be documented in the patient's clinical record.

Abbreviations

Respiratory Rate (breaths/min) <i>write RR value in box</i>	Blood Pressure (mmHg) <i>score systolic BP value only</i>
Oxygen (L/min)	↕
Oxygen Saturation (%) <i>write SpO₂ value in box</i>	
Heart Rate (bpm) <i>mark HR with X write value if off scale</i>	Temperature (°C) <i>mark Temp with X write value if off scale</i>
	Level Of Consciousness <i>mark LOC with ✓</i>



- RR
- Oxygen
- SpO₂
- HR
- BP
- Temp
- LOC

Why Modify?

- **TIME UNLIMITED:**

- Rare patients for whom **abnormal is normal** (e.g. on home O₂, resting HR 38)

- **TIME LIMITED:**

- Where deranged physiology has been **recognised, investigated & treatment has commenced** but improvement expected to lag behind



What To Modify?

- **The Trigger**

- Adjust score assigned to any vital sign parameter

- **The Response**

- Adjust who responds to specific triggers or scores

How To Modify

- **Provide parameter range & associated modified score**
- **Parameters should be exclusive (not overlap)**
 - e.g. 'HR 100-120 EWS=1, HR 120-140 EWS=2'
- **'<' or '>' should be avoided alone**
 - e.g. 'RR <40 EWS=0'
- **Modifications must be signed AND dated, or should be ignored. Contact details must be provided**
- **Normal EWS apply to any parameter not listed or values outside specified modifications range**

Why Provide A Reason?

- **Reduces doctors doing dumb things**
- Makes them think about why they are modifying
- Provides reasoning for other clinicians when the modifying physician is not available
- Information for audit purposes, reportable events, SAC reports, HDC reports etc.

Modifications To Trigger

Vital sign (use abbreviation)	Accepted values and modified EWS	Date and time	Duration (hours)	Name and contact details
HR	90-120 = EWS 0	26/ 7 /18 13 :15	24	Alex Psirides #6137
Reason: patient in fast AF with new treatment started				

Heart Rate (bpm)	Write if ≥ 140	RRT
	130s	3
	120s	2
	110s	
	100s	1
	90s	
	80s	0
	70s	
	60s	
	50s	
	40s	2
	30s	RRT

*mark HR with X
write value if off scale*

If HR >120, normal scores apply

If BP abnormal, normal scores apply

Modifications To Response

Vital sign (use abbreviation)	Accepted values and modified EWS	Date and time	Duration (hours)	Name and contact details
BP	<90 call ICU registrar	26/ 7 /18 13 :15	72	Alex Psirides #6137

Reason: patient has critical coronary artery disease, awaiting cardiac surgery

Blood Pressure (mmHg)	Score	RRT
30s		RRT
Write if ≥ 220		3
210s		
200s		
190s		
180s		
170s		
160s		0
150s		
140s		
130s		
120s		
110s		
100s		1
90s		2
80s		3
70s		
60s		RRT
50s		

