The ability of the National Early Warning Score (NEWS) to discriminate patients at risk of early cardiac arrest, unanticipated intensive care unit admission, and death

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ABSTRACT

Introduction: Early warning scores (EWS) are recommended as part of the early recognition and response to patient deterioration. The Royal College of Physicians recommends the use of a National Early Warning Score (NEWS) for the routine clinical assessment of all adult patients.

Methods: We tested the ability of NEWS to discriminate patients at risk of cardiac arrest, unanticipated intensive care unit (ICU) admission or death within 24 hours of a NEWS value and compared its performance to that of 33 other EWSs currently in use, using the area under the receiver-operating characteristics (AUROC) curve and a large vital signs database (n=198,755 observation sets) collected from 35,585 consecutive, completed acute medical admissions.

Results: The AUROCs (95% CI) for NEWS for cardiac arrest, unanticipated ICU admission, death, and any of the outcomes, all within 24 hours, were 0.722 (0.685 to 0.759), 0.857 (0.847 to 0.868), 0.894 (0.887 to 0.902), and 0.873 (0.866 to 0.879), respectively. Similarly, the ranges of AUROCs (95% CI) for the other 33 EWSs were 0.611 (0.568 to 0.654) to 0.710 (0.675 to 0.745) (cardiac arrest); 0.570 (0.553 to 0.568) to 0.827 (0.814 to 0.840) (unanticipated ICU admission); 0.813 (0.802 to 0.824) to 0.858 (0.849 to 0.867) (death); and 0.736 (0.727 to 0.745) to 0.834 (0.826 to 0.842) (any outcome).

Conclusions: NEWS has a greater ability to discriminate patients at risk of the combined outcome of cardiac arrest, unanticipated ICU admission or death within 24 hours of a NEWS value than 33 other EWSs.

INTRODUCTION

The use of early warning scoring systems, also known as physiological, aggregate weighted track and trigger systems,[1] has been recommended in a range of UK reports regarding the early recognition and response to patient deterioration.[1–8] These systems allocate points in a weighted manner, based on the derangement of patients' vital signs variables (e.g., pulse rate, breathing rate, blood pressure) from arbitrarily agreed 'normal' ranges. The sum of the allocated points - the early warning score (EWS) – is used to direct care, e.g. to increase vital signs monitoring, involve more experienced staff or call a rapid response team (e.g. outreach or medical emergency team). A range of EWS is in use in hospitals in the UK, with a significant degree of variation in the measured physiological variables, the weightings assigned, and the thresholds for triggering specific responses.[9 10]

In 2007, the report of the Acute Medicine Task Force of the Royal College of Physicians, London (RCPL) recommended that "…*physiological assessment of all patients should be standardised across the NHS with the recording of a minimum clinical data set result (sic) in an NHS early warning (NEW) score...*"[7] In 2010, we developed a novel early warning scoring system – ViEWS (VitalPAC Early Warning Score[11]) – which performed better than 33 other published systems when used to discriminate survival from non-survival at 24 hours post observation. ViEWS was developed using an *iterative, pragmatic, 'trial and error' approach*, with the cut-offs for its scoring bands being deliberately adjusted to maximise its ability to predict in-hospital death within 24 hours of a vital signs dataset.[11] No attempt was made to modify ViEWS with respect to maximise its ability to discriminate any other outcome.

Members of the RCPL National Early Warning Score Design and Implementation Group (NEWSDIG) made minor adjustments to ViEWS, based on clinical opinion, to develop the National Early Warning Score (NEWS) (Table 1).[12] (One of our group - GBS - was a member of NEWSDIG). As part of the development of NEWS, our group undertook an evaluation of NEWS versus other existing EWS systems for the RCPL. This article shows the application of NEWS to the same large vital signs database used in the ViEWS publication,[11] but now also applied to additional clinical outcomes, i.e., cardiac arrest and unanticipated intensive care unit (ICU) admission.

METHOD

Local research ethics committee approval was obtained for this study from the Isle of Wight, Portsmouth and South East Hampshire Research Ethics Committee (study ref 08/02/1394). The study considered only pseudoanonymised data.

Vital signs database and its development

A database of vital signs collected in real-time from completed consecutive admissions to beds in the Medical Assessment Unit (MAU) of the hospital between 8 May 2006 and 30 June 2008 was developed. Data from patients who were discharged from hospital before midnight on the day of admission were excluded. The MAU is the common entry point for all general medical emergency patients aged ≥16 years, with the exception of those transferred directly on admission to critical care areas of the hospital.

As a routine part of clinical care, MAU staff entered each patient's vital signs data into personal digital assistants (PDA) running the VitalPAC software.[13] Each time a vital signs measurement was made the following data were recorded at the bedside in the PDAs: date/time of observation set (automatically set by VitalPAC); pulse rate; systolic and diastolic blood pressure; breathing rate; body temperature; neurological status using either the Alert-Verbal-Painful-Unresponsive (AVPU) scale or Glasgow Coma Score (GCS); and peripheral oxygen saturation (S_pO_2). A record of the inspired gas (i.e., air or oxygen) being breathed by the patient at the time of S_pO_2 measurement was also recorded in real time in the VitalPAC software by the staff. Where a patient's conscious level had been assessed using a GCS instead of AVPU, we converted the GCS value to an 'AVPU equivalent' using a protocol established within the hospital (GCS 15 =A; GCS 14 =V; GCS 13–9 = P; GCS ≤8 = U). Vital signs observation sets were not available once the patient was transferred from MAU.