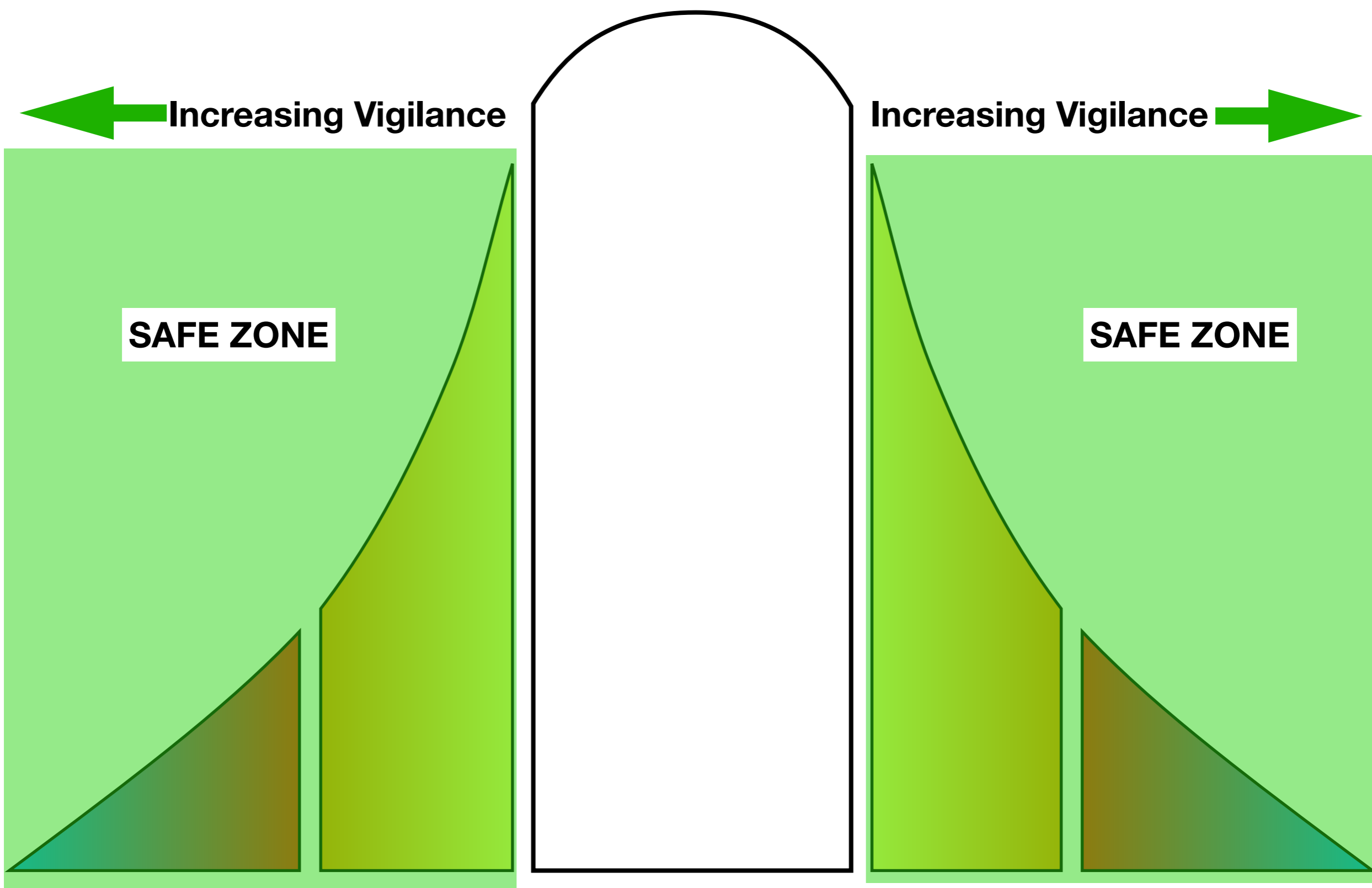
score systolic BP value only

If BP ≥ 90 , normal scores apply

Escalation to ICU occurs at earlier threshold

Modified To Death

- **Modifying parameters alters the ability of the system to detect deterioration**
 - Deterioration may go unnoticed
 - Escalation may be delayed
 - Treatment may be delayed
- **Modifications must be part of a treatment plan**
- **There is significant potential to 'hide' the patient from the rapid response system**