Outcomes

The measured outcomes studied were death, cardiac arrest, and unanticipated ICU admission, each within 24 hours of a vital signs dataset. Where it occurred, patient death was identified from the patient administration system (PAS); confirmed cardiac arrests were identified using the hospital cardiac arrest database; and unanticipated ICU admission was identified from the ICU admission database. Patients may have suffered more than one of the three outcomes within 24 hours. We applied precedence rules for the presence of multiple outcomes attached to each observation set. Where multiple outcomes occurred, the first outcome was the outcome used in the analysis. For example, if a patient suffered a cardiac arrest followed by unanticipated ICU admission and death, this was defined as a cardiac arrest for the purposes of analysis. Alternatively, if someone was admitted to ICU and then suffered a cardiac arrest followed by death, this was defined as an ICU admission, and so on. To provide an additional, more clinically useful outcome than death, cardiac arrest, and unanticipated ICU admission alone, we also analysed for the presence of any of these outcomes (that is death or cardiac arrest or unanticipated ICU admission) within 24 hours.

Data analysis

All data manipulation was performed using Microsoft® Visual FoxPro 9.0. The ability of NEWS to discriminate between those suffering and those not suffering an adverse outcome at 24 hours post vital signs observation was assessed using the area under the receiver-operating characteristics (AUROC) curve.[14] We also applied the 33 unique EWSs that we had previously analysed[10] to the same database using the range of adverse outcomes at 24 hrs post-observation to put the performance of NEWS into context. AUROC was performed using SPSS v18. The minimum AUROC possible is 0.5 and is the value that would be expected if the model was no better than chance at predicting mortality. Reasonable discrimination is indicated by AUROC values of 0.700 to 0.800 and good discrimination by values exceeding 0.800. In entering repeated observation sets from the same patient episode into the analysis, we have made the implicit assumption that the observation sets are independent of each other.

RESULTS

198755 vital signs datasets (94376 from males) were obtained from 35585 patient episodes. The mean (median) ages of the patients were 67.7 (72.6) yrs (male 65.9 (69.7); female 69.4 (75.5)). The number of observation sets followed by death within 24 hours was 1999 (1%), irrespective of any of the other three outcomes. When we applied the precedence rules as described in the methods, of the

198755 observation sets, 199 were followed by cardiac arrest, 1161 by unanticipated ICU admission, 1789 by death and 3149 by any of the outcomes, all within 24 hours.

The mean (± SD) vital signs in the dataset were: pulse rate 81 (± 19) beats.min^{-1}; breathing rate 17 (± 4) beats.min^{-1}; systolic BP 126 (± 22) mm Hg; diastolic BP 70 (± 15) mm Hg; temperature 36.7 (± 0.4) ^{o}C, and S_pO_2 96 (± 3) %. The numbers of observations at different AVPU levels were: Alert (A) 182307 (91.7%); responds to Voice (V) 11500 (5.8%); responds to Pain (P) 3568 (1.8%), and Unresponsive (U) 1380 (0.7%).

The distribution of NEWS values and their relationship to the four outcomes studied is shown in Figure 1.

The AUROCs (95% CI) for NEWS for cardiac arrest, unanticipated ICU admission, death, and any of the outcomes, all within 24 hours, were 0.722 (0.685 to 0.759), 0.857 (0.847 to 0.868), 0.894 (0.887 to 0.902), and 0.873 (0.866 to 0.879), respectively (Table 2). The AUROCs (95% CI) for the other 33 EWSs for cardiac arrest ranged from 0.611 (0.568 to 0.654)[15] to 0.710 (0.675 to 0.745).[16] For the other three outcomes, the AUROCs (95% CI) for the other 33 EWSs ranged from 0.570 (0.553 to 0.568)[17] to 0.827 (0.814 to 0.840)[18] (unanticipated ICU admission); 0.813 (0.802 to 0.824)[15] to 0.858 (0.849 to 0.867)[16] (death); and 0.736 (0.727 to 0.745)[17] to 0.834 (0.826 to 0.842)[19] (any outcome) (Table 2). The comparative performance of each of the 33 EWSs and NEWS, for each of the four outcomes, is shown in Figure 2. Therefore, with the exception of where cardiac arrest at 24 hours was the outcome, none of the 95% CIs for the best performing of the 33 EWSs[16 18 19] crossed those of NEWS.

Figure 3 shows the "EWS efficiency curve"[11] for NEWS using any outcome within 24 hours of the observation set. This provides a relative measure of the number of "triggers" that would be generated at different values of NEWS.

Figure 4 shows the "EWS efficiency curve" for NEWS for the combined outcome compared to that for the best performing, in terms of AUROC, of the other 33 EWS evaluated, i.e., that described by Paterson.[19] It demonstrates the reduction in workload resulting from the use of NEWS instead of the

EWS described by Paterson. In the example shown, the detection of ~75% of those who will die, suffer a cardiac arrest or require unanticipated ICU admission within 24 hours of a given EWS value requires a response to only ~17% of NEWS values compared to ~22% for the EWS described by Paterson, a potential workload decrease of 23%.