SAFE ZONE

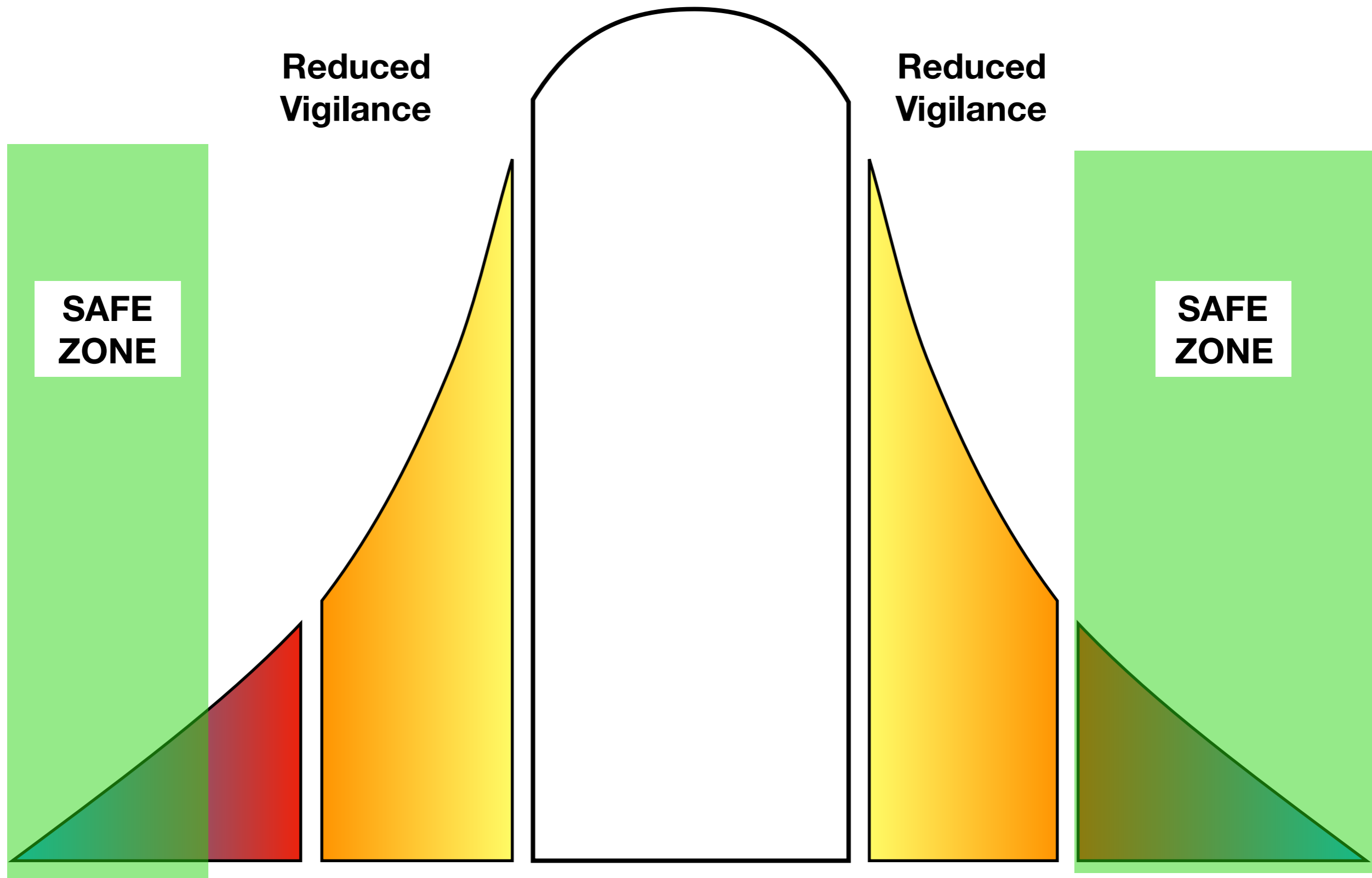
SAFE ZONE

Increasing Vigilance

Increasing Vigilance

NZEWS UNMODIFIED

INCREASED RISK



NZEWS WITH MODIFICATIONS

Modified To Death



- 3,133 Outreach escalations over 4 years in 2 tertiary Canadian hospitals
- Compared immediate escalation (*69% of cases*) with ≥ 60 minutes delay in escalation (*31%*)
- **Delay group had increased risk:**
 - **Death (OR 1.3)**
 - **ICU admission (OR 1.22)**

**ESCALATE CARE FOR ANY PATIENT
YOU, THEY OR THEIR FAMILY ARE
WORRIED ABOUT, REGARDLESS OF
VITAL SIGNS OR EWS**

Modifications **DO NOT override common sense, clinical
acumen or professional responsibility for your patient**

Special Circumstances

Modifications From PACU

- Some anaesthetists may wish oxygen to continue during recovery from anaesthesia even if the patient is not hypoxic
- Hyperoxia may provide a 'buffer' for hypoventilation; for similar reasons, some PCA policies require supplemental oxygen to be given to non-hypoxic patients
- If these patients leave PACU on oxygen, they will cause false escalation (score '2' & in **Orange** zone)

Vital sign (use abbreviation)	Accepted values and modified EWS	Date and time	Duration (hours)	Name and contact details
Oxygen	Flow \leq 4 L/min EWS=0	26/ 7 /18 13 :15	4	Alex Psirides #6137
Reason: patient requires oxygen post-anaesthesia				

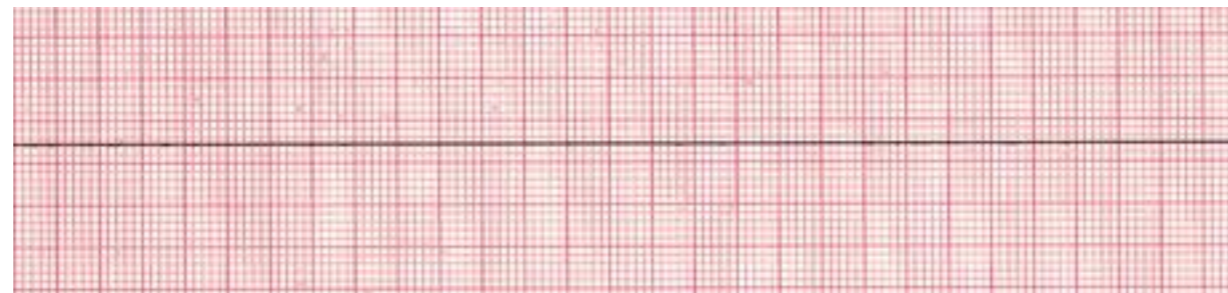
Modifications From ICU

- Sometimes patients have been monitored in ICU or HDU with abnormal vital signs for a period of time and have been stable
- Although abnormal physiology may not have completely resolved, it is expected to do so within a reasonable time frame
- Due to their stability, these patients are suitable for a ward environment