DISCUSSION

The measurement of vital signs and the use of EWS systems are essential components of the 'Chain of Prevention', a paradigm for structuring the early recognition and response to patient deterioration.[20] However, despite the clear advantages of standardisation, e.g., standardised training, reduced confusion and misunderstanding during use, transferability across organisations, there has been a lack of consistency in the choice of EWS used in the NHS.[9 10] Failure to adopt a common EWS has been influenced by personal preference, clinical knowledge or simply by the fact that the particular EWS in use has been locally designed. Additionally, the lack of data and access to sophisticated data analysis techniques, permitting comparison of systems, has also been an obstacle. Therefore, the development of a standardised, validated, national EWS brings the potential for a significant change in policy, practice and attitude, ultimately resulting in patient benefit.

This paper describes the application of the national EWS (NEWS) to a large vital signs database from unselected acute medical admissions to a MAU. It does not consider surgical admissions to hospital. NEWS was designed by a multiprofessional working group using evidence arising from the development of ViEWS.[11] The modifications to ViEWS resulting in NEWS reflect clinical considerations based on professional opinion, the paucity of extreme physiological values in the ViEWS database, and the recommendation that all extreme values in all physiological parameters in NEWS should score 3 points.[12]

NEWS was evaluated against a range of outcomes that are of major importance to patients and staff. It demonstrates a good ability to discriminate patients at risk of the combined outcome of cardiac arrest, unanticipated ICU admission or death within 24 hours, which provides ample opportunity for an appropriate clinical intervention to change patient outcome. This combined outcome appears to be an appropriate one, as the clinical response to all three individual outcomes (in terms of both urgency and skill) is essentially the same. The fact that NEWS discriminates the combined outcome better than 33 other EWSs also provides an opportunity for hospitals to improve their efficiency in identifying at risk patients, if they replace their current EWS with NEWS. NEWS also performed better than the other 33 systems for the individual outcomes of unanticipated ICU admission or death, but not for cardiac arrest alone. This may be because cardiac arrest is less predictable, sometimes occurring as an unanticipated, sudden event, occurring in a patient with coronary disease in the absence of antecedent physiological disturbance. This is in contrast to unanticipated ICU admission and death, which are almost always preceded by deranged physiology. In addition, cardiac arrest is a relatively 'artificial' outcome, being indistinguishable from death for most victims, except for the fact that a cardiac arrest team is called to the former but not the latter. As many in-hospital arrests occur during the night, with many of these being unwitnessed[21,] the outcome is effectively less objective and more random, which impacts upon the discriminate ability of all EWS systems. Nevertheless, the combined outcome that we describe in this paper will include all of the undocumented cardiac arrests that are followed by death, as well as those arrests where cardiopulmonary resuscitation is commenced.

Given the similarity between the structure of ViEWS and NEWS, it might be expected that NEWS would perform well for the ability to discriminate in-hospital death within 24 hours of a vital signs dataset. However, no attempt has ever been made to evaluate ViEWS with respect to its ability to predict either unanticipated ICU admission or cardiac arrest within 24 hours of a vital signs dataset. Consequently, it is encouraging to find that NEWS performs well, at least as a discriminator of unanticipated ICU admission.

An interesting observation is that most of the EWS systems studied performed similarly as discriminators of death and unanticipated ICU admission. Therefore, this suggests that the case mix factors that determine outcome for death within 24 hours and unanticipated ICU admission are essentially the same. However, the four EWS systems that include age as a co-variate,[16,22-24] and only these four, perform relatively poorly for the discrimination of unanticipated ICU admission compared to their performance for death. Age may be a consideration when patients are referred for ICU admission; however, we have no evidence that the study hospital operates an ageist policy in this respect. Indeed, the opposite appears to be the case.[25]

One of the important consequences of an EWS' sensitivity and specificity is the workload that it creates for an organisation. The presentation of the efficiency curve for NEWS and the combined outcome (Figure 3) provides a measure of the number of “triggers” that would be generated at different values of NEWS, thereby permitting hospitals to estimate the impact of choosing any particular NEWS value as the trigger for specific clinical intervention. Figure 4 demonstrates a significant reduction in the number of responses required to detect those who die, suffer a cardiac arrest or require unanticipated ICU admission within 24 hours of a given EWS value for NEWS compared to the EWS described by Paterson[19] - the best performing of the other 33 EWS evaluated.

One potential criticism of the precursor of NEWS, ViEWS,[11] is that the cut-off points for the scoring bands were deliberately adjusted to maximise the score’s ability to predict in-hospital death within 24 hours of a vital signs dataset. The true benefit of any EWS is its ability to recognise patients who are deteriorating but who can have their outcome changed by a timely intervention, rather than to predict those who are destined to die.[26] NEWS has been evaluated for its ability to predict a range of outcomes and it must be assumed that the fact that it is a good discriminator of those who required emergency admission to ICU implies that it does indeed identify patients who are potentially 'salvageable'.