Vital sign (use abbreviation)	Accepted values and modified EWS	Date and time	Duration (hours)	Name and contact details
HR	90-110 EWS=0, 111-139 EWS=1	26/ 7 /18 13 :15	36	Alex Psirides #6137
Reason: stable, resolving pneumonia				
RR	21-24 EWS=1, 25-35 EWS=2	26/ 7 /18 13 :15	24	Alex Psirides #6137
Reason: stable, resolving pneumonia				

Modifications In Dying

- Once it is recognised that a patient is dying, all medical & nursing care should be focused on symptom relief. *It is unlikely that (objective) vital signs offer anything over (subjective) clinical assessment*
- **Documenting dying on a vital signs chart is of no benefit to the patient**



Vital sign (use abbreviation)	Accepted values and modified EWS	Date and time	Duration (hours)	Name and contact details
All vital signs	Stop all vital sign monitoring	26/ 7 /18 13 :15	Forever	Alex Psirides #6137
Reason: patient is dying & on a palliative pathway				

! DANGER !

- **Detection of deterioration is delayed with:**
 - 2 or more parameters being modified
 - more extreme modifications on single parameters
- **Modifications should only be performed by:**
 - a clinician with understanding of acute deterioration
 - of appropriate (or delegated) seniority

DANGER

Vital sign (use abbreviation)	Accepted values and modified EWS	Date and time	Duration (hours)	Name and contact details
RR	<70 EWS=0	26/ 7 /18 13 :15	48 hours	Dangerous Doctor #1234
Reason: compensating for DKA				

NEWS key				FULL NAME													
0	1	2	3	DATE OF BIRTH						DATE OF ADMISSION							
				DATE						DATE							
				TIME						TIME							
A+B Respirations Breaths/min	≥25																≥25
	21-24																21-24
	18-20																18-20
	15-17																15-17
	12-14																12-14
	9-11																9-11
	≤8																≤8
A+B SpO ₂ Scale 1 Oxygen saturation (%)	≥95																≥95
	94-93																94-93
	92-93																92-93
	≤91																≤91
SpO₂ Scale 2† Oxygen saturation (%) <small>Use Scale 2 if target range is 88-92%, eg in hypercapnic respiratory failure</small>	≥97 on O ₂																≥97 on O ₂
	95-96 on O ₂																95-96 on O ₂
	93-94 on O ₂																93-94 on O ₂
	≥93 on air																≥93 on air
	88-92																88-92
	86-87																86-87
	84-85																84-85
	≤83%																≤83%
Air or oxygen?	A=Air																A=Air
	O ₂ L/min Device																O ₂ L/min Device
C Blood pressure mmHg <small>Score uses systolic BP only</small>	≥220																≥220
	201-219																201-219
	181-200																181-200
	161-180																161-180
	141-160																141-160
	121-140																121-140
	101-120																101-120
	91-100																91-100
	81-90																81-90
	71-80																71-80
	61-70																61-70
51-60																51-60	
	≤50															≤50	
C Pulse Beats/min	≥131																≥131
	121-130																121-130
	111-120																111-120
	101-110																101-110
	91-100																91-100
	81-90																81-90
	71-80																71-80
	61-70																61-70
	51-60																51-60
	41-50																41-50
31-40																31-40	
	≤30															≤30	
D Consciousness <small>Score by RWS level of confusion (see notes if drowsy)</small>	Alert																Alert
	Confusion																Confusion
	V																V
	P																P
	U																U
E Temperature °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†
	≤35.0†															≤35.0†	
NEWS TOTAL																	
Monitoring frequency																	Monitoring frequency
Escalation of care Y/N																	Escalation of care Y/N
Initials																	Initials

National Early Warning Score (NEWS) 2

Standardising the assessment of acute-illness severity in the NHS

SpO₂ Scale 2†
Oxygen saturation (%)

Use Scale 2 if target range is 88-92%, eg in hypercapnic respiratory failure

†**ONLY use Scale 2 under the direction of a qualified clinician**

≥97 on O ₂			
95-96 on O ₂			
93-94 on O ₂			
≥93 on air			
88-92			
86-87			
84-85			
≤83%			

Summary

- Modifications are *sometimes* necessary
- **There is significant potential to cause harm by hiding sick patients or masking deterioration**
- Modifications should be made by those with expertise to know what they are doing
- Documentation for rationale is key & **provides accountability**
- There is no 'right' way to modify
- Audit with appropriate governance is required

Questions?

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HEALTH QUALITY & SAFETY
COMMISSION NEW ZEALAND
Kupu Taurangi Hauora o Aotearoa