This large study has several strengths that are described in the original ViEWS paper.[11] Of particular note are that all vital signs variables were collected simultaneously in a standardised manner as part of the clinical process and that each vital signs observation set contained all of the necessary vital signs variables. The study also has several weaknesses that are also described elsewhere.[11] The current study excludes medical admissions who were admitted directly to critical care areas of the hospital, but patients with Do Not Attempt Resuscitation (DNAR) orders were not excluded. NEWS was evaluated using only vital signs observation sets from patients in the MAU, as vital signs observation sets were not available once the patient had been transferred from MAU. To derive the outcome of death used in the study, the date/time of death (or discharge) was obtained from the hospital's patient administration system (PAS). For reasons already outlined in the ViEWS publication,[11] the recorded date/time of death is likely to be systematically late and, therefore, the number of observations followed by death within 24 hours is liable to be an underestimate. Such errors are less likely in the databases used to identify the recorded date/time of ICU admission or cardiac arrest, which have different and more reliable sources. We used repeated observation sets from the same patient episode in the analysis, making the assumption that the observation sets are independent of each other. Finally, this is a single centre evaluation of NEWS and it requires further validation in different patient populations (e.g., surgical), diseases (e.g., chronic respiratory disease) and clinical settings (general hospital wards).

Whilst our statistical analysis demonstrates that NEWS performs better than other EWS systems for the outcomes studied, it is by no means guaranteed that this would be the case when NEWS is implemented operationally. EWSs using fewer parameters than NEWS are prone to errors in the inaccurate assignation of individual vital sign parameters to the correct EWS weighting group[27] and the calculation of the total EWS.[28-30] On this basis, it might be expected that NEWS would be associated with an increase in operational error over EWS with fewer parameters, but this hypothesis requires testing. Nevertheless, the electronic bedside capture of EWS data, which is increasing throughout the NHS, has been shown to reduce errors in EWS calculation.[29,30] Additionally, further work regarding the operational effectiveness of any EWS, including NEWS, compared to simpler systems of activating a rapid response team (e.g., single calling criteria[31] or subjective criteria[32]) needs to be undertaken.

Standardisation of the EWS used in the NHS is a commonsense development. It cannot be logical for different hospitals to employ different systems for the majority of their patients, given that the physiological signs of disease do not vary by location. However, the development of NEWS is not an end to the development of EWSs. Indeed the NEWS report[12] acknowledges that this first iteration is only the beginning.

Finally, NEWS should not be regarded as the sole solution to detecting patient deterioration. Rather, its use should be the *minimum* required for monitoring patients and should be used to alert staff to the need to assess a patient further. It should be used alongside, rather than instead of, other ‘triggers’, e.g., symptoms such as chest pain; signs such as diaphoresis; other assessment scores such as the Glasgow Coma Scale;[33] and nurse[32] or family concern.[34] The successful implementation of NEWS will be challenging to organisations and will not in itself necessarily change the outcomes for patients unless all other components of the ‘Chain of Prevention’[20] are present, and work efficiently and effectively.

CONCLUSIONS

We have demonstrated that the National Early Warning Score (NEWS), recently developed by a multiprofessional team at the Royal College of Physicians of London and proposed for use in all NHS hospitals, is able to discriminate patients at risk of the combined outcome of cardiac arrest, unanticipated ICU admission or death within 24 hours of a NEWS value better than 33 other EWSs. NEWS also performed better than the other 33 systems for the individual outcomes of unanticipated ICU admission or death, but not for cardiac arrest alone.

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CONFLICT OF INTERESTS STATEMENT

VitalPAC is a collaborative development of The Learning Clinic Ltd (TLC) and Portsmouth Hospitals NHS Trust (PHT). PHT has a royalty agreement with TLC to pay for the use of PHT intellectual property within the VitalPAC product. Professor Prytherch and Drs Schmidt, Featherstone and Meredith are employed by PHT. Professor Smith was an employee of PHT until 31/03/2011. Dr Schmidt, and the wives of Professors Smith and Prytherch are shareholders in TLC. Professors Smith and Prytherch, and Dr Schmidt, are unpaid research advisors to TLC. Professors Smith and Prytherch have received reimbursement of travel expenses from TLC for attending symposia in the UK. Professor Smith acted as expert advisor to the National Institute for Health and Clinical Excellence during the development of the NICE clinical guideline 50: 'Acutely ill patients in hospital: recognition of and response to acute illness in adults in hospital'. He was also a member of the National Patient Safety Agency committee that wrote the two reports: 'Recognising and responding appropriately to early signs of deterioration in hospitalised patients' and ' Safer care for the acutely ill patient: learning from serious incidents'. He was a member of the Royal College of Physicians of London's National Early Warning Score Development and Implementation Group (NEWSDIG).

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LEGENDS FOR FIGURES:

Figure 1

The distribution of NEWS values and the relationship with each of the four outcomes studied.

Figure 2

AUROCs for NEWS and the 33 early warning scores previously evaluated,[10] using the system numbers used in the previous study, [10] for each of the outcomes studied.

Figure 3

"Efficiency curve" for NEWS for the combined outcome of cardiac arrest, unanticipated ICU admission or death occurring within 24 hours of a NEWS value. For each NEWS value, this plots the percentage of the total number of observations at, or above, that NEWS value against the percentage of the total number of observations that were followed by cardiac arrest, unanticipated ICU admission or death within 24hours at, or above, a given NEWS. From the point at 100,100 the NEWS values are 0, 1, 2, 3 ….

Figure 4

Figure 4 shows the "EWS efficiency curve" for NEWS compared to that for the best performing of the other 33 EWS evaluated, i.e., that described by Paterson.[18] In the example shown, the detection of ~75% of those who will die, suffer a cardiac arrest or require unanticipated ICU admission within 24 hours of a given EWS value requires a response to only ~17% of NEWS values compared to ~22% for the EWS described by Paterson, a potential workload decrease of 23%.

Table 1: The National Early Warning Score (NEWS)

Physiological parameters	**3**	**2**	**1**	**0**	**1**	**2**	**3**
Respiration Rate (breaths per minute)	$\leq$8		9 - 11	12 - 20		21 - 24	$\geq$25
S_pO_2 %	$\leq$91	92 - 93	94 - 95	$\geq$96			
Any supplemental oxygen?		Yes		No			
Temperature (^oC)	$\leq$35.0		35.1 - 36.0	36.1 - 38.0	38.1 - 39.0	$\geq$39.1	
Systolic BP (mmHg)	$\leq$90	91 - 100	101 - 110	111 - 219			$\geq$220
Heart/pulse rate (beats per minute)	$\leq$40		41 - 50	51 - 90	91 - 110	111 - 130	$\geq$131
Level of consciousness using the AVPU system				A			V, P or U

Level of consciousness: A = Alert; V = Responds to voice; P = Responds to pain; U = Unresponsive

Modified from National Early Warning Score (NEWS): Standardising the assessment of acute-illness severity in the NHS. Report of a working party. Royal College of Physicians, London, 2012.[12]

Table 2: Area under the receiver operator characteristics curve (AUROC) (with 95% CI) for NEWS and the 33 aggregate-weighted track and trigger systems previously evaluated,[10] using cardiac arrest, unanticipated ICU admission or death within 24 hours of the observation set as the outcome. The system number refers to those used in the previous publication.[10]

System number	EWS	AUROC	95% CI
-	NEWS	0.873	0.866 to 0.879
23	Paterson[18]	0.834	0.826 to 0.842
31	Barlow	0.834	0.826 to 0.842
17	Goldhill	0.832	0.825 to 0.840
33	Von Lilienfeld-Toal	0.831	0.823 to 0.839
28	Duckitt[19]	0.829	0.822 to 0.837
19	Heaps	0.827	0.819 to 0.835
20	Andrews	0.827	0.818 to 0.835
22	Smith	0.826	0.818 to 0.835
24	Lam	0.826	0.818 to 0.835
26	Gardner-Thorpe	0.826	0.818 to 0.834
9	Wasson	0.825	0.817 to 0.834
7	Cooper	0.824	0.816 to 0.832
2	Wright	0.823	0.815 to 0.831
11	Carberry	0.823	0.815 to 0.831
12	Rees	0.823	0.814 to 0.831
25	Smith	0.823	0.814 to 0.831
32	Von Lilienfeld-Toal	0.822	0.814 to 0.830
3	Subbe	0.822	0.814 to 0.830
6	Riley	0.822	0.814 to 0.830
10	Odell	0.822	0.814 to 0.830
27	Hancock	0.822	0.814 to 0.830
30	Odell	0.822	0.814 to 0.830
14	Priestley	0.822	0.814 to 0.830
5	Fox	0.822	0.814 to 0.830
13	Rees	0.821	0.813 to 0.830
1	Morgan	0.820	0.812 to 0.829
18	Chatterjee	0.819	0.811 to 0.828
15	Ryan	0.817	0.808 to 0.825
4	Subbe[16]	0.804	0.795 to 0.812
16	Allen[15]	0.800	0.791 to 0.809
29	Subbe	0.794	0.785 to 0.803
8	Subbe	0.788	0.780 to 0.797
21	Bakir[17]	0.736	0.727 to 0.745

Figure 1

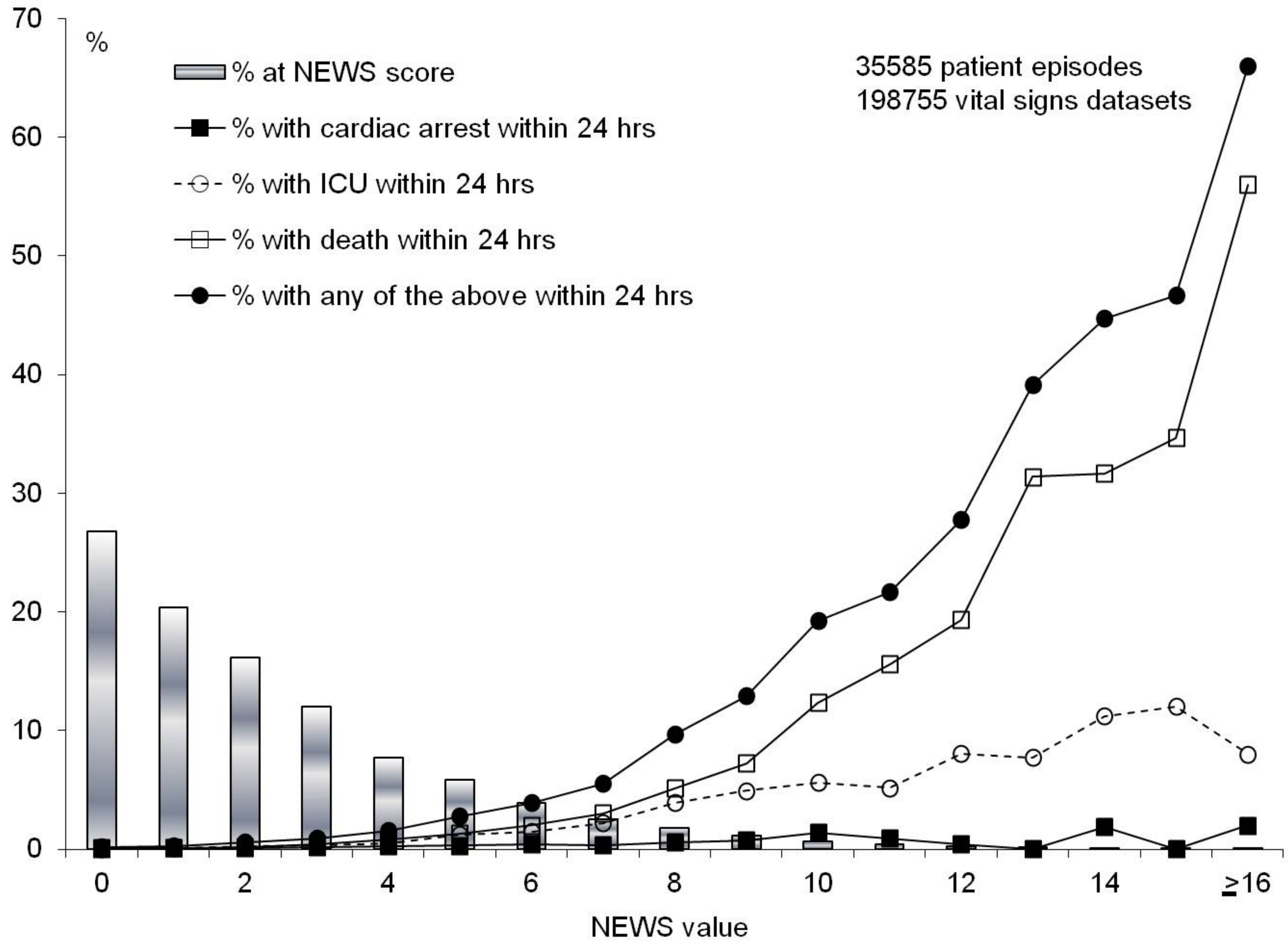

70
60
50
40
30
20
10
0
%
% at NEWS score
% with cardiac arrest within 24 hrs
% with ICU within 24 hrs
% with death within 24 hrs
% with any of the above within 24 hrs
35585 patient episodes
198755 vital signs datasets
0
2
4
6
8
10
12
14
≥16
NEWS value

Figure 2

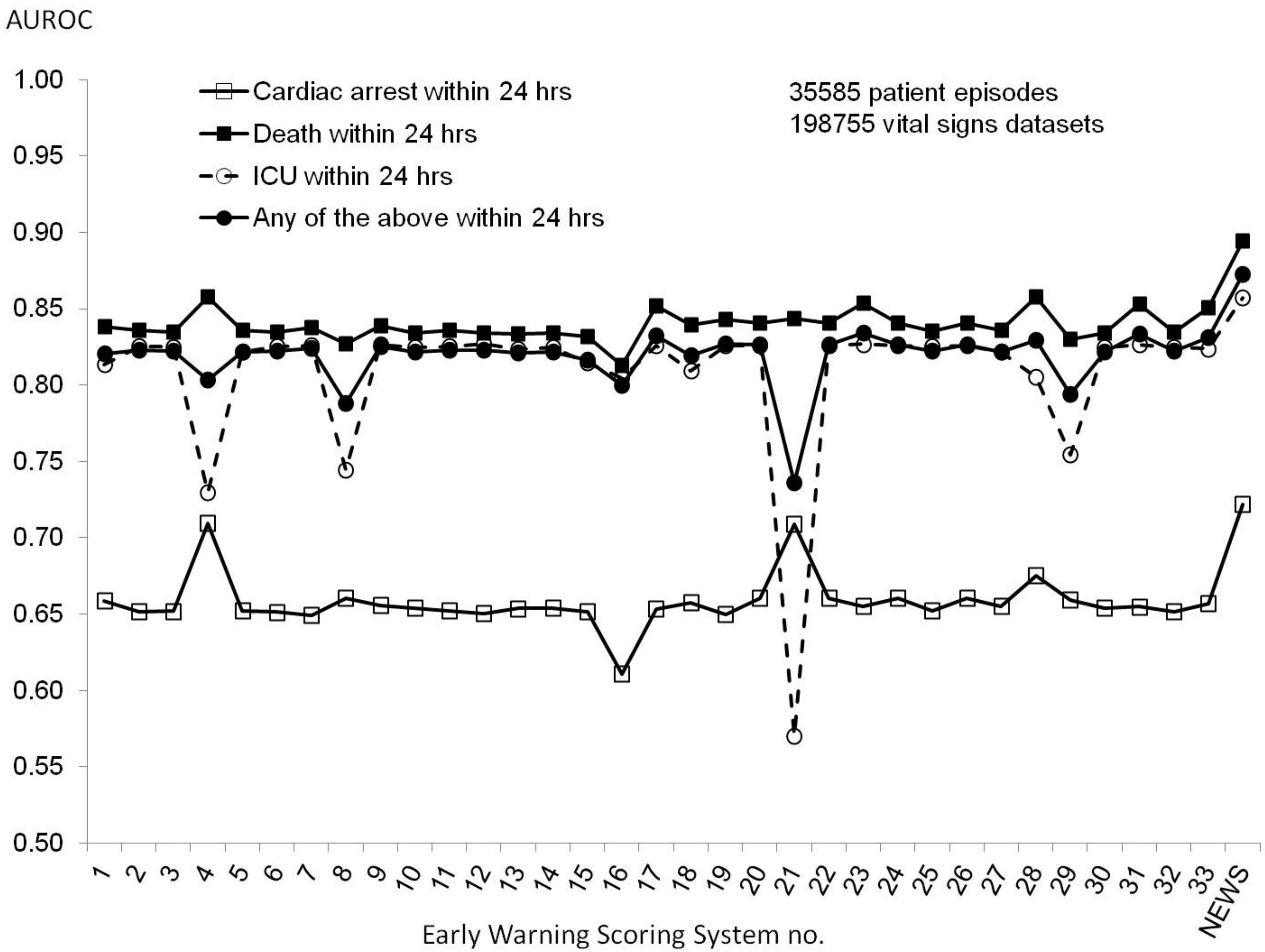

AUROC
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
Cardiac arrest within 24 hrs
Death within 24 hrs
ICU within 24 hrs
Any of the above within 24 hrs
35585 patient episodes
198755 vital signs datasets
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 NEWS
Early Warning Scoring System no.

Figure 3

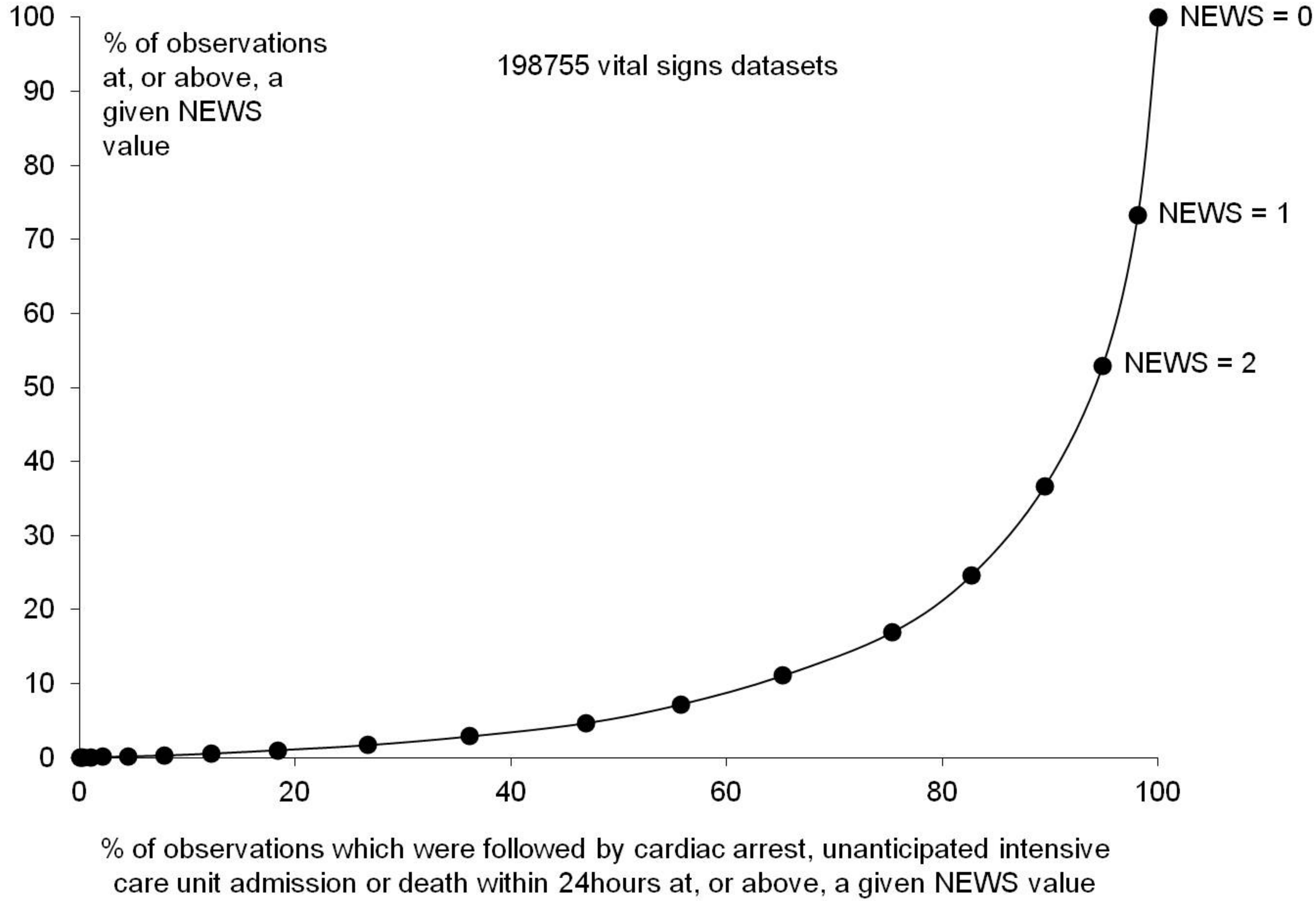
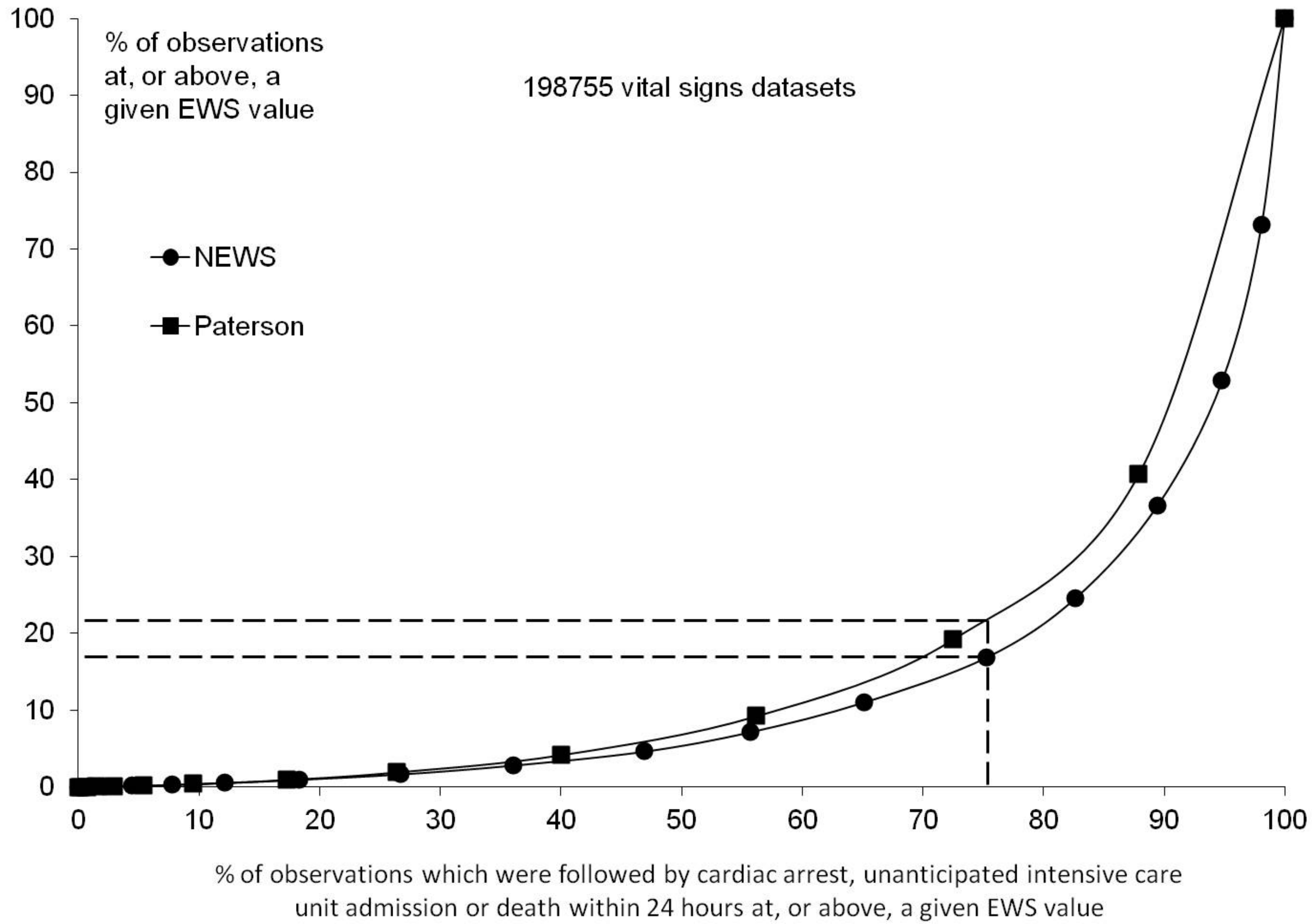

100
90
80
70
60
50
40
30
20
10
0
% of observations
at, or above, a
given NEWS
value
198755 vital signs datasets
NEWS = 0
NEWS = 1
NEWS = 2
0
20
40
60
80
100
% of observations which were followed by cardiac arrest, unanticipated intensive
care unit admission or death within 24hours at, or above, a given NEWS value

Figure 4



% of observations at, or above, a given EWS value
198755 vital signs datasets
NEWS
Paterson
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
% of observations which were followed by cardiac arrest, unanticipated intensive care unit admission or death within 24 hours at, or above, a given EWS value